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ABSTRACT

During the 1960's, the Teen-Aged Driver Study was undertaken in response to legislative concern over the high accident and conviction rate among teenage drivers. Since that study had to be completed rapidly, the present study was undertaken in order to provide a more comprehensive study of teenage drivers. The sample for this study consisted of 13,915 persons who were 16 or 17 years of age when licensed in five California counties in 1962-63. The driving records of persons in the sample for their first four years of driving were described and correlated with other biographical data. Data were collected from the California Department of Motor Vehicles, permanent high school records, a mail questionnaire, and personal interviews. Some findings include: (1) Those taking behind-the-wheel driver training had better driving records and more socially desirable personal characteristics than those not taking the course, (2) Citizenship grades in high school was the best predictor of accidents and convictions, and (3) The average number of accidents showed little change in the first four years of driving. (Author/GEB)

# The Young Driver Follow-Up Study:

## An Evaluation of the Role of Human Factors in the First Four Years of Driving

DAVID M. HARRINGTON
CALIFORNIA DEPARTMENT OF MOTOR VEHICLES

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FINAL

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The study was conducted by the Research and Statistics Section under the general direction of Ronald S. Coppin, Chief of Research, with the cooperation of Woodrow C. Wilson, Chief, Division of Administration; Ronald Thunen, Chief, Division of Field Offices; Keith Ball, Chief, Division of Drivers Licenses; and John L. McLaughlin, Chief, Division of Registration.

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ABSTRACT

The sample consisted of 13,915 persons who were 16 or 17 years of age when licensed in five California counties in 1962-63. This study described the driving record of the sample during their first four years of driving, and correlated their driving record with other biographical data.

Department of Motor Vehicle files supplied information on accident and conviction record. For those with fatal or injury accidents, California Highway Patrol accident reports yielded data on the circumstances surrounding the accidents. The research staff visited the public high schools attended by the subjects, and collected various data from the permanent records. A third source of data was a mail questionnaire requesting biographical and driving data sent to the subjects after they had been driving for three or four years. The fourth source of data was from personal interviews with 443 high and low accident subjects. Data was collected on biographical factors, attitudes, driving behavior, self-description via an adjective list, and a personality test.

The average number of accidents showed little change in the first four years of driving. This result does not provide support for increasing the licensing age to 18. The accident rate adjusted for mileage decreased with increasing experience. Conviction rates (adjusted for mileage) either increased or showed no change across years. Considerable changes were found in accident characteristics with increasing experience. Suspension and revocation of licenses was not very effective in keeping drivers off the road.

Citizenship Grade in high school was the best predictor of accidents and convictions. Generally, more socially desirable personal attributes were associated with better driving record. The overall relationship between accident frequency and biographical data was too low to permit accurate identification of "accident prone" drivers prior to licensing. Convictions were predictable to a moderately high degree from biographical data.

For those with fatal and injury accidents, the characteristics of the accidents were not predictive of the number of accidents and convictions.

An optimal point system for types of violations was better than number of convictions for predicting future accidents.

Those taking behind-the-wheel driver training had better driving records, and more socially desirable personal characteristics than those not taking the course, indicating volunteer bias. Taking these personal differences into account, driver training appeared to reduce fatal and injury accidents for females, but had little if any effect on male accidents. Classroom driver education appeared to reduce fatal and injury accidents for females, but had little if any effect on male accidents. These findings are not totally conclusive due to methodological limitations.

High accident subjects were characterized by social deviancy, greater involvement with cars, and more reckless, more emotionally motivated driving when a teenager. High and low accident drivers describe their driving behavior as similar at the time of interview.

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# CHAPTER 1

## INTRODUCTION

This introductory chapter is divided into three sections: (1) a description of the origin and general purposes of the study, (2) a review of the research literature on young drivers; and (3) a critical review of the research literature on the evaluation of the effectiveness of driver education and training.

### Origin and Purposes of the Study

The present study was conceived in 1963 as an outgrowth of the Teen-Aged Driver Study (Ferdun, Peck & Coppin, 1967). That study was done in response to legislative concern over the high accident and conviction rate among teen-age drivers, and was intended to determine whether or not the driving record of 16-17 year olds was worse than that of those 18-19 years old. These findings were to be taken into consideration in deciding whether or not the minimum licensing age should be raised to 18 years of age.

Since the Teen-Aged Driver Study had to be completed rapidly in order to be responsive to legislative needs, it was not possible to do a more comprehensive study of teen-age drivers at that time. The present study was intended to fulfill such a purpose. The need for such a study was apparent from the paucity of previous research in the area (McFarland & Moore, 1964). Work on the present study was begun in 1964.

This study was intended to provide basic data on the relationship between accident and conviction record, accident characteristics, and biographical data. First, a replication of the Teen-Age Driver Study was done, using longitudinal rather than a cross-sectional sample, thus providing a more definitive analysis of the effects of age and experience on driver record. Second, the degree to which accident record could be predicted from biographical data was determined, to see if the "accident prone" driver could be identified prior to licensing. Such prior identification would permit preventive measures such as special driver education, and more stringent licensing control. Although previous research on drivers of all ages had found that the multiple correlations between the number of accidents and biographical data were moderately low, it was hoped that the high accident means of teen-agers, as well as the hypothesized greater influence of personal factors (attitudes) in this age group, would permit a higher accuracy of prediction to be attained. Third, for those with fatal and injury accidents, a study was made of the value of the characteristics of such accidents in predicting accidents and convictions. Fourth, an evaluation was made of the effectiveness of driver education and training

in reducing accidents. Various other findings were examined for practical applications. Data mentioned in this report, but not included in full, are available upon request.

## Literature Review on Young Drivers

This review was generally restricted to research on young drivers which related human factors to accident and conviction record. While this review was not exhaustive, it did include most of the important, well-known studies in the area. Awareness abstracts from the Highway Research Information Service were used in compiling the references.

The literature for drivers of all ages will not be reviewed here, as it has been reviewed many times recently (Adams, 1970; Arthur D. Little, Inc., 1966; Goldstein, 1964; Haddon, Suchman & Klein, 1964; McFarland, 1968; Surry, 1969). The findings of this research are that most biographical variables have only very low correlations with accident record. The best predictors of accidents have been found to be such variables as traffic convictions, mileage, age, sex, marital status, and measures of social deviancy. The findings are often summed up that "a man drives as he lives."

Most of the limited literature prior to 1960 will not be reviewed individually as it has been reviewed, summarized, and interpreted well by McFarland, & Moore (1964). Klein (1966, 1968) has given critical overviews of the findings and methodology of studies on teen-aged drivers.

The literature will be reviewed in approximately chronological order. A comparison of these findings with the findings of the present study will be made in the last chapter.

Kemper (no date) studied 20,000 juniors and seniors at 29 high schools. Having a drivers license, owning a car, and amount of evening driving were each associated with lower grades.

McCord & McCord (1959) collected biographical data on several hundred young males prior to licensing. In correlating this data with subsequent driver record, they found that males convicted of serious traffic offenses tended to have passive or overprotective mothers, and to have been raised in broken or quarrelsome-neglecting homes. The background of those convicted of non-traffic offenses differed considerably from that of those convicted of traffic offenses. Those convicted of non-traffic offenses were more likely to suffer from parental neglect, parental cruelty, a criminal father, and either lax or erratically punitive discipline. The authors concluded that traffic violations seemed to be motivated by a search for power or mastery.

Rommel (1959) compared 25 accident free high school males with a matched sample of those with two or more accidents. A Driver Attitude Inventory, as well as the Psychopathic Deviate, Paranoia, Psychasthenia, Schizophrenia, and Hypomania scales of the Minnesota Multiphasic Personality Inventory (MMPI) were administered. High accident drivers scored higher on

the Attitude Inventory, and on the Psychopathic Deviate and Hypomania scales of the MMPI. Item analysis of the Attitude Inventory indicated that high accident subjects drove to relieve tensions, to feel grown up, to enjoy speeding, and to enjoy the cars' power. Item analysis of the MMPI indicated that the high accident subjects desired to leave home, had friends his parents did not like, had been in trouble with the law, had tendencies to do something harmful, to be influenced by others, to frighten others, and to be suspicious and impatient.

Brown & Berdie (1960) found that, for 993 male college students, the number of accidents and convictions were each correlated with higher scores on the Psychopathic Deviate and Hypomania scales of the MMPI.

Corbally & Knoll (1960) found little relationship between number of traffic violations and grade point average among a group of 297 high school age traffic violators.

Coleman (1961) did an extensive study of adolescent society, involving 8,000 students at 10 Illinois high schools. The automobile played an important role in the life of adolescents, particularly those in small towns. Among males the most frequent hobby was working on their car. Cars were important to the teen-age male for dating purposes, as well as for general transportation, especially with the increase in suburban living. In the fall of the freshman year only 5 percent of the males owned their own cars. This percentage increased steadily until the spring semester of the senior year, when 50 percent of the males owned their own car. Car ownership and customization of cars by boys was greatest in small towns. The more popular boys owned cars more often than the less popular males, but were less often involved in "being up on cars," that is, being considerably involved in fixing up cars. In some schools, however, "being up on cars" was characteristic of the whole adolescent culture. Considerable involvement with cars was more common among the children of working-class parents.

Levonian & Case (1961), and Levonian, Case & Wilson (1962), studied 119 California tenth grade pre-drivers, 169 tenth grade drivers, and 216 twelfth grade drivers. These subjects were administered an 80 item questionnaire, the Wilson Attitude Test, dealing with both driving and non-driving behavior. The 10th grade pre-drivers gave the most socially acceptable responses, followed by the 10th grade drivers, with the 12th grade drivers giving the least acceptable responses. In comparison to the 10th grade pre-drivers, the 10th grade drivers more frequently: (1) liked school less, (2) approved of risk-taking more, (3) approved of drinking more, (4) would have liked to be a race car driver more, (5) approved cutting classes more, and (6) approved disregarding stop signs more.

Beamish & Malfetti (1962) studied 86 young males with two or more traffic convictions and 186 young males with no convictions. Subjects were administered the Guilford Zimmerman Temperament Survey, the Minnesota Counseling Inventory, the Psychopathic Deviate, K and L scales of the MMPI,

the Siegel Biographical Inventory, the Otis, the Siebrecht Attitude Scale, and a personal history form. The violator group scored lower on the Emotional Stability and Objectivity scales of the Guilford-Zimmerman, and lower on the Conformity and Good Mood scales of the Minnesota Counseling Inventory.

Brazell (1962) studied the driving and high school records of 2,775 males. Attitude was rated by the driver education teachers. Those with good attitudes had better accident and conviction records than those with poorer attitudes. Better accident and conviction records were associated with: (1) higher grade point average, (2) higher intelligence, (3) graduation from high school, and (4) passing driver education on the first attempt.

Schuster (1966) administered his Driver Attitude Survey and a biographical questionnaire to approximately 1,000 California high school and junior college students and correlated the scores with moving violations and partially responsible accidents. Moving violations was the best predictor of accidents; the remaining variables added little to the predictive ability of a regression equation involving only moving violations.

Kritz & Nilsson (1967) questionnaired 6,000 newly licensed drivers of all ages as to accident involvement and driving experience in their first year of licensed driving. Approximately 80 percent responded. Younger drivers had a greater frequency of accidents than older drivers, even when such factors as mileage, area, sex, night driving, and accident responsibility were taken into account.

Kenel (1967) found that ratings of better personal adjustment by instructors of 1,100 students completing driver education were predictive of less future accident and violation involvement.

Schwenk (1967) studied 1,700 male high school students. Accident and violation frequency were found to be related to scores on the Minnesota Counseling Inventory. Accident involvement was associated with lower scores on the Social Relationships scale, higher scores on the Conformity scale, lower scores on the Leadership scale, lower scores on the Social Introversion-Extroversion scale, and higher scores on the Masculine Egoism and Drop-out scales.

Ferdun, Peck, & Coppin (1967) studied a random sample of 10,250 California drivers between 17 and 20 1/2 years of age. The driver record studied was for one year prior to selection, so that the subjects were 16 to 19 1/2 years of age at the beginning of the driver record interval. A mail questionnaire (2 waves) was sent out and 65 percent responded. There was no difference in accident frequency among the various ages. Moving violation frequency increased steadily until age 18, then decreased afterwards. Exposure (mileage) was more important than age in accounting for accidents and violations. Age was related only to accident rates (accidents/mile) with older drivers having lower rates.

Mullins (1967) studied 13,000 new Air Force personnel. Out of 40 variables studied, mileage was the best predictor of accidents, while the other variables added little to mileage in the ability to predict accidents.

A considerable amount of research is being done at the University of Michigan on the causes of accidents among young drivers, as well as the development of driver retraining programs for high school seniors (Schuman, Pelz, Ehrlich, & Selzer, 1967; Pelz & Schuman, 1968, 1970a, 1970b). Several thousand suburban youngsters, mostly males 16-24 years of age (cross-sectional), were interviewed about their driving behavior. Accident data was collected from both official files and self-report.

Young drivers changed from inexperienced, cautious, but impulsive drivers with minor accidents, to more confident, independent, heavier drinking drivers with more serious accidents. High accident/violation drivers were more prone to emotionally motivated driving, tended to own their own cars, and worked, rather than being in school.

High accident/violation drivers, compared to their counterparts, more often: (1) drove after drinking, (2) sped inside the city, (3) had driven a motorcycle, (4) raced other cars, (5) worked on their cars more, (6) had had a fist fight during the past year, (7) had older sibs, and (8) had lower grades in school.

Both accident and conviction rates (unadjusted and adjusted for mileage) rose steadily from 16 to 19 years of age then dropped sharply. Mileage rose steadily until 20 years of age, then levelled off.

Gallagher & Moore (1968) did a comprehensive study of 197 male college students and 196 male vocational high school students. Data was collected from medical and psychiatric examinations, personality tests, psychomotor tests, school records, and questionnaires. The best predictors of accident frequency were mileage and such practices as drag racing and speeding.

Gutshall (1968) found that IQ and socioeconomic status were not related to accidents, violations, or mileage for 216 young males.

Schuster (1968) studied 100 male California drivers under 25 years of age. His Driver Attitude Survey and prior driver record were the best predictors of subsequent three year accidents and violations. Other biographical data did not increase the accuracy of prediction over that of the aforementioned predictors.

Brezina (1969) studied the driving record of 2,000 drivers aged 16-24 in their first year of driving. Drivers aged 16-19 had the same accident rate as drivers 20-24. Males 20-24 had a higher conviction rate than males 16-19, but there was no difference for females.

Levonian (1969) studied 1,080 California tenth grade driver education students, few of whom were eligible for a license. The students were administered an 83 item questionnaire measuring five scales -- Determination, Adaptiveness, Expediency (oriented toward self-benefit at the expense of others), Defensiveness, and Ambivalence. The number of traffic violations was correlated with higher scores on the Expediency scale.

McGuire (1969) did a further analysis of the data collected in the aforementioned study by Mullins. The analysis was restricted to 3,000 enlisted men 17-20 years of age who had been driving for two years, since the mileage data was for two years. Accident frequency was correlated with higher scores on a mechanical aptitude test, higher scores on the AFQT, higher mileage, greater number of moving violations, higher values for parents' homes, higher family income, and smoking more.

Asher & Dodson (1969) analyzed some data from project TALENT. A mail questionnaire was sent to students nationwide one year after they were scheduled to graduate from high school. Asher did not specify the mail strategy used or the percentage responding. One of the questions asked was whether or not the person had had a traffic accident involving injury or $100 property damage during the past year. All subjects with an accident and 10 percent of the accident free subjects were included in the study, for a total sample size of 8,000. There were 377 variables analyzed, including test data and biographical questionnaire data gathered while the subjects were high school students. The author stated that he was using the 5 percent level of statistical significance, but all the results in his Table 1, for example, were significant beyond the 1 percent level, so it appears that some error was made (also see next section). In comparison to those without an accident, those with an accident in the past year: (1) were more interested in auto repair, (2) engaged in sports less often, (3) worked more often during the summer for pay, (4) had received less allowance, (5) dated at a younger age, (6) went out more evenings, (7) got lower grades than ability warranted, (8) did less well in school, (9) had more absences from school, (10) had a higher family income, (11) slept less, and (12) drove more.

Suchman (1970) studied 1,500 high school and college students through questionnaires and interviews. Subjects were asked how many accidental injuries they had suffered in the past year which had bothered them for 7 days or more. This included auto and non-auto accidents. Accident involvement was found to be related to behavior patterns, attitudes, and self-image. Having had 2 or more such accidents was associated with "socially deviant" responses, including getting a thrill out of riding in a fast car.

Carlson & Klein (1970) studied 8,094 male undergraduates. The number of traffic convictions was positively correlated with: (1) the fathers' having had more traffic convictions, (2) lower grade point average, (3) coming from a broken home, (4) underachievement in school, and (5) violations of non-traffic laws. The number of accidents was correlated with lower grade point averages.

Kraus, Steele, Ghent, & Thompson (1970) interviewed 205 persons under 21 who were involved in an injury accident or a property damage accident in

which the loss was greater than $100. The subjects, 91 percent of whom were males, were obtained from police and hospital sources. Comparisons were made with matched accident-free controls. Approximately 35 percent of the accident subjects contacted, and 8 percent of the control subjects contacted, refused to participate. As compared to the control subjects, accident subjects more often: (1) failed one or more grades in grammar school; (2) enrolled in a vocational course in high school; (3) smoked prior to age 17, although there was no difference at present; (4) were employed full time prior to 18 years of age, although there was no difference at present; and (5) were arrested and convicted for non-traffic offenses. No differences were found between the groups on: (1) mileage, (2) broken home, (3) number of residence changes, (4) school suspensions or poor conduct ratings, (5) high school dropout, (6) health problems (7) drinking habits, or (8) self-ratings on aggressiveness, irresponsibility, social conformity, or frustration tolerance.

In summary, these studies indicate that both youthfulness and inexperience are factors involved in the high accident and conviction records of teen-agers and young adult drivers. Those with more socially desirable personal characteristics have better accident and conviction records than others.

The results indicated that those with accidents and convictions were more often from broken homes, had more problems with their parents, had more problems in school, drove more, and had more "delinquent" type personalities. The results as to driving behavior also provided support for the stereotype of the reckless teen-age driver.

## Literature Review on Driver Education and Training

In general, early research prior to 1960 will not be reviewed specifically, as it has been critically reviewed before (Allgaier, 1964; Association of Casualty and Surety Companies, 1957; Barnes & Flannigan, 1958; National Education Association, 1957). This early research was done mostly by driver educators, and most of the research suffered from serious methodological deficiencies, for example, having a disproportionate number of females in the driver education group. This early research found that those taking driver education had better accident and conviction records than those not taking the course.

No truly experimental research has ever been completed on driver education or training and subsequent accidents. All research described below was ex post facto. Assignment of subjects to a driver education group or to a control group by the researcher is currently being done in a research project at the Center for Transport Studies, University of Salford, Salford M5 4WT, LANCASHIRE, ENGLAND, under the direction of Dr. S. Raymond.

California is unusual among the states in having separate courses for the classroom and behind-the-wheel phases of training. In other states "driver education" refers to an integrated classroom and behind-the-wheel course. In California, "driver education" refers to the classroom course, while "driver training" refers to a separate behind-the-wheel course.

New York Department of Motor Vehicles (undated) matched groups on academic standing in high school, and found those with driver education had better accident and conviction records.

Kemper (undated) studied approximately 20,000 students at 23 high schools nationwide. Groups were matched on several factors. Males with driver education had fewer accidents and convictions than those without. The results for females were not stated.

The Association of Casualty and Surety Companies (1957) reviewed the research in the area. They concluded that the research tended to be invalid, and that no conclusive evidence as to a cause and effect relationship could be established due to the presence of volunteer bias. By volunteer bias is meant that only a small proportion of students took driver education, and that these students volunteered for the course. Social scientists have found that those who volunteer for activities differ from those who do not on many biographical characteristics (Bell, 1961). Consequently, it was not determined if the differences in driver record were due to the driver education, or reflected pre-existing personal differences. Most of the studies presented showed accident means much lower than are known to be the case, indicating that they were based on poor accident records.

The Los Angeles City School Districts (1961) found that there was a volunteer bias involved in whether or not a pupil took driver training. Those taking behind-the-wheel driver training scored higher on IQ and achievement tests than those not taking the course, although there was no difference on grade point average. They also found a selective bias:

> The fact that pupils who take driver training in high school have, on the average, higher scores on tests of ability and achievement indicates that there is a certain amount of selectivity operating in the choice of pupils taking the course. In fact, counselors in approximately one-third of the schools in the sample admitted that some kind of ability selection takes place. Similarly, sixteen percent of the principals indicated that driver training is a privileged course and that pupils should be selected to take it only if they had earned it by worthy citizenship and achievement. Of course, in any subject in which the demand of pupils to take it exceeds the number of possible placements, there is a tendency to select good students and reject poor ones.

No differences were found between the groups on car ownership, percent-

age driving car to school, or amount of car driving on afternoons and evenings. The most common (68 percent) reason given for taking driver training was for lower insurance rates. Those not taking driver training were asked why they had not taken the course. Of these, 65 percent responded that they had applied for the course, but had never been scheduled.

Rainey, Conger, & Walsmith (1961) found significant differences between those taking and not taking driver education on 8 out of 26 scales on three personality tests. Studied were 52 males who took driver education and 104 non-driver education males, matched on residence area, graduation status, and access to cars. Those taking driver education had: (1) lower scores on the General Activity, Ascendance, Social Interest, and Masculinity scales of the Guilford-Zimmerman Temperament Survey; (2) a higher score on the Aesthetic scale of the Allport-Vernon-Lindzey Study of Values; and (3) lower scores on the Feelings of Inadequacy, Physical Defects, and Nervous Manifestations scales of the California Mental Health Analysis.

Kaesther (1961-62) studied all 17,000 sixteen to nineteen year olds licensed in 1959 by means of a questionnaire regarding driver education and training. Driver record data through 1961 was from Department of Motor Vehicle records. Three groups were analyzed: (1) the driver training group which had both behind-the-wheel driver training and classroom driver education, (2) the driver education group which had only classroom education, and (3) the no training group, comprising the majority of students, which had neither. Those in the driver training group had fewer accidents than those in the other groups, as well as fewer moving violations, but there was no difference for non-moving violation types. The differences persisted over two years.

Conger, Miller & Rainey (1966) studied three groups of male high school students. Group I consisted of 108 students who had completed driver education. Group II consisted of those 195 who had wanted to take driver education, but were unable to do so. Group III consisted of those 314 who did not wish to take driver education and did not. Those with driver education had fewer violations than the others, but there was no difference among the groups in responsible accidents in the first four years of driving. Those taking driver education drove less than the others, and had higher IQ's and higher socioeconomic status. Sub-groups of forty subjects each from each group were formed by matching on mileage, IQ and socioeconomic status. The results are presented in Table 1, in which the means for the matched groups are labelled adjusted means. For the adjusted means, those in Group I had significantly fewer accidents, but the same violation frequency, as the other groups.

This particular use of the method of matching to control for biographical differences between the groups is methodologically unsound for

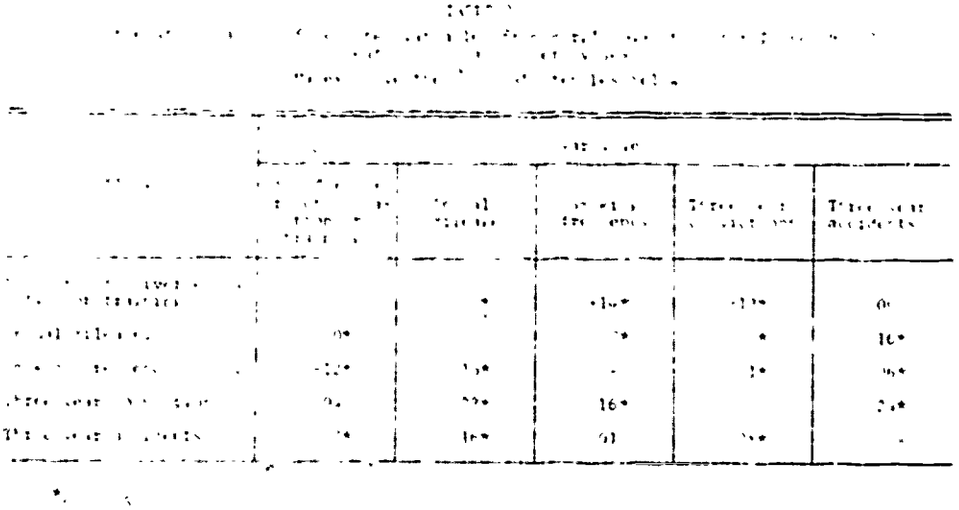
Table 1

Mean and Adjusted Mean Accidents and Violations For Center City by Group

| Item | Group | | |
|---|---|---|---|
| | I | II | III |
| Mean accidents | 0.26 | 0.41 | 0.27 |
| Adjusted mean accidents | 0.08 | 0.33 | 0.20 |
| Mean violations | 1.38 | 2.24 | 1.27 |
| Ajusted mean violations | 2.35 | 1.50 | 1.[illegible] |

several reasons (Campbell & Stanley, 1963; Freedman, 1950; Thorndike, 1942; Walker & Lev, 1953). First, the sample size and statistical power of the comparisons are drastically reduced. Second, the findings for the matched subgroups cannot be validly generalized to the total group, so that the overall effect of the treatment cannot be evaluated. Third, the subgroups were only matched on the observed scores. To the extent that there was error involved in the measurement of the matching variables, differential regression toward the mean could result in driver record differences between the matched groups, even if driver education was totally ineffective. The analysis of covariance does not suffer from the first two limitations mentioned; the influence of measurement error on the analysis of covariance with multiple covariates is discussed in Chapter 5. Given the fact that there was no difference in accident means among the groups, and given that the volunteer bias appeared to favor those with driver education, it would be mathematically impossible for an analysis of covariance to reach the conclusion that the adjusted accident means were lower for those with driver education. Consequently, the findings for accidents should be considered an artifact of the method used. The correct conclusion from the data should be that no evidence was found for the effectiveness of driver education in reducing accidents. Many of the other studies reviewed in this section also used a matching procedure.

Burg (1967) in conjunction with the California Department of Motor Vehicles, did a study of the relationship between visual acuity and driver record. As part of the study, data on driver education and training was collected. The data was collected by interviewers at many DMV offices throughout the state. Approximately 60 percent of those contacted agreed to be interviewed. In the sample were 2,000 drivers under 19 1/2 years of age. Some unpublished data from the study is presented in Table 2. The DMV driver record data was for approximately the first three years of driving. For males there was a lower conviction rate for those with any form of



driver education or training. For females there was a lower accident rate for those with any form of driver education or training. Those who took driver education or training drove and smoked less than those who did not take either course.

Ferdun, Peck, & Coppin (1967), in the study described previously, found that those taking behind-the-wheel training had fewer moving violations, but as many accidents, as those without training. Males who took driver training drove fewer miles than those not taking the course. The major limitation of this study was that the one year driving record was not keyed to either the date licensed or the date completing driver training. For those 19 1/2 years of age, for example, the driving record was for the period from 19 1/2 to 20 1/2 years of age. This might well be as long as 4 years after completing driver training. This study was therefore not very sensitive to any effects of driver training in the first year of driving, and cannot be considered conclusive.

Crancer (1967) found that those under 21 with "driver training" had fewer accidents and convictions than those without it. There was some evidence for between-county variability in the differences in driver record by driver training status.

Mullins (1967) studied 13,000 new Air Force personnel and found no relationship between the number of self-reported accidents and whether or not the subjects had any form of driver education or training.

Asher (1968) studied a nationwide sample of 532 seniors who had had the opportunity to take "driver training." The questionnaire item was "Did you take driver training in high school?" This question was rather ambiguous. Seventy variables from the project TALENT data bank were analyzed to determine if those taking driver training differed from those not taking the course. Slight differences were found on 11 variables. Those

taking driver training had a better knowledge of academic subjects, higher IQ, higher socio-economic status, started working at a later age, had fewer dates per week, and had higher educational aspirations, than their counterparts. Neither personality tests nor interest inventories discriminated between the groups.

Asher & Dodson (1969), in the research described previously, also studied the effectiveness of "driver training." The comparisons were made between those who took driver training and those who did not, even though a course was available. The correlations with accidents were -.01 for males and -.05 for females, with n's of 3,928 and 3,271, respectively. The authors indicated that neither of the correlations was statistically significant. This is incorrect. With a sample size of 3,271, a correlation of .034 is significant at the .05 level. The relationship was in the opposite direction to that expected, namely that females with driver training had more accidents.

McGuire (1969a) studied the effectiveness of behind-the-wheel driver training in California. There were 220 students from public and parochial schools. Comparisons were made between 47 matched pairs. No differences in accidents were found between those with and without training. Due to the small, unrepresentative sample, this result cannot be considered conclusive.

McGuire (1969b) did a further analysis of the study by Mullins mentioned above. He studied a subsample of 1,472 enlisted men between the ages of 17 and 20 who had been driving for 2 years. Those without any driver education or training were compared with those who had a maximum amount of education and training as well as with those who had a moderate amount. No differences in accident frequency were found among the three groups.

Harrington (1970) found that driver training instructors were able to predict success on the California DMV drive test with better than chance accuracy. Only 73 percent of those with both classroom driver education and behind-the-wheel driver training were able to pass DMV's drive test on their first attempt.

All of the studies evaluating driver education suffer from one or more of the following limitations: (1) unsound statistical techniques, (2) poor accident records, or (3) failure to adequately allow for volunteer or selection biases.

The general consensus of the studies is that those who have taken driver education or training have better accident and conviction records than those without any formal training. The general consensus of the findings comparing the biographical characteristic of those with and with-

out driver education is that those taking driver education have more favorable, more socially desired, characteristics. These two findings raise the question as to whether or not the differences in driver record between those taking and not taking driver education were caused by the driver education, or were merely a reflection of the superior personal characteristics of those taking driver education. No definitive study has been done to answer this question.

# CHAPTER 2

## METHOD

In this chapter we shall present the details of the data collection and processing, as well as the statistical techniques employed.

### Driver Record Data

For practical reasons, five counties were purposively selected as being fairly representative of the State of California. The five counties were Fresno, Sonoma, Sacramento, Stanislaus, and Los Angeles. Individual subjects were selected by searching the driver record file at DMV headquarters as follows. For the first four counties, all files of driver records whose license number ended in the digits from 05 to 99 were searched. Those subjects who obtained their licenses at any DMV field office within the county, who had a mailing address within the county, who were 16 or 17 years of age at the time of licensing, and whose license application was processed at DMV headquarters during the odd-numbered months of 1963, were selected. For Los Angeles county only subjects applying for a license at a DMV field office within or near the boundaries of the Los Angeles City School District were selected. The reason for this was that it was intended to restrict the school data collection to the Los Angeles City School District, for practical reasons. Also, in Los Angeles only subjects whose drivers license number ended in digits from 75 to 99 were selected, as this provided an adequate sample size. The sample can not be considered a completely representative sample of the entire state. The number of subjects from each county is presented in Table 3. Males

TABLE 3

Number of Subjects by Sex and County

| Sex | County | | | | | |
|---|---|---|---|---|---|---|
| | Los Angeles | Sacramento | Fresno | Stanislaus | Sonoma | All counties |
| Male | 3,16. | 1,9.8 | 1,69? | 759 | 952 | 8,1?1 |
| Female | 2,125 | 1,4.6 | 1,06. | 9?5 | 5?. | 5,.?4 |
| Both sexes | 2?? | 3,3?4 | ?,66? | 1,?51 | 1,23? | 13,?15 |

made up 58.4 percent of the sample.

Since this study was restricted to 16 and 17 year olds, the percentage of this age group which was licensed is presented in Table 4. This table was based on a 10 percent sample of the computerized driver record file. Population figures for each age group were obtained from the California Department of Finance (1968). The tabled values were point-in-time estimates, and cannot be interpreted, for example, as stating that only 36 percent of 16 year old males were licensed during the year they were 16. Rather, this figure lay between the 36 percent for 16 year olds and the 68 percent for 17

TABLE 4
Percentage of Age Group with Valid Licenses by Sex
(As of August 20, 1969)

| Age | Sex | |
|---|---|---|
| | Male | Female |
| 16..... | 36.0 | 25.9 |
| 17..... | 68.3 | 50.5 |
| 18..... | 84.6 | 63.2 |
| 19..... | 89.2 | 72.3 |
| 20..... | 91.8 | 71.3 |

year old males. It may be seen that the present study sampled from the majority, but far from all, of those who would eventually comprise the adult driving population.

Driver record data through December 31, 1967, from DMV files were manually coded by clerical personnel during the spring and summer of 1968. Definitions of variables obtained from the original (first) drivers license are presented in Exhibit 1. Some of these and subsequently defined variables were manually coded differently and recoded by computer processing. The definitions and codes presented were the final ones used in the data analysis. Some variables were multiplied or divided by powers of ten for scaling purposes. The values of all variables were rounded or truncated to integer form. Whenever any data was missing which was necessary for the definition of a variable, a control value 999 was coded. The definitions of accident types, violation types and actions from the driver record file are presented in Exhibit 2. The number of accidents, etc., was counted in five time periods -- six months prior to licensing, and by year during the four years subsequent to licensing. For those subjects with instruction permits, the number of accidents and convictions was also counted during the length of the permit.

It should be emphasized that whether or not an accident was entered on the driver record file did not depend to any great extent on self-report by subjects. Fatal and injury accidents, many property damage accidents investigated by the police, and property damage accidents reported by another driver were entered on the record, even if the subject did not report them. Previous California research has indicated that the vast majority of reportable accidents and convictions are entered on the record (Schuster & Guilford, 1964; McGuire, 1969a). The present results from the interview of high and low accident subjects tended to support the fairly high accuracy of DMV's records.

This still leaves the problem of the many minor property damage accidents which were not required by law to be reported. The influence of lack of knowledge of these accidents on the results is difficult to assess.

EXHIBIT 1

Definitions and Codes of Variables Obtained from the Original Drivers License

Fresno County
0. Other counties 1. Fresno county

Sonoma county
0. Other counties 1. Sonoma county

Sacramento county
0. Other counties 1. Sacramento county

Stanislaus county
0. Other counties 1. Stanislaus county

Los Angeles county
0. Other counties 1. Los Angeles county

Height
Height in inches

Weight
Weight in pounds

Single original license
1. Married, separated 2. Single, divorced, annulled or widowed

Drive test score
Score 70-99 on DMV drive test passed. Scores of 100 were coded as 99.

Age licensed
Number of weeks completed between 16th birthday and date licensed. Zero to 6 days subsequent to the 16th birthday is 0 weeks, 7-13 days is 1 week, etc.

Length instruction permit
Number of weeks between the date subject obtained instruction permit and the date licensed. If the subject did not have an instruction permit, 0 was coded.

Instruction permit
0. Did not have 1. Had instruction permit

Traffic density
Number of registered vehicles per linear mile of roadway in each county: Fresno--39, Sonoma--60, Sacramento--118, Stanislaus--57, Los Angeles--202.

EXHIBIT 2

Definitions and Codes of Driver Record Data

Accidents

The total number of accidents in each time period. All fatal and injury accidents are required by law to be reported by or to the California Highway Patrol (CHP), which reports them to DMV. Some non-injury accidents are also reported by the CHP. Entries are made on the driver record of each subject involved in the accident. Accidents in which one party suffered damages of $100.00 or more were required to be reported to DMV under the Financial Responsibility law. When any one driver in a multiple vehicle accident reported such an accident to DMV, the accident was entered on the driver record of all drivers involved in the accident.

Fatal and injury accidents

The number of accidents in which someone was killed or injured.

Property damage accidents

The number of accidents in which no one was killed or injured.

Single vehicle accidents

The number of fatal and injury accidents in which only one vehicle was involved (Codes 22-27 of the CHP coding manual for Vehicle Combination).

Drunk driving accidents

The number of fatal and injury accidents in which our subject was obviously drunk or his ability was impaired (Codes 1-2 of CHP Drivers Sobriety).

Partially-at-fault accidents

The number of fatal and injury accidents in which our subject's violation of the law contributed to the accident. In most instances, this was equivalent to legal responsibility (Codes 1-27 of CHP Driver's Violation).

Accident cost

Accident cost, in hundreds of dollars, calculated as follows: Cost = $90 x (number of fatal accidents) + $22 x (number of injury accidents) + $4 x (number of property damage accidents). The 1964 costs for each type of accident were the direct costs, and did not include the cost of loss of future earnings, for example, except to the extent compensated by insurance (Smith & Tamburri, 1968).

Length license gap

The number of days the drivers license was expired or cancelled. *Only gaps of 90 days or more were counted.

Accident rate

The number of accidents times 10,000 divided by Mileage T Score (see Exhibit 5). This yielded scaled accidents per standard score unit of mileage. For subjects with no accidents, the score was 100 divided by Mileage T Score. This yielded a different score depending on mileage, rather than having them all scored 0. Some examples are as follows:

| No. accidents | Mileage T Score | Accident rate |
|---|---|---|
| 0 | 50 | 2 |
| 0 | 100 | 1 |
| 1 | 50 | 200 |
| 1 | 100 | 100 |

EXHIBIT 2 (Continued)

Convictions
The number of convictions for traffic offenses. When a person received a traffic ticket and was found guilty or forfeited bail, the courts sent DMV an "abstract of conviction" which listed the sections of the Vehicle Code which the subject was found guilty of violating. Each abstract was counted as one conviction, irrespective of the number of sections of the Vehicle Code violated.

Violations
A violation was a section of the Vehicle Code listed on an abstract of conviction. That is, the subject was guilty of violating one section of the Vehicle Code. Each violation was counted separately, with one exception. Multiple speed violations on one abstract were counted as only one violation, since they usually referred to the same act, one violation for exceeding the posted speed limit, and the second for violation of the basic speed law, driving at an unsafe speed. Violations by passengers, bicyclists and pedestrians were excluded. The violation types are listed below, with the sections of the Vehicle Code in parentheses. PC indicates penal code.

Sign violations
Failure to stop for signs or signals, or otherwise obey traffic signs (21451a, 21452a,b,c, 21454a, 21457a,b, 21461-62, 22450-52, 22454).

Lane placement
Failure to drive on the right side of roadway, crossing double lines, etc. (21459-60, 21650-57, 21658a,b, 21659-64).

Following-too-close
Following too closely (21703-06).

Passing
Passing without clearance, passing on grades and curves, passing on the right, etc. (21750-59).

Right-of-way
Failure to yield the right-of-way to vehicles or pedestrians as required (21800a,b, 21801-04, 21805b, 21806a, 21950a, 21951-52, 21954b).

Turning
Illegal turn or failure to signal turn (21460.5, 22100a,b, 22101d, 22102-11).

Speed
Speed over posted limit, or too fast or too slow for conditions, speed contest (22349-58, 22358.3, 22362-63, 22400, 22405-08, 22412, 23109).

Drunk driving
(PC 367d,e, 23101, 23102).

Reckless driving
(PC 192.3, 23103-04).

Drug
Driving under the influence of any drug or glue (23101.5, 23102.5, 23105-06, 23108).

Driving while suspended
Driving with a suspended or revoked license, or after refusal by the Department to issue or renew a license (14601).

EXHIBIT 2 (Continued)

Hit and run
Failure to stop after an accident (20001-02, 20007).

FTA/FTP
Failure to appear in court or failure to pay fine, as promised, for a traffic conviction (40508-09).

Equipment
Defective brakes, headlights, etc. (23130, 24002-27907, 28050, 28050.5, 28051).

Miscellaneous moving
Failure to obey traffic officer or fireman, violation of restrictions on a drivers license, unlawful use of license, etc. (2800-01, 13360, 14603, 14610, 16457, 21700, 21702, 21707-10, 21711-12).

Miscellaneous non-moving
All sections of the Vehicle Code not specified above, including such areas as vehicle registration, transportation requirements, occupational licensing, etc.

Actions
Court suspensions were given for traffic convictions, and were noted on the abstract of conviction. Most court suspensions in this study were from juvenile courts, in which brief suspensions of the drivers license were the usual punishment.

DMV probation was usually received due to negligent operator status owing to a high conviction rate.

DMV suspension or revocation of the license was administered to "hard core" negligent operators, those not obeying the Financial Responsibility laws, and those committing certain serious offenses, such as repeated drunk driving.

In the event of an overlap between a court suspension and a DMV suspension/revocation, only the DMV action was coded for the period of overlap.

Single license renewal
0. Married, separated 1. Single, divorced, annulled or widowed. Coding was from the most recent drivers license on file at the time of coding.

Adding these accidents to the criterion measure would obviously increase the accuracy of the count, and the effect would generally be to increase the magnitude of the correlations. However, it still might be necessary to set some lower monetary limit below which accidents would not be counted. Very minor property damage accidents may be more randomly distributed among the population than more serious accidents. It would make an interesting research project to collect accurate cost data on all accidents, then determine the effects on the correlation coefficients of omitting accidents below various costs from the criterion measure.

The characteristics surrounding fatal and injury accidents were coded from the accident reports filed by or with the California Highway Patrol (CHP). The definitions of accident characteristics will not be presented here for three reasons: (1) the names of the variables and the classifi-

cations in the tables make the meaning clear in most instances, (2) the recoding from the CHP accident coding manual is obvious in most instances, and (3) the variables are named and classified differently in Chapters 3 and 4. Appropriate comments on these variables will be made as they appear in the text. Most of this data, such as road class and time of day was purely descriptive, and was probably quite accurate. Some variables difficult to assess, such as drunk driving or vehicle defect, were probably underreported.

## School Data

School records were chosen as a source of data since the school is the main extra-familial social institution of which the teenager is a member, and degree of socialization has been found to be one of the best predictors of driver record. By socialization is meant conformance with the prescribed behavior, norms, and ideals of society.

In Los Angeles county, only school data from the Los Angeles City School District was used. The mail questionnaire (see next section) asked the names of high schools attended. The names of the subjects, and the high schools attended, and their birthdates were sent to the Los Angeles City School District. Names and addresses (on the original license) of subjects not responding to the questionnaire were sent to the District, which located the probable high school of attendance on the basis of the address. Photo-copies of the school records were then made and lent to DMV for coding.

In the other counties, all public high schools were visited, and the records were searched and coded by DMV employees. Transfers to other high schools within the county were followed up.

The percentage of subjects for whom we were able to obtain school records is shown in Table 5 by county. The lower percentages for Los Angeles

TABLE 5
Percentage for Whom School Records were Obtained by County and Sex

| Sex | County | | | | | |
|---|---|---|---|---|---|---|
| | Fresno | Sonoma | Sacramento | Stanislaus | Los Angeles | All counties |
| Male..... | 81 | 76 | 86 | 85 | 52 | 71 |
| Female..... | 79 | 77 | 82 | 78 | 51 | 69 |

county reflected the different methods of sample selection and data collection for that county.

The definitions of the school data variables are presented in Exhibit 3. These variables represented most of the variables commonly available on the permanent records.

EXHIBIT 3

Definitions and Codes for the School Variables

Birth location
1. Same county 2. California 3. Other

Home status
1. Lived with both natural parents 2. Lived with one natural parent 3. Other

Year left school
Last grade (8-12) completed prior to leaving school for any reason.

Transfer
0. No 1. Transferred to another high school

Dropout
0. No 1. Dropped out of high school before graduation

College transcript
0. Other 1. High school graduate with transcript sent to college

Driver training grade
Grade received in behind-the-wheel driver training. 1. D 2. C 3. B 4. A

Grade point average
Sum of grade points for all classes per above times 10 divided by the number of classes

GPA trend
0. GPA falling -- Senior GPA < Junior GPA < Sophomore GPA. 1. GPA oscillating -- Other 2. GPA rising -- Sophomore GPA < Junior GPA < Senior GPA. Subjects without GPA's in all three years were coded 999 as a control value.

Citizenship grade
This was a measure of work habits, cooperation and classroom behavior. Grades were standardized separately for each sex within each high school to T scores, with a mean of 50 and a standard deviation of 10. High scores indicated good citizenship.

Absences
Ten times the average number of absences per regular school year.

Non-language IQ
Non-language intelligence quotient in IQ score form. If this datum was missing, Language IQ or Total IQ was substituted when available. If none of these was available, then the Achievement Test score was transformed to an IQ score, directly via standard deviation units, and the transformed score was substituted.

Achievement test
Average of the T scores on English and Mathematics Achievement Tests. Missing data was handled per Non-language IQ.

IQ discrepancy
0. Other 1. Non-language IQ was more than 14 points greater than Language IQ. Some clinical psychologists claim that this suggests "psychopathic tendencies."

Achievement index
Grade Point Average times 100 divided by Total IQ. High scores indicate overachievement in school in relation to "native ability."

EXHIBIT 3 (Continued)

Rural school
0. Other 1. High school was in a rural area or in a city of less than 10,000 population

School data missing
0. School data was collected 1. School data missing

Two variables, Language IQ and Total IQ were dropped due to a programming error. Other variables defined in terms of either of these variables were calculated prior to the introduction of the error, so were not affected.

Three variables were dropped due to a lack of adequate data available at the schools in readily accessible form. These variables were Times Tardy, Sports Activities, and Non-sports Activities. The latter two were included in the mail questionnaire data.

Two variables collected, Parents Occupation and Driver Training Status, will be discussed under Questionnaire Data.

Various means of defining the variables were evaluated in order to determine which had the highest correlation with four year accidents and convictions. None of the less obvious or more complex variables was appreciably superior to those presented in Exhibit 3. After comparing the correlations with accidents and convictions with those presented in Exhibit 3, these other variables were not analyzed any further, but are described in the following paragraphs.

Ability groupings were made in many schools, so that brighter students were in the same class, and the less bright were in one or more other levels of classroom ability. This data was transferred to T scores, with higher scores indicating brighter Ability Groups. This T score was used to define variables as follows.

In addition to simple Grade Point Average (GPA), the following were evaluated: (1) Ability Group GPA -- the product of Ability Group T score and GPA; the purpose of this was to take into account any difference in grading practices in the various ability groups; (2) English GPA; (3) Mathematics GPA; (4) English-Math GPA -- the average of (2) and (3); and (5) English-Math GPA times Ability Group T score. The purpose of these latter variables was to compare academic GPA with overall GPA. Another measure of academic standing examined was Graduating Class Rank.

In addition to the Achievement Index shown, three other such indices were studied. These other indices used Ability Group GPA, English-Math GPA, or Ability Group English-Math GPA in place of simple GPA.

The absences variable shown is total absences, which was also broken down into excused and unexcused absences, as it was thought that the latter would be a superior predictor.

Achievement Test was also broken down into subscores on English and Mathematics tests.

In summary, the attempt to find better correlates of accidents and convictions than the more straightforward ones presented in Exhibit 3 was a failure.

## Questionnaire Data

A mail questionnaire, presented in reduced size in Exhibit 4, was sent to all subjects. The mailings to the Los Angeles and Sonoma county subjects were begun in December, 1966. The mailings to the remaining subjects were begun in September, 1967. The split-up of the mailing was done for practical reasons. The subjects were aged 19-22 at the time of the mailing.

The mailing strategy took into account previous research on the subject (Parten, 1950; Peck & Harrington, 1968; Scott, 1961). Each subject was first sent a questionnaire with a cover letter and a business reply envelope. Those failing to respond were sent up to three additional questionnaires, at two week intervals, which also included new cover letters and business reply envelopes.

Respondents were defined as those returning a completed questionnaire. Non-recipients were defined as those who did not receive the questionnaire. This was evidenced by either return of all questionnaires by the Post Office, or receipt of a letter from a relative saying that the subject was out of the country or was otherwise unable to receive the questionnaire. Non-respondents were defined as those not falling in the two previous categories.

The percentage of subjects in each category is presented in Table 6.

TABLE 6
Percentage Distribution of Response Category by Sex

| Response category | Sex | | |
|---|---|---|---|
| | Male | Female | Both sexes |
| Respondent | 62.38 | 76.04 | 68.07 |
| Non-respondent | 23.31 | 16.00 | 20.27 |
| Non-recipient | 14.31 | 7.96 | 11.66 |
| All categories | 100.00 | 100.00 | 100.00 |

Sixty-two percent of the males and 76 percent of the females responded to the questionnaire. This rather moderate response rate for four letters probably reflected the fact that so many of the subjects were out of the state -- either in the armed forces, or at school, or simply emigrated. With the non-recipient category excluded, the response rate was 77 percent.

EXHIBIT 4

# YOUNG DRIVER QUESTIONNAIRE

1. In your opinion, court fines for most traffic violations are generally:
   ☐ much too low ☐ a little too low ☐ about right
   ☐ a little too high ☐ much too high

2. What is the name of the senior high school from which you graduated (or the last one you attended)?

   _____ (Name) _____ (Location) _____ (Date)

3. List the names, dates and cities of any other high schools you attended. _____

4. Did you attend a high school which offered a driver education class with actual on-the-road instructions? ☐ yes ☐ no

5. Did you complete a course in on-the-road driver training in high school? ☐ yes _____ (school) _____ (year) ☐ no

   If yes, do you think it has made you.....
   ☐ a much safer driver ☐ a slightly safer driver ☐ little or no different
   ☐ a slightly less safe driver ☐ a much less safe driver

   If yes, how would you rate the training you received in your on-the-road driver training course in high school?

   5 Very poor — 4 — 3 Fair — 2 — 1 Excellent

6. How would you describe the classroom driver education you received in high school?
   ☐ none received ☐ excellent ☐ good ☐ fair ☐ not very good ☐ very poor

7. In your opinion, what is the major cause of auto accidents?
   ☐ poor drivers ☐ unsafe vehicles ☐ poor roadways ☐ other (specify) _____

8. In licensing drivers, do you feel that DMV should use testing procedures that are:
   ☐ much less difficult to pass ☐ slightly less difficult to pass ☐ about the same as now
   ☐ slightly more difficult to pass ☐ much more difficult to pass

9. The enforcement of traffic laws is:
   ☐ not nearly strict enough ☐ not quite strict enough ☐ about right
   ☐ a little too strict ☐ much too strict

10. How many convictions for moving violations should a driver be permitted to have in one year before the DMV considers revoking his license? _____

11. During an average or typical month, approximately how many miles do you drive.....
    To, from, and during work or school _____ miles
    For errands and personal business (to store, bank, doctor, etc.)..... _____ miles
    Recreation (dates, pleasure driving, to places of recreation, etc.) _____ miles
    Other..... _____ miles
    TOTAL..... _____ miles

12. During the past 12 months, did you drive a lot more in one month than any of the others? ☐ yes ☐ no
    If yes, what month was it and how many miles did you drive during that month?

    _____ (month) _____ (miles driven)

13. Since learning to drive, approximately how many miles have you driven? _____

14. How many miles of driving experience did you have prior to obtaining your first California drivers license (the one with your picture on it)? _____

15. Describe the vehicle you have driven most since learning to drive:

| Vehicle type (motorcycle, truck, car, etc.) | Make (Buick, Fiat, Honda, etc.) | Model and body type (Corvair, station wagon, F-85, etc.) | Year | Color | Approximate number of miles driven by you |
|---|---|---|---|---|---|
| | | | | | |

16. When were you born? _____ (month) _____ (day) _____ (year)

(TURN OVER AND COMPLETE OTHER SIDE)

ADM 824 (NEW 12/66)

Dept. of Motor Vehicles
Research and Statistics
P.O. Box 1828, Sacramento

# EXHIBIT 4 (Continued)
## Young Driver Questionnaire



17. Is the vehicle you drive most of the time equipped with seat belts? ☐ yes ☐ no
    If so, do you wear them.....
    ☐ never ☐ occasionally ☐ about half of the time
    ☐ most of the time ☐ always

18. Circle present marital status: Single, Married, Divorced, Widowed, Separated.

19. If married, about how old were you when first marriage took place? _____

20. How many children do you have? _____

21. What was your father's primary occupation? Occupational title _____ Industry _____

22. What was your mother's primary occupation? (If housewife, indicate so.)
    Occupational title _____ Industry _____

23. How many brothers and sisters do you have? _____ How many are older than you? _____

24. Are both your parents still alive? ☐ yes ☐ no
    Are they....☐ married ☐ separated ☐ divorced ☐ other

25. What is your occupation at present? (If primarily a housewife or student, indicate so. If unemployed, list most recent occupation.) Occupational title _____ Industry _____

26. Circle the highest grade you completed in school.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grammar School | | | | | | | | High School | | | | College | | | | |

27. What is your ultimate occupational objective? _____
    (Specify type of industry and kind of occupation you are striving for.)

28. What is your present occupational status?
    ☐ employed full-time ☐ employed part-time ☐ retired
    ☐ unemployed ☐ not employed because full-time student or housewife

29. While in high school, did you participate in any of the following types of school activities or organizations?
    a. Social clubs (sororities, fraternities, etc.)..... ☐ yes ☐ no
    b. Academic clubs (math club, spanish club, etc.)..... ☐ yes ☐ no
    c. Student body activities and school functions (e.g. school dance committees, student politics and administration, student body office holders, etc.).. ☐ yes ☐ no
    d. Intramural athletic activity (athletic activity within your school but not as part of regular physical education)..... ☐ yes ☐ no

30. If member of any of your school's athletic teams, how many school letters did you earn? (If not a participant, write "X" in blanks.) Varsity _____ Non-varsity _____

31. Check the sports you lettered in during high school.
    ☐ baseball ☐ football ☐ track ☐ basketball ☐ none ☐ other - _____ (specify)

32. In terms of safety, how would you rate yourself as a driver?

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Very unsafe | | about average | | extremely safe |

33. In relation to most people of your age and sex, how much do you drink (alcoholic beverages)?
    ☐ I never drink. ☐ much less ☐ a little less ☐ about the same
    ☐ a little more ☐ much more

34. On the average, how many cigarettes do you smoke per day? _____

35. Approximately how many full-time jobs have you had in the past 12 months? _____

36. Did you have a car while in high school? ☐ yes ☐ no (If yes, in what school year did you first start driving it regularly?) ☐ Sophomore ☐ Junior ☐ Senior

37. How many hours of driving did you do last week? _____

38. What percentage of your driving during the past year was done on a motorcycle? _____%

39. Have you ever been in the Armed Forces? ☐ yes ☐ no (If yes, when?) _____

The definitions and codes for the questionnaire data are presented in Exhibit 5. The numbers in parentheses following the names of the variable refer to the questionnaire number. Some of the variables were coded in a direction opposite to that which would be expected from the name of the variable.

Questions 2, 3, 7, 10, 16, 19, and 31 were not analyzed for various reasons.

The accident and conviction rates by Response Category are presented in Table 7. As is usually the case, the Non-recipients had the lowest

TABLE 7

Mean Accidents and Convictions [illegible] Years
Response Category and Sex

| Response category | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | Accidents | Convictions | Accidents | Convictions |
| Respondent..... | 0.643 | 2.971 | 0.338 | 0.788 |
| Non-respondent..... | 0.666 | 3.923 | 0.390 | 0.994 |
| Non-recipient..... | 0.579 | 2.829 | 0.310 | 0.193 |
| All categories..... | 0.640 | 3.173 | 0.345 | 0.830 |

rates, probably reflecting lack of exposure, and the Non-respondents had the highest rates. An unusual exception was the result for female convictions, where the Respondents had the lowest mean. The rates for the Respondents were fairly close to those for the total sample.

Both school and questionnaire data were available for 45 percent of the males and 54 percent of the females. This permitted determining the difference on school data between those responding and not responding (including non-recipients) to the mail questionnaire. The multiple regression equations are presented in Table 8. As in all such tables, the

TABLE 8

Regression Equations (Beta Coefficients) for Predicting Response Bias from School Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| | Response Bias = -0.17 Grade point average +[illegible] College transcript |
| | -0.08 Los Angeles county [illegible] Parents occupation |
| | +0.07 Home status +[illegible] Birth location +[illegible] Schedule |
| | lic renewal +0.04 GPA trend +0.04 Sacramento county |
| Female | |
| | Response Bias = -0.14 Grade point average -0.1[illegible] Los Angeles county |
| | -0.10 Year left [illegible] +[illegible] Birth location +0.07 |
| | College transcript [illegible] Home status |
| | Achievement index +0.05 Absences |

EXHIBIT 5

Definitions and Codes for the Questionnaire Data

Questionnaire response date
Codes 0-5 indicating period (of approximately 2 weeks) in which mail questionnaire was returned. High codes indicated the questionnaire was returned later.

Attitude (7, 8, 9)
The responses to questions 1, 8, and 9 were each scaled 0-4 with high scores indicating court fines were too high, DMV tests should be less difficult, and traffic enforcement is too strict. The value coded was the sum of the three scores.

Driver training safety (5)
Codes 0-4. High scores indicate driver training made the subject a less safe driver.

Driver training quality (5)
Codes 1-5. High scores indicate poor ratings.

Driver education (6)
0 None received 1. Took driver education

Driver education quality (6)
Codes 1-5, with the none received category excluded. High scores indicated poor ratings.

Mileage work (11)
Monthly mileage in tens of miles.

Mileage errands (11)
Monthly mileage in tens of miles.

Mileage other (11)
Monthly mileage for recreation and other purposes in tens of miles.

Mileage total (11)
Monthly mileage in tens of miles.

Annual mileage (11, 12)
Mileage total times 11 plus mileage in the highest month of driving (question 12). In hundreds of miles per year.

Total mileage (13)
In thousands of miles.

Prior mileage (14)
In hundreds of miles.

Mileage T score (11, 13, 37)
T score based on standardization of Total Mileage for each sex separately. When Total Mileage was missing, the T score for Mileage Total or Hours Driving was substituted, in order of preference.

Vehicle weight (15)
0 Motorcycle 1. Foreign compacts (under $2,500) 2. American compacts ($2,500-$2,999) 3. Standard American cars ($3,000-$3,699) 4 Moderately expensive cars ($3,700-$4,200) 5. Luxury cars (over $4,200) 6 Trucks and buses. Classifications 1 through 5 were based solely on new 1967 blue book price. Consequently, the names for the classifications are merely descriptions of the majority of cars in the classification. There were some foreign cars in classifications 2 through 5.

Vehicle year (15)
Coded last two digits, e.g., 1963 = 63.

EXHIBIT 5 (Continued)

Vehicle mileage (15)
In thousands of miles.

Equipped seat belts (17)
0. No 1. Yes

Wear seat belts (17)
Codes 0. Never ... 4. Always. Those without seat belts were excluded.

Married (18)
0. Single, divorced or widowed 1. Married or separated

Divorced/separated (18)
0. Single, widowed or married 1. Divorced or separated

Number of children (20)

Number of brothers (23)

Number of older sibs (23)
If the number of brothers and sisters was zero, code 0.

Parents alive (24)
0. No 1. Yes

Parents married (24)
0. Both parents not alive, separated, or divorced 1. Married

Student (25)
0. No 1. Yes

Housewife (25)
0. No 1. Yes

Grade completed (26)
1-17+

Occupational goal (27)
Coded Duncan's Socio-economic Status Index (Reiss, 1961) for the occupation. High scores indicated high status.

Social mobility (21, 22, 27)
Occupational Goal times 10 divided by Parents Occupation (see below). High scores indicated the subjects occupational status goal was higher than his parents' occupational status.

Unemployed (28)
0. Employed full or part time, or full time student or housewife.
1. Unemployed

Social activities (29)
0. No 1. Yes

Academic activities (29)
0. No 1. Yes

Student activities (29)
0. No 1. Yes

Intramural activities (29)
0. No 1. Yes

Varsity letters (30)
Number of

Non-varsity letters (30)
Number of

EXHIBIT 5 (Continued)

Safety self-rating (32)
Codes 1-5 with high scores indicating unsafe.

Drinking (33)
Codes 0. Never drink ... 5. Much more

Number of cigarettes (34)

Number of jobs (35)

Year own car (36)
1. Sophomore 2. Junior 3. Senior 4. After high school

Hours driving (37)
Number of

Percent motorcycle (38)
0, 2, 10, 20, ... 80+ percent

Armed forces service (39)
0. No 1. Yes

Response bias
0. Responded to mail questionnaire 1. Non-respondent or Non-recipient. Those for whom we did not have school data were excluded.

Driver training not offered (4,5, School data, see Chapter 6)
0. Driver training offered 1. Not offered

Driver training not taken
0. Driver training taken and driver training not offered
1. Driver training not taken

Driver training taken
0. Driver training not taken or not offered
1. Driver training taken

Driver training taken when offered
0. Driver training not taken 1. Driver training taken. Those who were not offered driver training were excluded.

Parents occupation (21, 22, School data)
Coded Duncan's SES for the father. If the father's occupation was unavailable, used the mothers. If neither was available, used the School data.

Questionnaire data missing
0. Responded to mail questionnaire 1. Non-respondent or non-recipient

order in the equation represents the order in which they were selected by the stepwise regression program (see below). Response bias is defined in Exhibit 5. For both sexes Grade Point Average was the best predictor, with those responding to the questionnaire having higher grade point averages. In general, the best predictors were related to school achievement. This would be expected, since completing the questionnaire would be a more difficult task for the less able. Also, those with less academic achieve-

ment would probably be less interested in the questionnaire or the study. The multiple correlation coefficients were 0.31 for males and 0.26 for females, indicating a moderately low overall difference between the response groups.

That less than 100 percent responded to the questionnaire probably has lead to a bias in the data, so that the results are not entirely representative. For any particular statistic, the direction and amount of bias are unknown. In general, the difference on driver record and biographical data between respondents and others was moderately low, suggesting that the overall bias was also moderately low. With regard to the bias in the correlation coefficients, the fact that the non-respondents had worse driver records as well as less favorable biographical characteristics, has generally resulted in reduced correlations between driver record and questionnaire data, so that the correlations obtained were probably conservative estimates of the true figures.

## Interview Data

In order to obtain a more comprehensive set of data on each subject, it was decided to personally interview high and low accident subjects, and to determine the biographical differences between the two groups.

All males with three or more accidents, and all females with two or more accidents, in their first four years of driving, were defined as high accident subjects. High accident subjects comprised 3.48 percent of the male sample, and 5.32 percent of the female sample. Low accident subjects were defined as those with no accidents during the same time period. Low accident subjects comprised 54.80 percent of the male sample and 71.95 percent of the female sample.

The low accident subjects were chosen by computer as follows. If the computer tape record (records were in drivers license order) read was for a low accident subject, the drivers license number was stored by sex and county. If the record read was that of a high accident subject, the drivers license number, sex, county, and number of accidents were printed out. A count was made of the number of records read. When a high accident subject was found, and the total number of records read was an even number, the drivers license number, sex and county of the last low accident subject of the same sex and from the same county was printed out. When the number of records read was odd, the tape continued to be read until the next low accident subject of the same sex and from the same county was encountered -- it was then printed out. In other words, the high and low accident subjects were matched on sex and county, and in half the cases the low accident subject had a higher drivers license number, and in the other half a lower number. In some instances, when there was no, or only one, low accident record between two high accident records of the same sex and county, the same low accident subject could be selected twice; consequently, there were a few less low accident subjects than high accident subjects. A total of 1,145 subjects were selected.

Sacramento county subjects were interviewed during the course of developing the interview questionnaire. Several were found to be DMV employees or children of DMV employees. Also, many of the coding clerks were the same age as the subjects and might have known some of them. Consequently, it would have been difficult to maintain the confidentiality of the information for the Sacramento county subjects, so that they were dropped from the interview phase. Tracking down the subjects turned out to be more difficult and expensive than anticipated, so that the money allocated to the interview phase was expended prior to completing all the interviews. Consequently, the last 80 names (both low and high accident) on the Los Angeles county list were dropped from the interview phase.

After these deletions, there remained 744 subjects we attempted to interview. Every means available, including attempting to contact the parents, was used to locate and contact the subjects. Subjects were offered $5.00 to participate. If this was unsuccessful, another interviewer offered $10.00. The degree of success in obtaining interviews is presented in Table 9. Interviewed were 55 percent of the males and a significantly

TABLE 9
Percentage Distribution of Interview Response Classification by Accident Status and Sex

| Response classification | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | High accident (N=175) | Low accident (N=177) | High accident (N=210) | Low accident (N=182) |
| Interviewed..... | 54.29 | 55.37 | 67.14 | 60.99 |
| Unable to locate..... | 20.00 | 15.25 | 12.38 | 17.03 |
| Out of state..... | 14.29 | 18.08 | 10.00 | 11.54 |
| Remote California..... | 4.00 | 4.52 | 4.29 | 5.49 |
| Refused..... | 5.71 | 3.39 | 5.24 | 4.94 |
| Deceased..... | 1.71 | 3.39 | 0.95 | 0.00 |
| All classifications.... | 100.00 | 100.00 | 100.00 | 99.99 |

$x^2$ male accident status vs. classification = 3.99, 5 df, $p > .20$.

$x^2$ female accident status vs. classification = 4.29, 5 df, $p > .20$.

$x^2$ male vs. female (both statuses) = 13.56, 5 df, $p < .01$.

higher 64 percent of the females. There were no differences between the distributions by high and low accident status for either sex. The main reason for failure to interview the subjects was that they could not be located, or the subjects were found to be living out of California.

Only 5 percent of the subjects refused to be interviewed. The Remote California classification meant that the subject was residing in California outside the areas in which the interviewing was done -- Los Angeles county, Sonoma county, Stanislaus county, Fresno county, and the San Francisco Bay area.

The interviewers were told they were interviewing people with all types of driver record, and that they were to tell their subjects this if they were asked by the subjects if they had been selected because of traffic tickets or accidents. Questions regarding the accident history of the subjects were placed at the end of the interview questionnaire, so as not to influence the results.

Most of the interview was taken up with the interviewer asking questions about the subjects' life and driving habits. Also, a "driving behavior sort" was used. Fifty statements were printed on cards about the subjects' driving behavior at present and at ages 16-17. The subjects sorted the cards into "me" and "not me" piles. Also sorted into the same piles were 115 cards with adjectives on them, so that the subject could describe himself. These adjectives were from lists developed by Hathaway, Meehl, and Black (Black, 1956), together with a few added by the present author. Finally, Scales based on the Aggression, Exhibitionism, and Change scales of the Edwards Personal Preference Schedule (EPPS) (Edwards, 1959). Items dealing with sex were deleted from the scales. Also items which were scored on more than one scale were deleted, so that the new scales were not ipsative. Since the scales were changed and taken out of context, the present findings can not be generalized to the usual scales, or to other uses of the EPPS.

The interview questionnaire is not presented here for reasons of space. Those questions which differentiated between high and low accident subjects are presented in Chapter 6. The interview questionnaire, coding instructions, and means and standard deviations for all interview variables by accident group and sex, are available upon request.

## Data Processing

All data were coded onto code sheets which were keypunched, then transferred to tape. A computer program was written which transformed the raw data into the final master tapes from which most analyses were done. The codes presented previously in the Exhibits were the final codes generated by the computer. The hand coding was designed to be as simple and error-free as possible. For example, only the dates of accidents were coded. The computer program then determined what year after licensing the accident occurred in, and added 1 to the number of accidents for that year. If any data was missing, a code of 999 was entered. An exception was made to the above for the interview data, where all coding was done manually.

All coders were thoroughly trained and checked 100 percent during the learning phase. Thereafter quality control checks were made throughout

the coding process. All coding of accidents was double-checked by a second clerk for accuracy.

Computer programs were written to check the punch cards for the range of permissable values, as well as for the consistency of the relationship among the variables on each card. For the interview data, only the range of values was checked. All errors were corrected. Only one check was made between one card and another card, on driver training status. The results are presented in Chapter 5.

After the master tapes were created, the means, standard deviations, number of subjects, minimums and maximums were calculated for each variable, and inspected for accuracy. Two variables, Language IQ and Total IQ were deleted from further analysis, as errors had been introduced into the data by a computer program. The other errors found were negligible.

## Statistical Techniques

All hand calculations were double-checked by a second clerk. Table totals may not add due to independent rounding or truncation. All analyses of variance and t-tests followed Winer (1962). All tests of statistical significance were two-tailed at the 0.05 level.

All $\chi^2$ statistics were calculated on the raw frequency distributions, even when shown with percentage tables. All $\chi^2$ statistics with 1 degree of freedom (df) were corrected for continuity. In some instances $\chi^2$ tests were made in violation of the assumption of independence between categories. This was done when there was no practical alternative. In most, if not all, cases the resulting $\chi^2$ statistic was so large that the significance of the differences was beyond question. In any event, such calculated $\chi^2$ statistics should be considered approximations.

The Pearson Product Moment correlation coefficient (r) was the main statistic used. The correlations required for statistical significance are presented in Table 10. Due to the violation of the assumptions for the use of r, the maximum value of r attainable was not 1, but some lower figure (California Department of Motor Vehicles, 1964-1967; Peck, McBride, & Coppin, in press). The correlation between any two variables was based only on those subjects for whom data was available on both variables. Since driver record data was available for everyone, the correlations between driver record and school or questionnaire data, were based on all subjects for whom school and questionnaire data was available, respectively. In the case of correlations between school and questionnaire data, they were based only on subjects for whom both school and questionnaire data were available, and consequently were somewhat biased. The percentage of subjects for whom we have data from various sources is presented in Table 11.

Another major statistical method used was multiple regression analysis (Blalock, 1964; Cochran, 1968, 1970; Cohen, 1968; Darlington, 1968; Draper &

TABLE 10

Correlation Coefficients Required for Statistical Significance at the .05 and .01 Levels as a Function of the Sample Size N

| N | r.05 | r.01 |
|---|---|---|
| 8000 | .022 | .029 |
| 7000 | .023 | .031 |
| 6000 | .025 | .033 |
| 5000 | .028 | .036 |
| 4000 | .031 | .041 |
| 3000 | .036 | .047 |
| 2000 | .044 | .058 |
| 1000 | .062 | .081 |
| 500 | .088 | .115 |

Note.--Values for N greater than 2000 were calculated from the formula--critical ratio divided by the square root of N.

TABLE 11

Number and Percentage of Subjects for Whom we Have Data From Various Sources

| Source of data | Sex | | | |
|---|---|---|---|---|
| | Males | | Females | |
| | Number | Percent | Number | Percent |
| Driver record..... | 8,121 | 100 | 5,794 | 100 |
| School record..... | 5,761 | 71 | 4,001 | 69 |
| Mail questionnaire..... | 5,066 | 62 | 4,407 | 76 |
| Both school record and mail questionnaire..... | 3,654 | 45 | 3,115 | 54 |

Smith, 1966; Gordon, 1968; Li, 1964; Linn & Werts, 1969; Pugh, 1968). A forward selection stepwise regression program following Efromyson's algorithm was used. Variables were added to the equation one at a time, until the multiple correlation ceased to increase significantly. The F values shown in the tables were the F's upon entry. The beta coefficients shown in the tables were the standardized regression coefficients for the final equation. The beta coefficients are sometimes interpreted as reflecting the unique contribution of the variables, which is not quite correct. The unique contribution relative to the other variables is the part correlation coefficient. However, the ratio of the part correlations of two variables in the equation is equal to the ratio of their beta coefficients, so that the magnitude of the beta coefficients may be interpreted as the importance of the variable as a predictor, relative to the other variables in the equation. This interpretation of the beta coefficients, which is often expressed by saying that they represent the effect adjusted for all other variables in the equation, is subject to certain limitations. For example, when two variables measuring essentially the same phenomenon are entered in the equation, the magnitude of their beta coefficients may be increased and have opposite signs. For an example, see pages 78-79. Another possible outcome would be a reduction in the magnitudes of the beta coefficients. Consequently, interpretation of the beta coefficients, and comparison of them with the correlation coefficients, should be made with caution.

For a discussion of other statistical considerations involved in accident research see Peck, McBride, & Coppin (in press).

Comments on the analysis of covariance will be made in Chapter 5.

# CHAPTER 3
# LONGITUDINAL DRIVING RECORD

This chapter will begin with an analysis of variables associated with licensing, such as drive test scores. Then an analysis of the accident and conviction record prior to licensing will be made. Driver record data for the first four years of driving after licensing will be presented, including year-to-year trends in accident types, accident characteristics, convictions, violation types, and DMV and court actions. The means, standard deviations and correlation coefficients for most variables are presented in the Appendices.

## Driver Record Prior to Licensing

Three variables derived from the original license application will be analyzed: (1) drive test score, (2) age licensed, and (3) length of instruction permit. Then an analysis will be made of the accident and conviction rates prior to licensing.

The average score on the drive test was 83 for males and 82 for females. This difference was statistically significant ($t = 4.53$, $p < .001$). The percentage distribution of scores on the drive test is shown in Table 12. Approximately 8 percent had very high scores of 95-99. The remaining

TABLE 12

Percentage Distribution of Drive Test Score by Sex

| Score | Sex | |
|---|---|---|
| | Male | Female |
| 95 - 99 | 8.82 | 6.54 |
| 90 - 94 | 15.70 | 14.90 |
| 85 - 89 | 19.32 | 19.26 |
| 80 - 84 | 20.08 | 20.00 |
| 75 - 79 | 18.10 | 19.28 |
| 70 - 74 | 17.98 | 20.02 |
| All scores | 100.00 | 100.00 |

scores were distributed fairly evenly throughout the other categories.

The minimum licensing age was 16 years. The average age when licensed was 16 years, 23 weeks for males, and 16 years, 27 weeks for females ($t = 10.05$, $p < .001$). The percentage distribution of age licensed is shown in Table 13. Thirty seven percent of the males and 28 percent of the females obtained their license within four weeks of their sixteenth birthday. A steadily decreasing percentage were licensed at later ages.

TABLE 13

Percentage Distribution of Age Licensed by Sex
(In weeks after 16 years of age)

| Age (weeks) | Sex | | Age (weeks) | Sex | |
|---|---|---|---|---|---|
| | Male | Female | | Male | Female |
| 0 - 3..... | 37.35 | 27.89 | 52 - 55..... | 2.29 | 2.58 |
| 4 - 7..... | 7.44 | 7.66 | 56 - 59..... | 1.90 | 1.78 |
| 8 - 11..... | 5.32 | 5.52 | 60 - 63..... | 1.33 | 1.78 |
| 12 - 15..... | 4.88 | 5.33 | 64 - 67..... | 1.42 | 1.71 |
| 16 - 19..... | 4.22 | 5.22 | 68 - 71..... | 1.39 | 1.49 |
| 20 - 23..... | 4.21 | 4.25 | 72 - 75..... | 1.32 | 1.56 |
| 24 - 27..... | 3.94 | 4.67 | 76 - 79..... | 1.34 | 1.73 |
| 28 - 31..... | 3.36 | 3.91 | 80 - 83..... | 1.10 | 1.16 |
| 32 - 35..... | 2.87 | 3.89 | 84 - 87..... | 0.86 | 1.57 |
| 36 - 39..... | 2.92 | 3.27 | 88 - 91..... | 1.13 | 1.47 |
| 40 - 43..... | 2.68 | 2.73 | 92 - 95..... | 1.07 | 1.21 |
| 44 - 47..... | 2.35 | 2.87 | 96 - 99..... | 0.82 | 1.21 |
| 48 - 51..... | 1.90 | 2.44 | 100 - 103.... | 0.57 | 1.09 |
| | | | All ages..... | 99.98 | 100.02 |

The minimum age for an instruction permit was 15 and one-half years. Ninety percent of the females and 86 percent of the males obtained an instruction permit ($\chi^2 = 54.21$, 1 df, $p < .001$). The average length of the instruction permit (excluding those with no permit) was 17 weeks for females and 16 weeks for males ($t = 8.67$, $p < .001$). The percentage distribution of length of instruction permit is shown in Table 14. Thirteen percent of the males and 9 percent of the females had permits for less than four weeks. Forty percent of the males and 47 percent of the females had permits for 24 to 27 weeks, when the permits expired. This concentration probably was due to many subjects' obtaining their permits and licenses as soon as they were eligible. The older the subjects were when they were licensed, the shorter the length of their instruction permits ($r = -.32$ for males, $r = -.20$ for females). These correlations reflected the fact that those under 16 when they obtained their instruction permit necessarily had to wait until 16 to be licensed.

The average numbers of accidents and convictions were low prior to licensing. The rates per thousand drivers are shown in Table 15. There were four accidents per thousand males during the period of the instruction permit (16 weeks). The figures in parentheses give an annual rate in order to permit comparison with the rate during the first year of

TABLE 14

Percentage Distribution of Length of Instruction Permit by Sex
(In weeks)

| Length (weeks) | Sex | |
|---|---|---|
| | Male | Female |
| No permit | 13.93 | 9.77 |
| 0 - 3 | 12.61 | 8.94 |
| 4 - 7 | 8.48 | 7.04 |
| 8 - 11 | 8.02 | 8.16 |
| 12 - 15 | 7.57 | 8.06 |
| 16 - 19 | 8.66 | 10.89 |
| 20 - 23 | 12.57 | 14.98 |
| 24 - 27 | 27.73 | 31.55 |
| 28+ | 0.43 | 0.60 |
| All lengths | 100.00 | 99.99 |

TABLE 15

Number of Accidents and Convictions per 1,000 Drivers Prior to Licensing by Sex

(Figures in parentheses are the number adjusted to an annual rate)

| Item | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | On instruction permit | 6 months prior | On instruction permit | 6 months prior |
| Accidents | 4 (13) | 5 (10) | 2 (6) | 3 (6) |
| Convictions | 39 (127) | 58 (116) | 5 (15) | 10 (20) |

driving. For example, the accident rate for males during the first year of driving was 159, or more than ten times the rate of 13 while on an instruction permit. The 6 months prior column gives the rates for all subjects during the period 6 months prior to licensing, irrespective of

whether the accident or conviction occurred during the period of an instruction permit. In absolute terms, males had 44 accidents and females 17 accidents during the period 6 months prior to licensing.

## Accident and Conviction Trends

First, the joint distributions of accidents and convictions for the first year and for the first four years of driving will be presented. Then the year-to-year trends in the types of accidents and violations will be presented.

The joint distributions of accidents and convictions for the first year of driving are presented in Tables 16 and 17. Fifty-seven percent of

TABLE 16
Joint Distribution of Accidents by Convictions for the First Year of Driving for Males
(Figures in parentheses are percentage of all subjects)

| Number of convictions | Number of accidents | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3+ | Total |
| 0 | 4,668 (57.48) | 428 (5.27) | 21 (0.26) | 0 (0.00) | 5,117 (63.01) |
| 1 | 1,386 (17.07) | 340 (4.19) | 37 (0.46) | 3 (0.04) | 1,766 (21.75) |
| 2 | 516 (6.35) | 154 (1.90) | 21 (0.26) | 1 (0.01) | 692 (8.52) |
| 3 | 215 (2.65) | 75 (0.92) | 8 (0.10) | 1 (0.01) | 299 (3.68) |
| 4 | 83 (1.02) | 43 (0.53) | 7 (0.09) | 1 (0.01) | 134 (1.65) |
| 5 | 41 (0.50) | 14 (0.17) | 1 (0.01) | 1 (0.01) | 57 (0.70) |
| 6 | 19 (0.23) | 4 (0.05) | 1 (0.01) | 0 (0.00) | 24 (0.30) |
| 7 | 12 (0.15) | 4 (0.05) | 2 (0.02) | 0 (0.00) | 18 (0.22) |
| 8 | 2 (0.02) | 3 (0.04) | 1 (0.01) | 0 (0.00) | 6 (0.07) |
| 9 | 3 (0.04) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 5 (0.06) |
| 10 | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.01) |
| 11+ | 1 (0.01) | 0 (0.00) | 0 (0.00) | 1 (0.01) | 2 (0.02) |
| Total | 6,947 (85.54) | 1,067 (13.14) | 99 (1.22) | 8 (0.10) | 8,121 (100.00) |

TABLE 17
Joint Distribution of Accidents by Convictions for the First Year of Driving for Females
(Figures in parentheses are percentage of all subjects)

| Number of convictions | Number of accidents | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3+ | Total |
| 0 | 4,657 (80.38) | 319 (5.51) | 15 (0.26) | 1 (0.02) | 4,992 (86.16) |
| 1 | 525 (9.06) | 140 (2.42) | 16 (0.28) | 0 (0.00) | 681 (11.75) |
| 2 | 75 (1.29) | 25 (0.43) | 0 (0.00) | 0 (0.00) | 100 (1.73) |
| 3 | 12 (0.21) | 4 (0.07) | 1 (0.02) | 0 (0.00) | 17 (0.29) |
| 4 | 2 (0.03) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 2 (0.03) |
| 5 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.02) | 1 (0.02) |
| 6 | 1 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.02) |
| Total | 5,272 (90.99) | 488 (8.42) | 32 (0.55) | 2 (0.03) | 5,794 (100.00) |

the males and 80 percent of the females were both accident and conviction free in their first year of driving. The "Total" row and column gives the percentage having a given number of accidents and convictions respectively. For example, for males, 85.54 percent had no accidents, 13.14 percent had one accident, 1.22 percent had two accidents, and 0.10 percent had 3 or more accidents. Similarly, 63.01 percent of the males had no convictions, 21.75 percent had one conviction, etc.

The joint distributions for the first four years of driving are presented in Tables 18 and 19. Only 15 percent of the males and 44 percent of the females were both accident and conviction free during their first four years of driving. Seventy-two percent of the females, but only 55 percent of the males avoided accident involvement in their first four years of driving. Three or more accidents were reported for 3.49 percent of the males and 0.96 percent of the females.

The number of accidents and convictions per year is presented in Table 20 and shown in Figure 1. Repeated measures analyses of variance were done separately on each trend shown in Table 20 for each sex separately

TABLE 18

Joint Distribution of Accidents by Convictions for the First Four Years of Driving for Males

(Figures in parentheses are percentage of all subjects)

| Number of convictions | Number of accidents | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| | 1,318 (16.24) | 282 (3.47) | 65 (0.80) | 9 (0.11) | 2 (0.02) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 1,577 (19.42) |
| | 968 (11.92) | 462 (5.69) | 92 (1.13) | 12 (0.15) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1,536 (18.91) |
| | 719 (8.73) | 420 (5.17) | 106 (1.31) | 25 (0.31) | 4 (0.05) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1,264 (15.56) |
| | 480 (5.91) | 360 (4.43) | 117 (1.44) | 27 (0.33) | 8 (0.10) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 992 (12.22) |
| | 340 (4.19) | 276 (3.40) | 99 (1.22) | 25 (0.31) | 3 (0.04) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 744 (9.16) |
| | 204 (2.51) | 205 (2.52) | 80 (0.99) | 24 (0.30) | 6 (0.07) | 3 (0.04) | 0 (0.00) | 0 (0.00) | 522 (6.43) |
| | 165 (2.03) | 151 (1.86) | 70 (0.86) | 21 (0.26) | 7 (0.09) | 1 (0.01) | 0 (0.00) | 1 (0.01) | 416 (5.12) |
| | 89 (1.10) | 99 (1.22) | 63 (0.78) | 12 (0.15) | 5 (0.06) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 268 (3.30) |
| | 80 (0.99) | 60 (0.74) | 45 (0.55) | 9 (0.11) | 3 (0.04) | 1 (0.01) | 2 (0.02) | 0 (0.00) | 200 (2.46) |
| | 62 (0.76) | 61 (0.75) | 37 (0.46) | 13 (0.16) | 6 (0.07) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 180 (2.22) |
| 10 | 36 (0.44) | 25 (0.31) | 23 (0.28) | 10 (0.12) | 2 (0.02) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 89 (1.10) |
| 11 | 27 (0.33) | 39 (0.48) | 20 (0.25) | 6 (0.07) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 93 (1.15) |
| | 22 (0.27) | 17 (0.21) | 14 (0.17) | 6 (0.07) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 60 (0.74) |
| | 13 (0.16) | 20 (0.25) | 7 (0.09) | 4 (0.05) | 3 (0.04) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 47 (0.58) |
| 14 | 12 (0.15) | 12 (0.15) | 6 (0.07) | 1 (0.01) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 29 (0.36) |
| 15 | 14 (0.17) | 11 (0.14) | 6 (0.07) | 4 (0.05) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 30 (0.37) |
| | 15 (0.18) | 1 (0.01) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 19 (0.23) |
| | 4 (0.05) | 11 (0.14) | 2 (0.02) | 3 (0.04) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 20 (0.25) |
| 18 | 2 (0.02) | 3 (0.04) | 1 (0.01) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 7 (0.09) |
| 19 | 1 (0.01) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 3 (0.04) |
| | 1 (0.01) | 0 (0.00) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 3 (0.04) |
| | 0 (0.00) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 2 (0.02) |
| | 0 (0.00) | 1 (0.01) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 3 (0.04) |
| 23 | 2 (0.02) | 2 (0.02) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 5 (0.06) |
| 24 | 1 (0.01) | 1 (0.01) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 5 (0.06) |
| 25 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) |
| 26 | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.01) |
| 27 | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.01) |
| 28 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) |
| 29 | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (0.01) |
| 30 | 0 (0.00) | 0 (0.00) | 2 (0.02) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 2 (0.02) |
| 31 | 1 (0.01) | 0 (0.00) | 0 (0.00) | 1 (0.01) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 2 (0.02) |
| Total | 4,450 (54.80) | 2,525 (31.09) | 863 (10.63) | 212 (2.61) | 55 (0.68) | 11 (0.14) | 4 (0.05) | 1 (0.01) | 8,121 (100.00) |

TABLE 19

Joint Distribution of Accidents by Convictions for the First Four Years of Driving for Females

(Figures in parentheses are percentage of all subjects)

| Number of convictions | Number of accidents | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4+ | Total |
| 0 | 2,543 (43.89) | 517 (8.92) | 61 (1.05) | 9 (0.16) | 0 (0.00) | 3,130 (54.02) |
| 1 | 1,012 (17.47) | 388 (6.70) | 82 (1.42) | 12 (0.21) | 2 (0.03) | 1,496 (25.82) |
| 2 | 366 (6.32) | 236 (4.07) | 48 (0.83) | 12 (0.21) | 0 (0.00) | 662 (11.43) |
| 3 | 147 (2.54) | 104 (1.79) | 33 (0.57) | 9 (0.16) | 0 (0.00) | 293 (5.06) |
| 4 | 57 (0.98) | 40 (0.69) | 13 (0.22) | 2 (0.03) | 0 (0.00) | 112 (1.93) |
| 5 | 22 (0.38) | 17 (0.29) | 9 (0.16) | 2 (0.03) | 2 (0.03) | 52 (0.90) |
| 6 | 6 (0.10) | 4 (0.07) | 2 (0.03) | 1 (0.02) | 1 (0.02) | 14 (0.24) |
| 7 | 4 (0.07) | 4 (0.07) | 2 (0.03) | 1 (0.02) | 0 (0.00) | 11 (0.19) |
| 8 | 2 (0.03) | 5 (0.09) | 1 (0.02) | 1 (0.02) | 0 (0.00) | 9 (0.16) |
| 9 | 2 (0.03) | 1 (0.02) | 1 (0.02) | 0 (0.00) | 0 (0.00) | 4 (0.07) |
| 10 | 2 (0.03) | 1 (0.02) | 0 (0.00) | 0 (0.00) | 1 (0.02) | 4 (0.07) |
| 11 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) |
| 12 | 5 (0.09) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 5 (0.09) |
| 13+ | 1 (0.02) | 0 (0.00) | 0 (0.00) | 1 (0.02) | 0 (0.00) | 2 (0.03) |
| Total | 4,169 (71.95) | 1,317 (22.73) | 252 (4.35) | 50 (0.86) | 6 (0.10) | 5,794 (100.00) |

TABLE 20
Number of Accidents and Convictions per 1,000 Drivers by Sex and Year

| Item | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Accidents | M | 159 | 182 | 172 | 127 | 640 |
| | F | 96 | 94 | 84 | 70 | 345 |
| Accident cost (in thousands of dollars) | M | 164 | 182 | 181 | 130 | 656 |
| | F | 92 | 88 | 74 | 69 | 323 |
| Property damage accidents | M | 109 | 125 | 116 | 86 | 436 |
| | F | 69 | 68 | 63 | 48 | 246 |
| Fatal and injury accidents | M | 50 | 57 | 56 | 41 | 204 |
| | F | 28 | 26 | 22 | 23 | 98 |
| Partially-at-fault accidents | M | 30 | 32 | 31 | 20 | 114 |
| | F | 15 | 11 | 9 | 10 | 46 |
| Single vehicle accidents | M | 13 | 16 | 14 | 10 | 52 |
| | F | 7 | 4 | 2 | 4 | 17 |
| Convictions | M | 649 | 835 | 961 | 728 | 3,173 |
| | F | 164 | 204 | 247 | 215 | 830 |

to determine if there were significant changes in the means across years. With the single exception of fatal and injury accidents for females ($p < .15$) all trends were significant at the .05 level. As a check for the influence of any violation of the mathematical assumptions, Box's conservative F test (Winer, 1962, p. 123) was applied. Only partially-at-fault accidents for females ($F = 3.73$) and single vehicle accidents for males ($F = 3.77$) barely failed to meet the critical value of $F = 3.84$.

The accident mean for males reached its peak in the second year of driving, and then declined; whereas the female mean declined from the first year on. The conviction mean rose dramatically for both sexes until the third year of driving, then declined. Males averaged four times as many convictions, and twice as many accidents, as females. Males averaged over three convictions in their first four years of driving.

The accident and conviction trends for both sexes combined are shown in Figure 2, together with the accident, conviction, and mileage trends from the Teen-Age Driver Study (Ferdun, Peck & Coppin, 1967). As can be seen, the accident trends were quite similar and relatively flat, showing

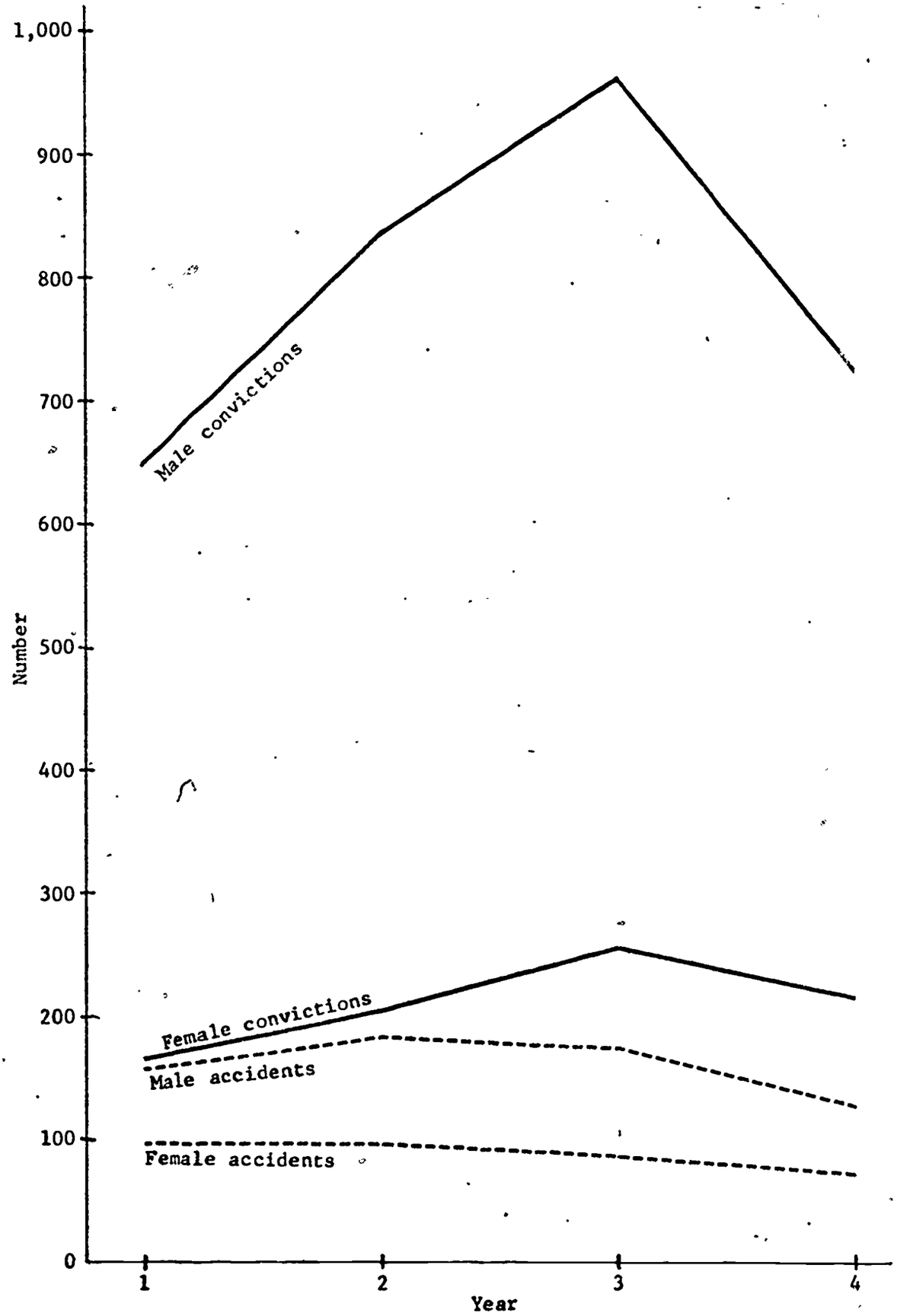



Fig. 1-Number of Accidents and Convictions per 1,000 Drivers by Sex and Year

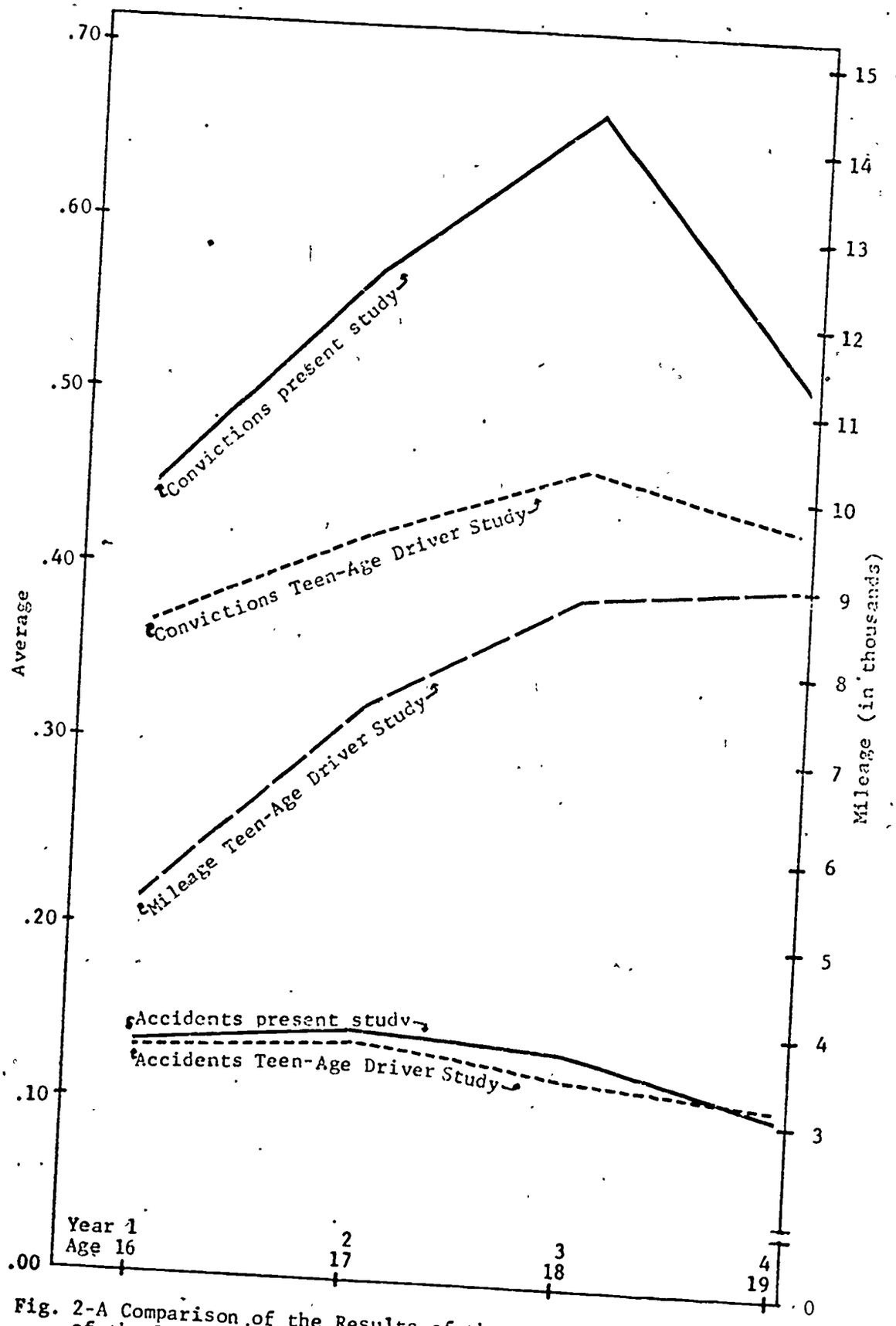



Fig. 2-A Comparison of the Results of the Present Study with Those of the Teen-Age Driver Study with Respect to Year by Year Changes in Accident and Conviction Rates and Mileage

a slight decline overall. In the Teen-Age Driver Study, only convictions for moving violations were included, which accounts for the discrepancy in the elevations of the conviction curves in the figure. However, the shape of the curves was similar -- peaking in the third year (age 18 for the Teen-Age Driver Study), then declining. Thus there was little difference in the trends for the present longitudinal study, in which the subjects remained the same in the various time periods, and a cross-sectional study such as the Teen-Age Driver Study, in which the 17 year olds were a different group of people from the 16 year olds.

The average mileage rose each year. Consequently, the accident rate per mile dropped from the first year onward. The mileage trend tended to parallel the conviction trend until after the third year of driving, when mileage continued to rise but the absolute number of convictions decreased. As a result, the conviction rate per mile decreased in the fourth year.

It may be argued that the per mile rate is not the proper way to adjust for differences in mileage. Pelz & Schuman (1970), for example, pointed out that dividing by the logarithm of mileage would more adequately represent the relationship between mileage and accidents. They themselves used another method, which was, in effect, an analysis of covariance with mileage as the covariate. The present situation differs somewhat, however. The preceding methods of analysis are most appropriate for adjustments "across persons", that is, for different people having different mileages at the same time (cross-sectional analysis). In such an analysis, we would not expect a group driving twice as many miles to have twice as many accidents, with a correlation of only .10 between mileage and accidents (see p. 93). In a longitudinal analysis however, the different mileages (across years) are obtained by the same persons ("within person analysis"). Consequently, apart from practice effects, we might expect a person who drove twice as many miles one year as the year previously to have approximately twice as great a chance of an accident (this is perhaps the intuitive basis for the usual mileage adjustment of accidents divided by miles). For this reason, the appropriate model for adjusting for changes in mileage in a longitudinal study would be an analysis of covariance within a repeated measures analysis of variance with the (possibly transformed) covariate (mileage) varying across measures (Winer, 1962, p. 607).

Year to year trends in mileage were not available in the present study. Since the accident and conviction trends were similar in the Teen-Age Driver Study and the present study, it may reasonably be assumed that the mileage trend for subjects in this study would also be similar to that of the Teen-Age Driver Study.

It is clear that no matter how one adjusted the accident trend for mileage, the resulting rate would show a steady decrease across years, since the number of accident accidents decreased and mileage increased.

For similar reasons, there was a decline in the mileage adjusted rate of convictions from the third to the fourth year. No firm conclusions can be reached about the mileage-adjusted conviction trend in the first three years of driving. If increasing mileage were followed by a similar increase in convictions (i.e., the simple adjustment of convictions divided by mileage), then the mileage-adjusted trend for the first three years would be flat. If some less proportional adjustment were the correct one, then the mileage-adjusted conviction rate would show an increase in the first three years. The only possibility that can be firmly excluded on the basis of the present data is that the conviction rate decreased during the first three years of driving.

In summary, the mileage-adjusted accident rate decreased during the first four years of driving. The mileage-adjusted conviction rate either increased or remained constant during the first three years of driving, then decreased from the third to the fourth year.

This discrepancy between the accident and conviction trends suggests that the subjects were actively trying to avoid accidents, and became more skillful at doing so as they gained driving experience, but that there was no improvement in their attitudes and driving practices relative to traffic violations until their fourth year of driving. This lack of improvement might be due to such factors as: (a) increased confidence in their ability to drive recklessly without being involved in an accident, or (b) decreased fear of receiving a traffic ticket.

The number of accidents by type is presented in Table 20 and shown in Figures 3 and 4. Each accident type approximately paralleled total accidents. That accident cost paralleled total accidents indicated that there was little change in the proportions of property damage, injury, and fatal accidents. That the accident cost curves had elevations relative to the total accident curves differently for males and females indicated a sex difference in the severity of accidents, with a greater proportion of the males' accidents being more severe. The percentage distribution of accidents by whether or not an injury or fatality was involved is presented in Table 21. There was no significant change in the severity of the accidents during the first four years of driving for either sex. There was, however, a significant difference between the sexes in accident severity -- 32 percent of the male accidents and 29 percent of the female accidents involved a fatality or injury

The percentage distribution of violations by type is presented in Table 22. The overall impression is that there was little change in the percentage distribution across years for most violation types, although the overall variation was statistically significant. Exceptions were: (1) a decreasing percentage of equipment violations for males, (2) an increase in percentage of FTA and FTP violations for both sexes, and (3) an increasing percentage of speed and a decreasing percentage of right-of-way violations for females from the first to the second year of driving.

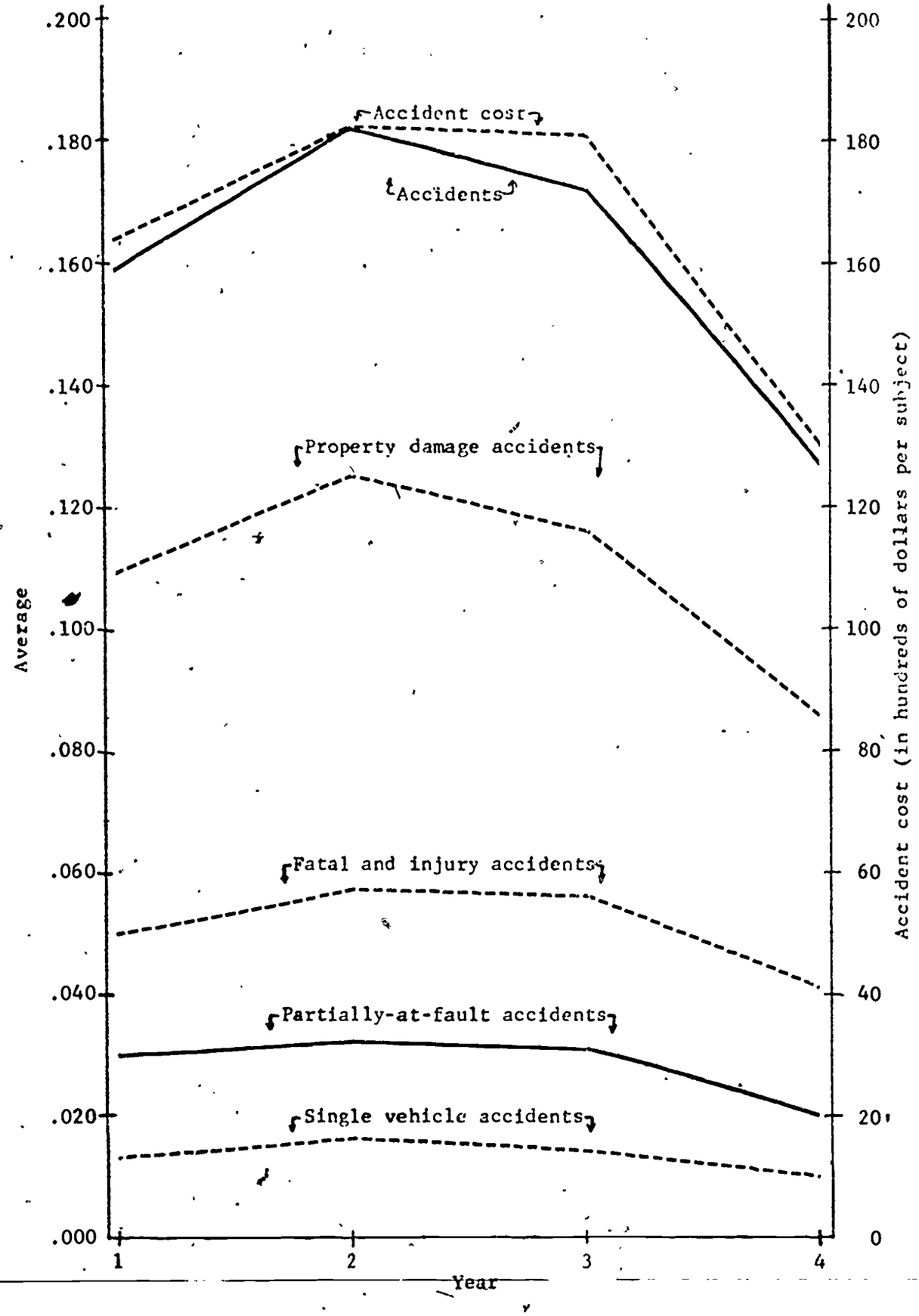



Fig. 3- Average Number of Accidents by Type and Year for Males

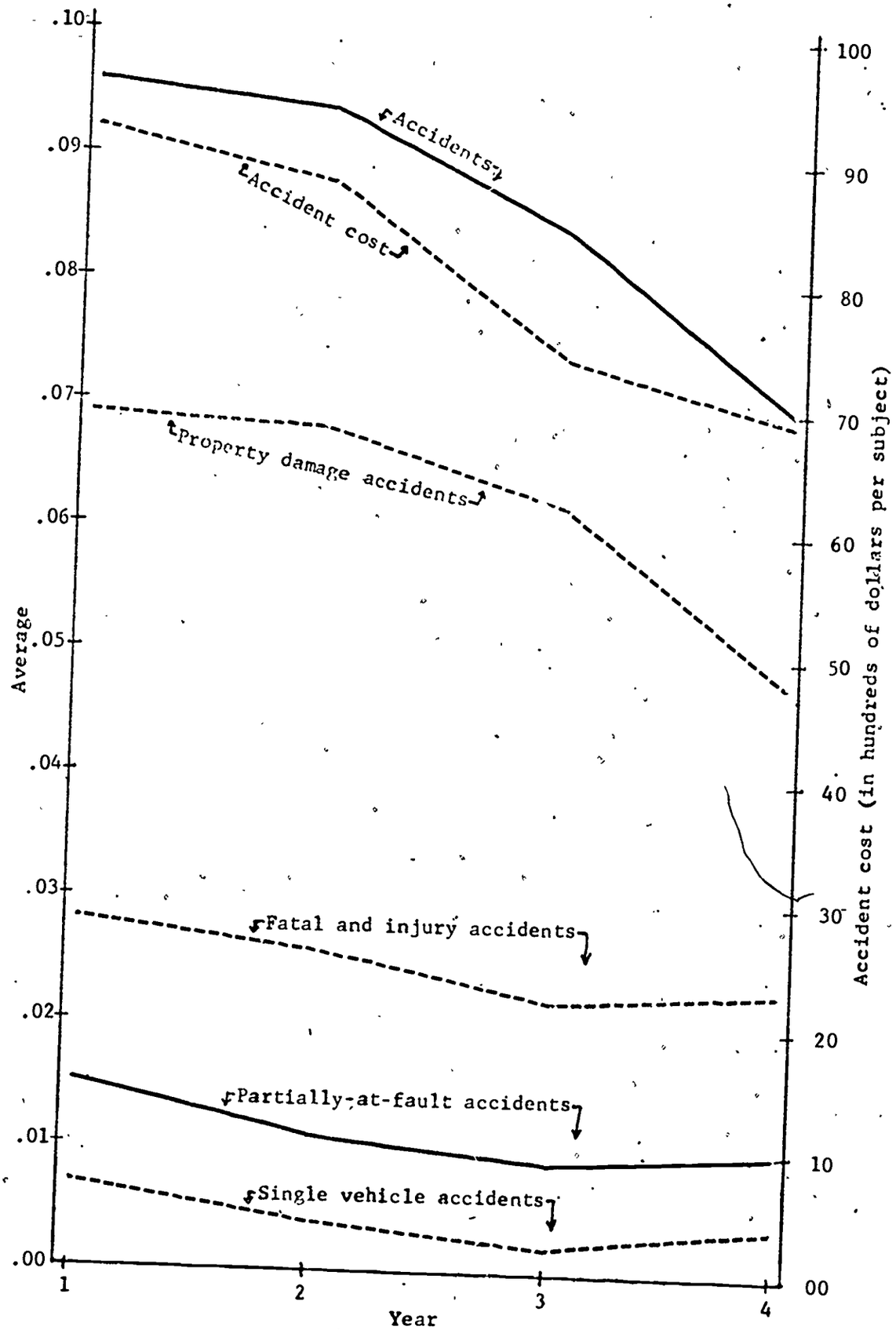



Fig. 4-Average Number of Accidents by Type and Year for Females

TABLE 21
Percentage Distribution of Fatal and Injury Accidents vs. Property Damage Accidents by Year and Sex

| Accident type | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Property damage..... | M | 68 | 69 | 67 | 68 | 68 |
| | F | 71 | 72 | 74 | 67 | 71 |
| Fatal and injury..... | M | 32 | 31 | 33 | 32 | 32 |
| | F | 29 | 28 | 26 | 33 | 29 |
| Both types..... | M | 100 | 100 | 100 | 100 | 100 |
| | F | 100 | 100 | 100 | 100 | 100 |

$x^2$ Male type vs. year = 0.99, 3 df, $p > .80$.

$x^2$ Female type vs. year = 5.43, 3 df, $p > .10$.

$x^2$ Male vs. female (all years) = 7.51, 1 df, $p < .01$.

The average number of violations on each abstract of conviction is shown on the bottom lines of the Table. There was very little change in this index across years. That neither the percentage distribution nor the number of violations per conviction changed much across years necessarily implies that the trend across years for most violation types paralleled that of total convictions. Some of the averages for violation types for females are plotted in Figure 5. The frequency of right-of-way violations declined from the first to the second year, then remained flat, while the other types showed a peak in the third year similar to that for total convictions. The averages for each type are presented in Appendix A.

There were statistically significant sex differences. A greater percentage of male violations were equipment and miscellaneous non-moving; whereas a greater percentage of female violations were speed or sign violations. Also noteworthy was the considerable sex difference in right-of-way violations in the first year. Males averaged a considerably greater number of violations/convictions.

Since a great deal of the sex differences were in non-moving violations, an analysis was made to determine the effects on the percentage distribution by sex if the non-moving violations were removed. The percentage distribution of moving vs. non-moving violations is presented in Table 23. A

TABLE 22

Percentage Distribution of Violations by Type, Sex and Year

| Type | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Speed | M | 29 | 31 | 31 | 31 | 31 |
| | F | 31 | 37 | 41 | 39 | 38 |
| Sign | M | 13 | 12 | 11 | 11 | 12 |
| | F | 20 | 20 | 18 | 19 | 19 |
| Equipment | M | 24 | 22 | 21 | 18 | 21 |
| | F | 11 | 10 | 10 | 8 | 10 |
| Miscellaneous non-moving | M | 13 | 13 | 15 | 15 | 14 |
| | F | 9 | 9 | 10 | 8 | 9 |
| Turning | M | 5 | 4 | 4 | 4 | 4 |
| | F | 7 | 6 | 5 | 5 | 5 |
| Right-of-way | M | 4 | 3 | 2 | 2 | 3 |
| | F | 11 | 6 | 5 | 6 | 6 |
| FTA and FTP | M | 3 | 5 | 8 | 9 | 7 |
| | F | 2 | 3 | 5 | 6 | 4 |
| Lane placement | M | 4 | 4 | 3 | 3 | 4 |
| | F | 4 | 4 | 4 | 3 | 4 |
| Following-too-close | M | 1 | 1 | 1 | 2 | 1 |
| | F | 2 | 1 | 2 | 4 | 2 |
| Major | M | 2 | 2 | 2 | 3 | 2 |
| | F | 1 | 0 | 0 | 0 | 0 |
| Passing | M | 1 | 1 | 1 | 1 | 1 |
| | F | 1 | 1 | 1 | 1 | 1 |
| Miscellaneous moving | M | 1 | 1 | 1 | 1 | 1 |
| | F | 2 | 1 | 0 | 1 | 1 |
| All types | M | 100 | 99 | 100 | 100 | 101 |
| | F | 101 | 98 | 101 | 100 | 99 |
| Violations/conviction | M | 1.32 | 1.33 | 1.36 | 1.33 | 1.34 |
| | F | 1.15 | 1.15 | 1.17 | 1.16 | 1.15 |

$x^2$ Male type vs. year = 403.5, 33 df, P<.001.

$x^2$ Female type vs. year = 144.80, 33 df, P<.001.

$x^2$ Male vs. female (all years) = 1086.10, 11 df, P<.001.

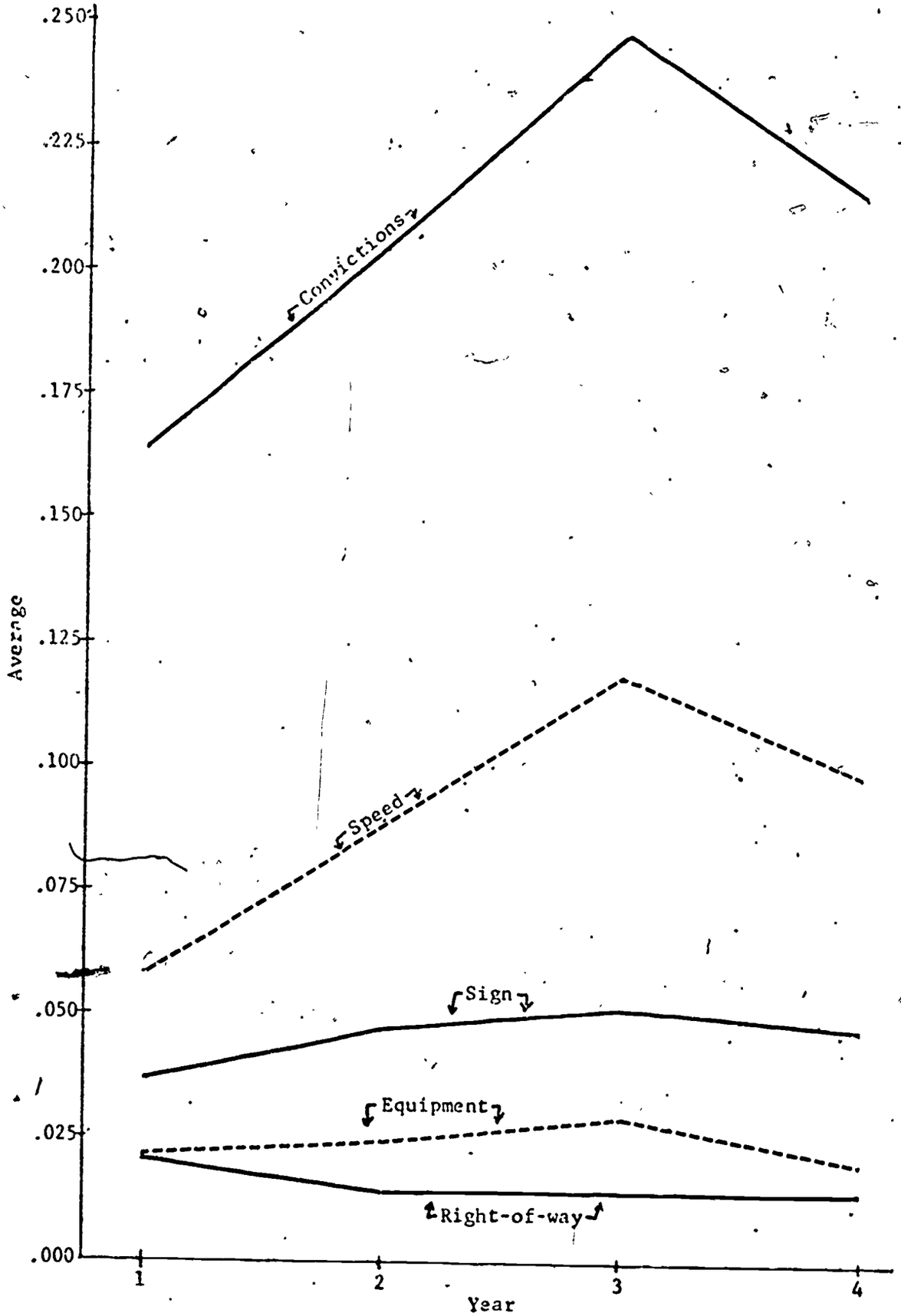



Fig. 5-Average Number of Convictions and Types of Violations by Year for Females

TABLE 23

Percentage Distribution of Violations by Sex, Year and Moving - Non-moving Status

| Status | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Moving | M | 59 | 59 | 56 | 58 | 58 |
| | F | 78 | 77 | 76 | 78 | 77 |
| Non-moving | M | 41 | 41 | 44 | 42 | 42 |
| | F | 22 | 23 | 24 | 22 | 23 |
| Both statuses | M | 100 | 100 | 100 | 100 | 100 |
| | F | 100 | 100 | 100 | 100 | 100 |

$x^2$ Male Status vs. Year = 26.80, 3 df, $p < .001$

$x^2$ Female Status vs. Year = 2.00, 3 df, $p > .50$

$x^2$ Male vs. Female (all years) = 747.10, 1 df, $p < .001$

much greater percentage of male violations were non-moving violations. The percentage of non-moving violations did not change significantly across years for females. The male percentages did change slightly and significantly, but showed no distinct trend, so that the differences may merely represent Type I error. The percentage distribution of moving violations is presented in Table 24. The differences between the distributions of total and moving violations relative to year were slight, but the sex differences were reduced, and the direction reversed for speed violations. Speed violations comprised one-half, and sign violations comprised one-quarter, of all moving violations.

The number of major violations for the first four years of driving is presented in Table 25. Driving while suspended was the most common type, while driving under the influence of drugs was the least common type. Males had a much higher rate of major violations than did females.

## Fatal and Injury Accident Characteristics

This section will examine how the characteristics of fatal and injury accidents varied by sex, year, and number of vehicles involved.

The number of fatal and injury accidents on which these analyses were

TABLE 24
Percentage Distribution of Moving Violations
by Type, Sex and Year

| Type | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Speed..... | M | 49 | 53 | 55 | 53 | 53 |
| | F | 39 | 48 | 54 | 51 | 49 |
| Sign..... | M | 21 | 20 | 20 | 20 | 20 |
| | F | 25 | 26 | 23 | 24 | 25 |
| Turning..... | M | 8 | 7 | 7 | 8 | 7 |
| | F | 9 | 7 | 6 | 6 | 7 |
| Right-of-way..... | M | 7 | 5 | 4 | 3 | 5 |
| | F | 14 | 8 | 7 | 7 | 8 |
| Lane placement..... | M | 7 | 6 | 6 | 6 | 6 |
| | F | 5 | 5 | 5 | 4 | 5 |
| Following-too-close.. | M | 1 | 2 | 2 | 3 | 2 |
| | F | 3 | 2 | 3 | 5 | 3 |
| Major..... | M | 3 | 3 | 3 | 5 | 3 |
| | F | 1 | 1 | 0 | 1 | 1 |
| Passing..... | M | 2 | 2 | 2 | 1 | 2 |
| | F | 1 | 2 | 1 | 1 | 1 |
| Miscellaneous moving. | M | 1 | 2 | 1 | 1 | 1 |
| | F | 2 | 1 | 0 | 1 | 1 |
| All types..... | M | 99 | 100 | 100 | 100 | 99 |
| | F | 99 | 100 | 99 | 100 | 100 |

$x^2$ Male type vs. year = 170.46, 24 df, P<.001.
$x^2$ Female type vs. year = 102.80, 24 df, P<.001.
$x^2$ Male vs. female (all years) = 261.10, 8 df, P<.001.

TABLE 25

Number of Major Violations During the First Four Years of Driving by Type and Sex

| Sex | Type | | | | |
|---|---|---|---|---|---|
| | Drunk driving | Reckless driving | Drugs | Driving while suspended | Hit and run |
| Male..... | 96 | 173 | 7 | 330 | 75 |
| Female..... | 5 | 5 | 0 | 6 | 9 |

based is shown in Table 26.

TABLE 26

Number of Fatal and Injury Accidents by Sex and Year

| Sex | Year | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | All years |
| Male ..... | 410 | 460 | 459 | 330 | 1,659 |
| Female. ..... | 160 | 152 | 125 | 133 | 570 |
| Both sexes..... | 570 | 612 | 584 | 463 | 2,229 |

The definitions of most of the variables presented in the tables in this section should be sufficiently clear from the names alone. Following are some clarifications of the definitions of some variables. Rural included cities under 10,000 population. Freeway included expressways. Not clear weather included cloudy. Non-daylight included dawn and dusk. Vehicle combination was derived from the CHP variable Directional Analysis, rather than CHP Vehicle Combination. Single vehicle included collisions with non-motor vehicles, but excluded pedestrian accidents. Violation indicated that the subject's violation of the law contributed to the accident, but did not imply that a citation was issued. Defective physical condition referred to eyesight, hearing, fatigue, being asleep, etc. Variables such as physical condition and drinking referred only to the subjects of this study, and not to any other driver involved.

The percentage distribution by sex is presented in Table 27. As can be seen, the most typical accident took place on a city street, in the afternoon, in clear weather, on a straight-level road, between two or more vehicles, with our subject driving a vehicle six or more years old,

TABLE 27

Percentage Distribution of Fatal and Injury Accident Characteristics by Sex

| Accident characteristic | Percent by sex | | | $x^2$ | df | p |
|---|---|---|---|---|---|---|
| | Male | Female | Both sexes | | | |
| Location | | | | | | |
| Urban | 60 | 65 | 61 | | | |
| Rural | 40 | 35 | 39 | 3.45 | 1 | > .05 |
| Road class | | | | | | |
| Highway | 13 | 11 | 12 | | | |
| County road | 29 | 27 | 29 | | | |
| City street | 58 | 62 | 59 | 3.15 | 2 | > .10 |
| Road type | | | | | | |
| Non-freeway | 93 | 93 | 93 | | | |
| Freeway | 7 | 7 | 7 | 0.00 | 1 | > .90 |
| Number of lanes | | | | | | |
| 1-2 | 53 | 48 | 52 | | | |
| 3+ | 47 | 52 | 48 | 4.46 | 1 | < .05 |
| Day of week | | | | | | |
| Monday-Thursday | 47 | 52 | 48 | | | |
| Friday-Sunday | 53 | 48 | 52 | 3.86 | 1 | < .05 |
| Hour of day | | | | | | |
| 12a.m.-6a.m. | 10 | 6 | 9 | | | |
| 6a.m.-noon | 16 | 21 | 17 | | | |
| Noon-6p.m. | 41 | 48 | 43 | | | |
| 6p.m.-12p.m. | 32 | 25 | 31 | 25.43 | 3 | .001 |
| Number injured | | | | | | |
| 0 | 1 | 1 | 1 | | | |
| 1 | 61 | 57 | 60 | | | |
| 2 | 23 | 25 | 23 | | | |
| 3 | 8 | 10 | 9 | | | |
| 4 | 4 | 5 | 4 | | | |
| 5+ | 3 | 2 | 3 | 5.30 | 5 | > .30 |
| Number killed | | | | | | |
| 0 | 98 | 99 | 98 | | | |
| 1+ | 2 | 1 | 2 | 2.11 | 1 | > .10 |
| Weather | | | | | | |
| Clear | 79 | 81 | 79 | | | |
| Not clear | 21 | 19 | 21 | 1.65 | 1 | > .10 |
| Light conditions | | | | | | |
| Daylight | 58 | 68 | 60 | | | |
| Non-daylight | 42 | 32 | 40 | 17.84 | 1 | < .001 |

TABLE 27 (Continued)
Percentage Distribution of Fatal and Injury Accident Characteristics by Sex

| Accident characteristics | Percent by sex | | | $x^2$ | df | p |
|---|---|---|---|---|---|---|
| | Male | Female | Both sexes | | | |
| Road character | | | | | | |
| Straight-level.. | 79 | 87 | 81 | | | |
| Other..... | 21 | 13 | 19 | 13.60 | 1 | < .001 |
| Vehicle combination | | | | | | |
| Multiple vehicle | 76 | 85 | 78 | | | |
| Single vehicle... | 24 | 15 | 22 | 16.03 | 1 | < .001 |
| Speed zone | | | | | | |
| 00-25..... | 34 | 37 | 35 | | | |
| 26-35..... | 31 | 36 | 33 | | | |
| 36+..... | 35 | 27 | 33 | 11.78 | 2 | < .01 |
| Vehicle age | | | | | | |
| Less than 2..... | 23 | 25 | 24 | | | |
| 2-5..... | 28 | 39 | 31 | | | |
| 6+..... | 49 | 36 | 45 | 30.65 | 2 | < .001 |
| Violation status | | | | | | |
| Violation..... | 58 | 47 | 55 | | | |
| No-violation.... | 42 | 53 | 45 | 17.63 | 1 | < .001 |
| Violation type | | | | | | |
| Speed..... | 47 | 38 | 45 | | | |
| Right-of-way.... | 18 | 28 | 20 | | | |
| Other types..... | 35 | 34 | 34 | 12.04 | 2 | < .01 |
| Physical condition | | | | | | |
| No defect..... | 98 | 99 | 98 | | | |
| Defec ..... | 2 | 1 | 2 | 2.03 | 1 | > .10 |
| Drinking | | | | | | |
| Not drinking.... | 94 | 98 | 95 | | | |
| Drinking..... | 6 | 2 | 5 | 14.83 | 1 | < .001 |
| Vehicle condition | | | | | | |
| No defect..... | 95 | 97 | 96 | | | |
| Defect..... | 5 | 3 | 4 | 3.12 | 1 | > .05 |
| Speed before accident | | | | | | |
| 00-20..... | 33 | 50 | 38 | | | |
| 21-40..... | 44 | 38 | 43 | | | |
| 41+..... | 23 | 12 | 20 | 53.67 | 2 | < .001 |

speeding, with no defect in his physical or vehicle condition, and sober.

These were quite a few statistically significant sex differences. A greater percentage of male accidents were: (1) on 1-2 lane roads, (2) on weekends, (3) in the evening, (4) in non-daylight, (5) on a curved or graded road, (6) involved only 1 vehicle, (7) occurred where the speed limit was over 35 MPH, (8) in a vehicle 6+ years old, (9) in violation of the law, (10) involved speed violations rather than right-of-way violations, (11) involved drinking, and (12) involved travelling over 40 MPH prior to the accident.

These differences appear to reflect: (1) differences in exposure between the two sexes, (2) males' greater risk taking and reckless driving, and (3) males' driving older vehicles, which was probably due to the fact that males tended to own their own (older) cars, while females tended to drive their parents' cars.

The percentage distribution by year is presented in Table 28 for both sexes combined. Due to the small number of female fatal and injury accidents in any one year, it was considered that cross-classifying females separately would not yield statistically reliable results. However, the tabulations were done separately for each sex, and then visually inspected. Since there did not appear to be any marked sex differences in the trends across years, the combined data probably represent each sex separately reasonably well.

The statistically significant changes in the accident characteristics during the first four years of driving were: (1) an increase in the percentage occurring on highways and freeways, (2) an increased percentage occurring on roads with 3+ lanes, (3) an increase in the percentage from 12 a.m. - 6 a.m., and a decrease in the afternoon, (4) a decrease in the number injured, (5) an increasing percentage in non-daylight, (6) a decreasing percentage of single vehicle accidents, (7) an increasing percentage in higher speed zones, (8) a decrease in vehicle age, (9) a decreasing percentage in violation of the law, and (10) an increasing percentage with defective physical condition.

These differences appeared to mainly reflect changes in exposure. The decrease in single vehicle accidents and law violations probably reflected improvement in driving ability and a decreased willingness to take risks and commit dangerous traffic violations.

Next will be presented the differences between single vehicle and multiple vehicle accidents during the first four years of driving. First, some literature on the subject will be reviewed.

Stewart, Hill & Forbath (1969) studied 9,744 single vehicle accidents in Oregon. Single vehicle accidents were proportionately more often rural, fatal, occurred on curves, occurred in darkness, occurred during the summer, and involved speeding and drinking.

TABLE 28

Percentage Distribution of Fatal and Injury Accident Characteristics by Year

| Accident characteristics | Percent by year | | | | $x^2$ | df | p |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | |
| Location | | | | | | | |
| Urban | 62 | 61 | 60 | 61 | | | |
| Rural | 38 | 39 | 40 | 39 | 0.34 | 3 | > .95 |
| Road class | | | | | | | |
| Highway | 9 | 10 | 15 | 16 | | | |
| County road | 30 | 31 | 28 | 26 | | | |
| City street | 61 | 59 | 57 | 58 | 18.84 | 6 | < .01 |
| Road type | | | | | | | |
| Non-freeway | 96 | 94 | 92 | 87 | | | |
| Freeway | 4 | 6 | 8 | 13 | 33.91 | 3 | < .001 |
| Number of lanes | | | | | | | |
| 1 - 2 | 55 | 56 | 50 | 45 | | | |
| 3+ | 45 | 44 | 50 | 55 | 14.62 | 3 | < .01 |
| Day of week | | | | | | | |
| Monday-Thursday | 48 | 47 | 49 | 48 | | | |
| Friday-Sunday | 52 | 53 | 51 | 52 | 0.24 | 3 | > .95 |
| Hour of day | | | | | | | |
| 12a.m. - 6a.m. | 3 | 7 | 12 | 16 | | | |
| 6a.m. - noon | 19 | 16 | 17 | 18 | | | |
| Noon - 6p.m. | 48 | 41 | 42 | 38 | | | |
| 6p.m. - 12p.m. | 29 | 36 | 29 | 27 | 71.01 | 9 | < .001 |
| Number injured | | | | | | | |
| 0 | 1 | 1 | 2 | 0 | | | |
| 1 | 57 | 57 | 62 | 66 | | | |
| 2 | 23 | 24 | 25 | 21 | | | |
| 3 | 12 | 9 | 6 | 7 | | | |
| 4 | 4 | 5 | 3 | 4 | | | |
| 5+ | 4 | 3 | 2 | 2 | 30.08 | 15 | < .02 |
| Number killed | | | | | | | |
| 0 | 98 | 98 | 98 | 98 | | | |
| 1+ | 2 | 2 | 2 | 2 | 1.23 | 3 | > .70 |
| Weather | | | | | | | |
| Clear | 80 | 78 | 82 | 78 | | | |
| Not clear | 20 | 22 | 18 | 22 | 2.97 | 3 | > .30 |
| Light conditions | | | | | | | |
| Daylight | 65 | 57 | 62 | 58 | | | |
| Non-daylight | 35 | 43 | 38 | 42 | 10.25 | 3 | < .02 |

TABLE 28 (Continued)
Percentage Distribution of Fatal and Injury Accident Characteristics by Year

| Accident characteristics | Percent by year | | | | $x^2$ | df | p |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | |
| Road character | | | | | | | |
| Straight-level | 83 | 81 | 81 | 80 | | | |
| Other | 17 | 19 | 19 | 20 | 2.23 | 3 | > .50 |
| Vehicle combination | | | | | | | |
| Multiple vehicle | 76 | 74 | 81 | 81 | | | |
| Single vehicle | 24 | 26 | 19 | 19 | 9.98 | 3 | < .02 |
| Speed zone | | | | | | | |
| 00-25 | 39 | 36 | 34 | 28 | | | |
| 26-35 | 32 | 31 | 33 | 35 | | | |
| 36+ | 29 | 33 | 33 | 36 | 12.84 | 6 | < .05 |
| Vehicle age | | | | | | | |
| Less than 2 | 21 | 21 | 27 | 26 | | | |
| 2-5 | 29 | 32 | 30 | 34 | | | |
| 6+ | 50 | 47 | 43 | 40 | 16.69 | 6 | < .02 |
| Violation status | | | | | | | |
| Violation | 61 | 55 | 54 | 49 | | | |
| No violation | 39 | 45 | 46 | 51 | 13.53 | 3 | < .01 |
| Violation type | | | | | | | |
| Speed | 46 | 44 | 44 | 46 | | | |
| Right-of-way | 20 | 19 | 24 | 18 | | | |
| Other types | 34 | 36 | 32 | 36 | 3.84 | 6 | > .70 |
| Physical condition | | | | | | | |
| No defect | 100 | 98 | 98 | 98 | | | |
| Defect | 0 | 2 | 2 | 2 | 9.19 | 3 | < .05 |
| Drinking | | | | | | | |
| Not drinking | 97 | 95 | 95 | 94 | | | |
| Drinking | 3 | 5 | 5 | 6 | 4.97 | 3 | > .10 |
| Vehicle condition | | | | | | | |
| No defect | 95 | 96 | 96 | 97 | | | |
| Defect | 5 | 4 | 4 | 3 | 3.80 | 3 | > .20 |
| Speed before accident | | | | | | | |
| 00-20 | 39 | 36 | 39 | 35 | | | |
| 21-40 | 44 | 44 | 41 | 41 | | | |
| 41+ | 17 | 20 | 20 | 24 | 8.35 | 6 | > .20 |

New York Department of Motor Vehicles (1964b) reported on 300,000 accidents in 1963. Single vehicle accidents were proportionately more often rural, fatal, involved young drivers, involved reckless driving and speeding, occurred in the evening and early morning hours, and occurred on dry pavement and on grades and curves.

Penn (1963-1965) studied 5,200 single vehicle accidents in California, and obtained results similar to those mentioned above. In addition, he contrasted the causes of single vehicle accidents among various age groups. Speed was a major cause among the young, drinking among the middle-aged, and faulty driving or medical problems among the aged. Drivers involved in single vehicle accidents were found to have worse prior accident and conviction records than the average driver, as well as less socially desirable biographical characteristics.

On the California State highway system, 50 percent of the fatal accidents on non-freeways, and 60 percent of those on freeways were single vehicle accidents (Womack, 1965).

Baker (1967) studied 850 single vehicle, rural accidents on Route 66 between Chicago and Los Angeles. Some of the numerous findings were as follows. Ninety-two percent of the accidents involved leaving the roadway, the majority of which (57 percent) resulted from loss of vehicle control. Compact cars, small cars, and cars pulling trailers were more likely to be involved in single vehicle accidents than were other classes of vehicles. Driver factors were more often considered the cause of the accident than road or vehicle factors. The leading driver factors were: (1) driver asleep, (2) slippery road, (3) tire failure, (4) distractions, and (5) alcohol.

Baker (1968), in his review of the research literature on single vehicle accidents, found that approximately twenty thousand persons are killed in single vehicle accidents in the United States each year. Single vehicle accidents account for an increasing percentage of highway fatalities each year, and the percentage of accidents involving a single vehicle was higher on freeways than other types of roads. After reviewing the literature, Baker made recommendations for reducing the frequency of single vehicle accidents.

The percentage distribution of accident characteristics by vehicle combination is presented in Table 29. There were dramatic differences between single vehicle and multiple vehicle accidents on most characteristics. A greater percentage of single vehicle accidents were: (1) rural, (2) on county roads, highways, and freeways, (3) on 1-2 lane roads, (4) on weekends, (5) from 6 p.m. to 6 a.m., (6) with 0-1 persons injured, (7) at night, (8) on other than straight-level roads, (9) in speed zones of 36+ MPH, (10) in violation of the law, (11) involved speed violation, (12) involved defective physical condition, (13) involved drinking, (14) involved defective vehicles, and (15) involved speeds of 41+ MPH prior to the accident. These differences point up some of the causal factors in single vehicle accidents.

TABLE 29

Percentage Distribution of Fatal and Injury Accident Characteristics by Vehicle Combination

| Accident characteristics | Percent by vehicle combination | | $x^2$ | df | p* |
|---|---|---|---|---|---|
| | Multiple vehicle | Single vehicle | | | |
| Location | | | | | |
| Urban | 59 | 29 | | | |
| Rural | 41 | 71 | 109.35 | 1 | < .001 |
| Road class | | | | | |
| Highway | 12 | 24 | | | |
| County road | 31 | 50 | | | |
| City street | 57 | 26 | 120.26 | 2 | < .001 |
| Road type | | | | | |
| Non-freeway | 94 | 87 | | | |
| Freeway | 6 | 13 | 17.99 | 1 | < .001 |
| Number of lanes | | | | | |
| 1 2 | 49 | 76 | | | |
| 3+ | 51 | 24 | 80.17 | 1 | < .001 |
| Day of week | | | | | |
| Monday-Thursday | 50 | 42 | | | |
| Friday-Sunday | 50 | 58 | 7.69 | 1 | < .01 |
| Hour of day | | | | | |
| 12 a.m.-6 a.m. | 8 | 19 | | | |
| 6 a.m.-noon | 18 | 14 | | | |
| Noon-6 p.m. | 44 | 32 | | | |
| 6 p.m.-12 p.m. | 30 | 35 | 55.35 | 3 | < .001 |
| Number injured | | | | | |
| 0 | 1 | 2 | | | |
| 1 | 60 | 67 | | | |
| 2 | 24 | 21 | | | |
| 3 | 9 | 7 | | | |
| 4 | 4 | 3 | | | |
| 5+ | 3 | 0 | 16.22 | 5 | < .01 |
| Number killed | | | | | |
| 0 | 98 | 96 | | | |
| 1+ | 2 | 4 | 3.34 | 1 | > .05 |
| Weather | | | | | |
| Clear | 76 | 76 | | | |
| Not clear | 24 | 24 | 0.00 | 1 | > .95 |
| Light conditions | | | | | |
| Daylight | 63 | 47 | | | |
| Non-daylight | 37 | 53 | 30.15 | 1 | < .001 |

TABLE 29 (Continued)

Percentage Distribution of Fatal and Injury Accident Characteristics by Vehicle Combination

| Accident characteristics | Percent by vehicle combination | | $x^2$ | df | p |
|---|---|---|---|---|---|
| | Multiple vehicle | Single vehicle | | | |
| Road character | | | | | |
| Straight-level | 88 | 53 | 220.80 | 1 | < .001 |
| Other | 12 | 47 | | | |
| Speed zone | | | | | |
| 00-25 | 39 | 22 | 163.17 | 2 | < .001 |
| 26-35 | 31 | 12 | | | |
| 36+ | 30 | 66 | | | |
| Vehicle age | | | | | |
| Less than 2 | 23 | 24 | 0.15 | 2 | > .50 |
| 2-5 | 30 | 29 | | | |
| 6+ | 47 | 47 | | | |
| Violation status | | | | | |
| Violation | 52 | 69 | 36.61 | 1 | < .001 |
| No-violation | 48 | 31 | | | |
| Violation type | | | | | |
| Speed | 38 | 73 | 123.44 | 2 | < .001 |
| Right-of-way | 27 | 1 | | | |
| Other types | 35 | 26 | | | |
| Physical condition | | | | | |
| No defect | 99 | 94 | 32.52 | 1 | < .001 |
| Defect | 1 | 6 | | | |
| Drinking | | | | | |
| Not drinking | 97 | 86 | 70.29 | 1 | < .001 |
| Drinking | 3 | 14 | | | |
| Vehicle condition | | | | | |
| No defect | 97 | 90 | 26.61 | 1 | < .001 |
| Defect | 3 | 10 | | | |
| Speed before accident | | | | | |
| 00-20 | 45 | 10 | 343.79 | 2 | < .001 |
| 21-40 | 43 | 36 | | | |
| 41+ | 12 | 54 | | | |

## DMV and Court Actions

In this section will be presented the lengths of court suspension, DMV probation, DMV suspension and revocation, and license gaps. Data will also be presented on the accident and convictions occurring while driving under suspension or revocation, as well as the percentage receiving a traffic violation for driving under suspension or revocation.

The lengths of actions for those subjects having actions are presented in Table 30. This table was constructed in an unusual manner, so that the

TABLE 30
Means and Standard Deviation for Lengths of Actions (In Days) by Type, Sex and Year

| Type of action | Sex | Year | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | 2 | | | 3 | | | 4 | | | All years | | |
| | | N | $\bar{X}$ | SD | N | $\bar{X}$ | SD | N | $\bar{X}$ | SD | N | $\bar{X}$ | SD | N | $\bar{X}$ | SD |
| Court suspension.... | M | 881 | 25 | 28 | 854 | 26 | 27 | 143 | 40 | 47 | 58 | 58 | 83 | 1,550 | 34 | 50 |
| | F | 200 | 16 | 24 | 150 | 19 | 24 | 5 | 22 | 22 | 2 | 23 | 10 | 328 | 19 | 33 |
| DMV probation..... | M | 28 | 121 | 104 | 123 | 230 | 137 | 277 | 223 | 145 | 415 | 274 | 119 | 455 | 455 | 323 |
| | F | 2 | 186 | 219 | 3 | 315 | 54 | 9 | 117 | 119 | 16 | 280 | 91 | 19 | 361 | 265 |
| DMV suspension/ revocation..... | M | 131 | 120 | 93 | 319 | 146 | 121 | 364 | 166 | 130 | 244 | 203 | 132 | 668 | 298 | 294 |
| | F | 16 | 159 | 78 | 33 | 210 | 123 | 37 | 253 | 135 | 41 | 234 | 137 | 60 | 474 | 407 |
| License gap..... | M | 36 | 137 | 84 | 233 | 72 | 94 | 1,004 | 193 | 111 | 802 | 288 | 118 | 1,091 | 409 | 223 |
| | F | 8 | 106 | 68 | 208 | 74 | 80 | 594 | 208 | 108 | 414 | 290 | 116 | 618 | 421 | 240 |
| All types..... | M | 984 | 43 | 62 | 1,247 | 69 | 95 | 1,412 | 184 | 123 | 1,181 | 263 | 132 | 2,675 | 261 | 285 |
| | F | 219 | 30 | 53 | 379 | 66 | 87 | 634 | 210 | 111 | 453 | 287 | 119 | 942 | 313 | 288 |

Note.--See text for explanation of row and column totals.

row and column totals do not add. The N refers to the number of different persons having an action in that year. If a subject, for example, had a court suspension which began in his first year, but extended into his second year, this would add 1 to the N's for both the first and second years. However, it would add 1, not 2, to the N for all years. In other words, for each type of action, a subject could only add 1 to the N for all years, no matter how many actions he had or how many years they covered. Also, if a person had two court suspensions during his first year of driving, this would add only 1 to N. Similarly, if a person had two different types of actions in the same year, it would add only 1 to the N for all types. The reason for obtaining the row and column totals in this manner was in order to determine the number of different persons receiving actions, rather than the number of actions.

Statistical tests indicated that there were significant differences in the number of persons receiving actions across years (all $\chi^2 > 11.49$, 3 df, $p < .01$ for each type separately and each sex separately). The number of subjects receiving court suspensions declined greatly after the second year of driving, as the subjects no longer received juvenile court

suspensions, but paid fines in adult court. The number receiving DMV probation, suspension or revocation increased considerably, due to the increasing accumulation of convictions and accidents. The number with license gaps increased dramatically in the third year, when the original licenses expired.

A greater percentage of males received each type of action over the four year period than did females (all $x^2 > 23.79$, 1 df, $p < .001$).

The means in Table 30 were calculated in a manner consistent with the previous definition of N. If a person had both a ten day and another 20 day court suspension in his first year of driving, his score used in calculating the mean would be the sum, 30. Thus, the mean was based on the total number of days per subject receiving that type of action, rather than the number of days divided by the number of separate actions. With minor exceptions, the average length of action for each type of action increased as driving experience increased. This increase reflected the progressively severe actions taken against those with previous actions.

The preceding analysis has been restricted to those having an action. Another way to look at it is from the point of view of the total sample. The trends for the sample as a whole are shown in Figures 6 and 7. A table of the means is not presented here, but may readily be derived from Table 30 by multiplying N by $\bar{X}$ and dividing the result by the total sample size for that sex. Repeated measures analyses of variance for each sex and each action type separately indicated that all trends were statistically significant. The same conclusions obtained using Box's conservative F test. There were increases in license gaps, DMV probation, and DMV suspensions, and decreases in court suspensions. These trends were similar to those of the preceding analysis of the length of action, except for court suspensions. While the lengths of court suspensions increased over the years, the number of drivers receiving them decreased to a relatively greater extent, so that the overall effect for the total sample was a decrease in the number of days of court suspension.

The percentage of subjects having an accident or conviction while under suspension, revocation or license gap during their first four years of driving is presented in Table 31. Such illegal driving was detected mainly from convictions, since accidents occurred less frequently. Thirty-two percent of males under DMV suspension/revocation had an accident or received a conviction during the period of their action. Considering the small chance of being detected for illegal driving, it would appear that the majority of males drove during their suspension/revocation. The percentages for the other action types were considerably lower.

One limitation of basing the preceding analysis on percentages was that the length of the actions varied greatly among the types, with court suspensions being brief and the other types quite lengthy. One way to avoid this limitation was to look at the accident and conviction means adjusted to an annual rate. The annual rate for each year was computed by multiplying

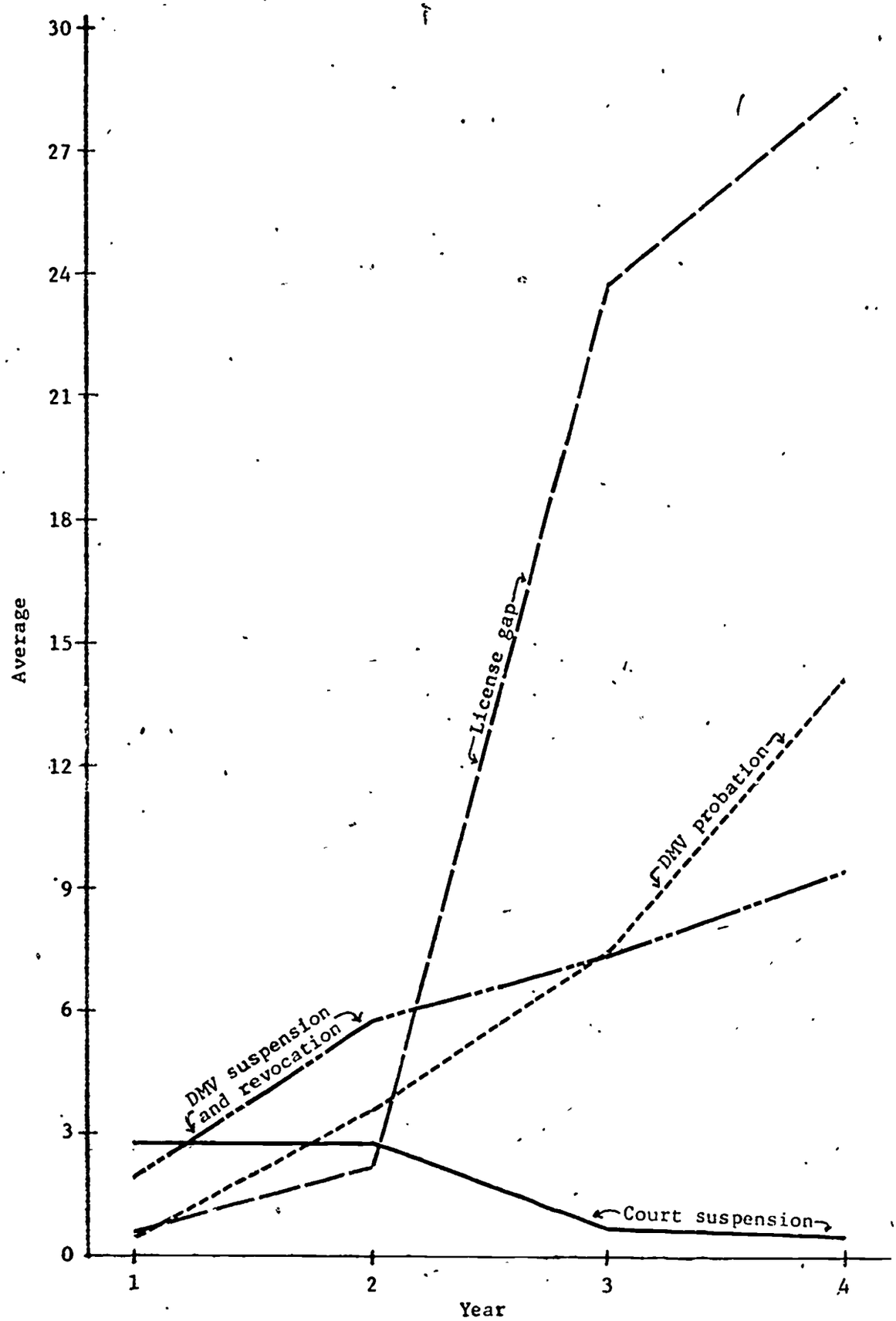



Fig. 6-Average Number of Days of Action Per Subject for the Total Male Sample

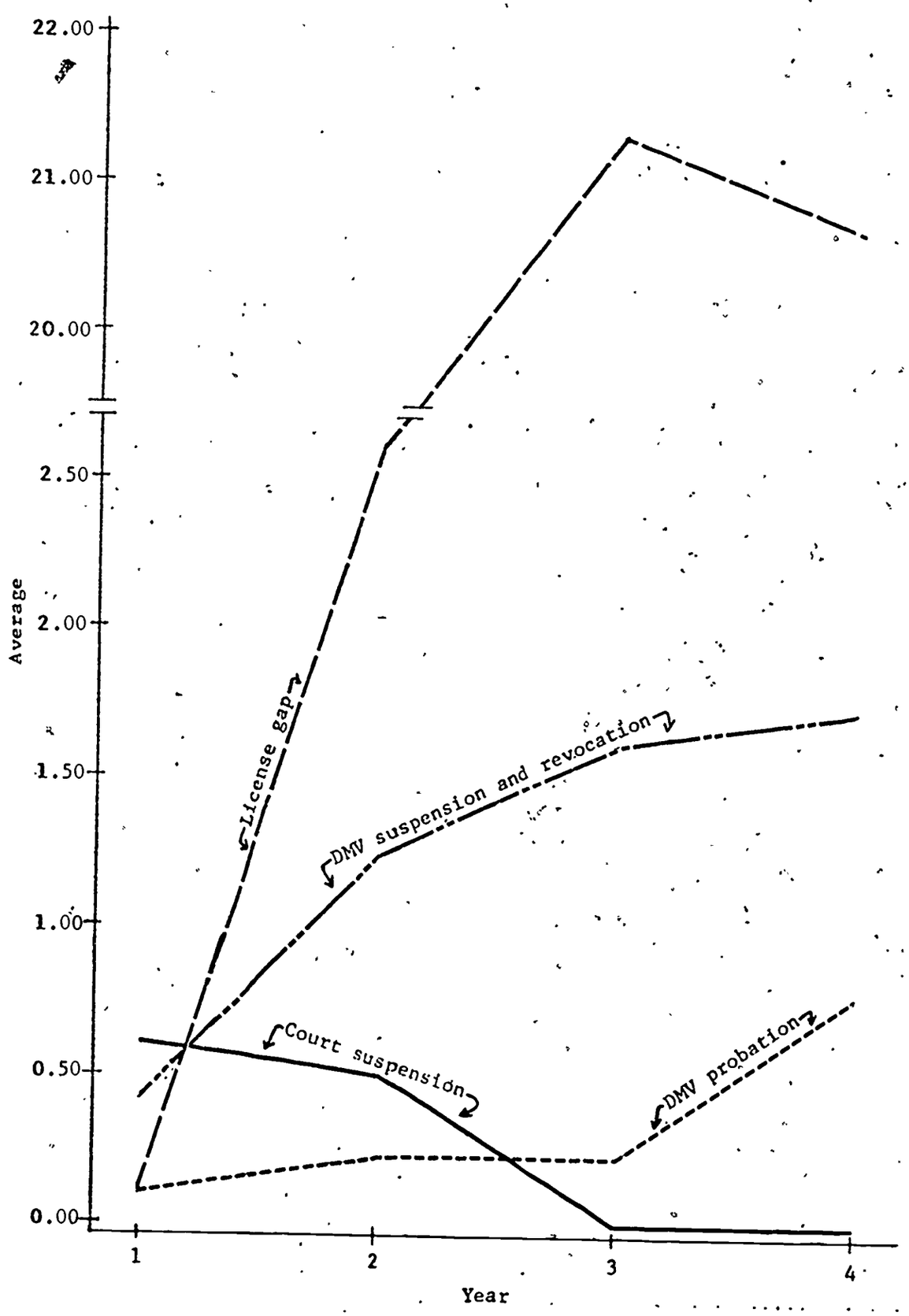



Fig. 7-Average Number of Days of Action Per Subject for the Total Female Sample

TABLE 31
Percentage of Subjects Having Accidents or Convictions During an Action by Type of Action and Sex

| Type of action | Sex | Percentage having... | | |
|---|---|---|---|---|
| | | Accidents | Convictions | Accidents and/or convictions |
| Court suspension..... | M | 1 | 7 | 8 |
| | F | 1 | 2 | 2 |
| DMV suspension/revocation.... | M | 5 | 31 | 32 |
| | F | 2 | 13 | 13 |
| License gap..... | M | 4 | 12 | 14 |
| | F | 3 | 7 | 5 |
| All types..... | M | 3 | 15 | 16 |
| | F | 2 | 3 | 4 |

the total number of convictions during the actions by 365 and dividing the result by the total number of days of action in that year. The all years column was calculated the same, except that the multiplication was by 1,460.

The adjusted (to an annual rate) number of accidents and convictions received while driving under suspension, revocation or license gap is presented in Tables 32 and 33. All subjects action status referred to the total sample, irrespective of whether or not they had an action, in order to compare the average driver's accident and conviction rate with that of those who were not supposed to be driving at all, and should have had a mean of zero. The row and column totals for those with actions do not add, due to the overlapping N, explained previously. Most accident means were lower for those with actions than for the total sample. For example, males with DMV suspensions or revocations averaged half as many accidents as the average driver. Those means in the opposite direction were of doubtful significance. These findings should be interpreted with considerable caution, since the subjects may have avoided having accidents reported, in order to prevent detection of their illegal driving.

The results were more complex with respect to convictions. Those with court suspensions had higher conviction rates than all subjects. Males with DMV suspension/revocations had higher conviction rates than all subjects, but there was little difference for females. These findings indicated

TABLE 32

Adjusted Number of Accidents Per 1,000 Drivers by Action Status, Sex and Year

| Action status | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| All subjects..... | M | 159 | 182 | 172 | 127 | 640 |
| | F | 96 | 94 | 84 | 70 | 345 |
| Court suspension.... | M | 101 | 33 | 0 | 433 | 357 |
| | F | 0 | 257 | 0 | 0 | 466 |
| DMV suspension/ revocation..... | M | 185 | 55 | 60 | 82 | 309 |
| | F | 0 | 0 | 0 | 0 | 0 |
| License gap..... | M | 148 | 0 | 51 | 30 | 160 |
| | F | 0 | 48 | 27 | 18 | 95 |
| All actions..... | M | 137 | 43 | 53 | 307 | 217 |
| | F | 0 | 58 | 25 | 20 | 99 |

Note.--See text for explanation.

TABLE 33

Adjusted Number of Convictions Per 1,000 Drivers by Action Status, Sex and Year

| Action status | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| All subjects..... | M | 649 | 835 | 961 | 728 | 3,173 |
| | F | 164 | 204 | 247 | 215 | 830 |
| Court suspension... | M | 1,174 | 1,179 | 1,740 | 1,300 | 4,969 |
| | F | 334 | 257 | 0 | 0 | 1,165 |
| DMV suspension/ revocation..... | M | 1,043 | 1,238 | 1,238 | 1,475 | 5,253 |
| | F | 0 | 158 | 234 | 152 | 719 |
| License gap..... | M | 0 | 630 | 347 | 234 | 1,180 |
| | F | 0 | 0 | 38 | 18 | 107 |
| All actions..... | M | 988 | 1,104 | 585 | 3,582 | 2,627 |
| | F | 219 | 73 | 52 | 28 | 188 |

Note.--See text for explanation

clearly the ineffectiveness of suspension and revocation. Both sexes with license gaps had lower than average conviction rates, reflecting lack of exposure. Those subjects who did have convictions during an action had much higher averages. Males who had a conviction during DMV suspension/revocation, for example, averaged 3.47 convictions during the period of their suspension/revocation. This would tend to suggest that DMV suspension or revocation had little or no effect on some drivers.

When a subject under DMV suspension or revocation received a traffic ticket, his lack of a valid license may or may not have been detected. If every instance were detected, a subject would have as many violations for driving under suspension/revocation (Section 14601, VC) as he did total convictions. The number of tickets during suspension/revocation as well as the number of convictions for driving when suspended, are presented in Table 34. In only 37 percent of the cases for males and 32

TABLE 34
Number of Driving When Suspended Violations and Total Convictions When Suspended by Sex and Year

| Sex | Item | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Male | Violations for driving when suspended..... | 45 | 75 | 83 | 127 | 330 |
| | Total convictions when suspended..... | 115 | 230 | 232 | 319 | 896 |
| | Percent..... | 39 | 33 | 36 | 40 | 37 |
| Female | Violations for driving when suspended..... | 1 | 1 | 2 | 2 | 6 |
| | Total convictions when suspended..... | 4 | 5 | 6 | 4 | 19 |
| | Percent..... | 25 | 20 | 33 | 50 | 32 |

percent of the cases for females, were those we know to have driven under suspension/revocation convicted for doing so. Given the low percentage of those with suspension/revocation receiving traffic tickets at all during the period of the action, and also given the low percentage of this violator group which was convicted for driving under suspension/revocation, it can be seen that the percentage who were actually convicted for violating their suspension/revocation was low relative to the percentage who were actually driving.

For males with license gaps, the adjusted accident rate during license gaps for the all years period was 25 percent of the rate for all males. The corresponding figure for females was 28 percent. During the first year of driving, the length of license gap was negligible. The correlation coefficients between the length of license gap (in days) for all four years and the number of accidents in the first year of driving did not differ

significantly from zero for either sex, indicating that those with license gaps had a similar personal accident liability as those without gaps. Consequently, the figures of 25 and 28 percent may be considered a fairly close approximation to the percentage of those who continued to drive after their license had expired for 90 days.

The fact that many of the sample were no longer driving in California during the third and fourth years would affect the year to year trends presented previously. Hence, the accident and conviction means in the third and fourth year of driving were adjusted for license gap as follows. The first two years were not adjusted due to the small amount of license gap. The adjustment was done by subtracting from the total number of subjects the number of subjects corresponding to the number of man-years of license gap (not counting the 25 percent of the males and 28 percent of the females who were still driving). The total numbers of accidents and convictions were then divided by the reduced N to obtain the adjusted means, presented in Table 35 and Figure 8. As can be seen, the adjustment had little effect on the trends.

TABLE 35
Number of Accidents and Convictions per 1,000 Drivers by Sex and Year with the Third and Fourth Years Adjusted for License Gap

| Variable | Sex | Year | | | |
|---|---|---|---|---|---|
| | | 3 | | 4 | |
| | | Unadjusted | Adjusted | Unadjusted | Adjusted |
| Accidents..... | M | 172 | 181 | 127 | 135 |
| | F | 84 | 89 | 70 | 75 |
| Convictions..... | M | 961 | 1,010 | 728 | 773 |
| | F | 247 | 262 | 215 | 228 |

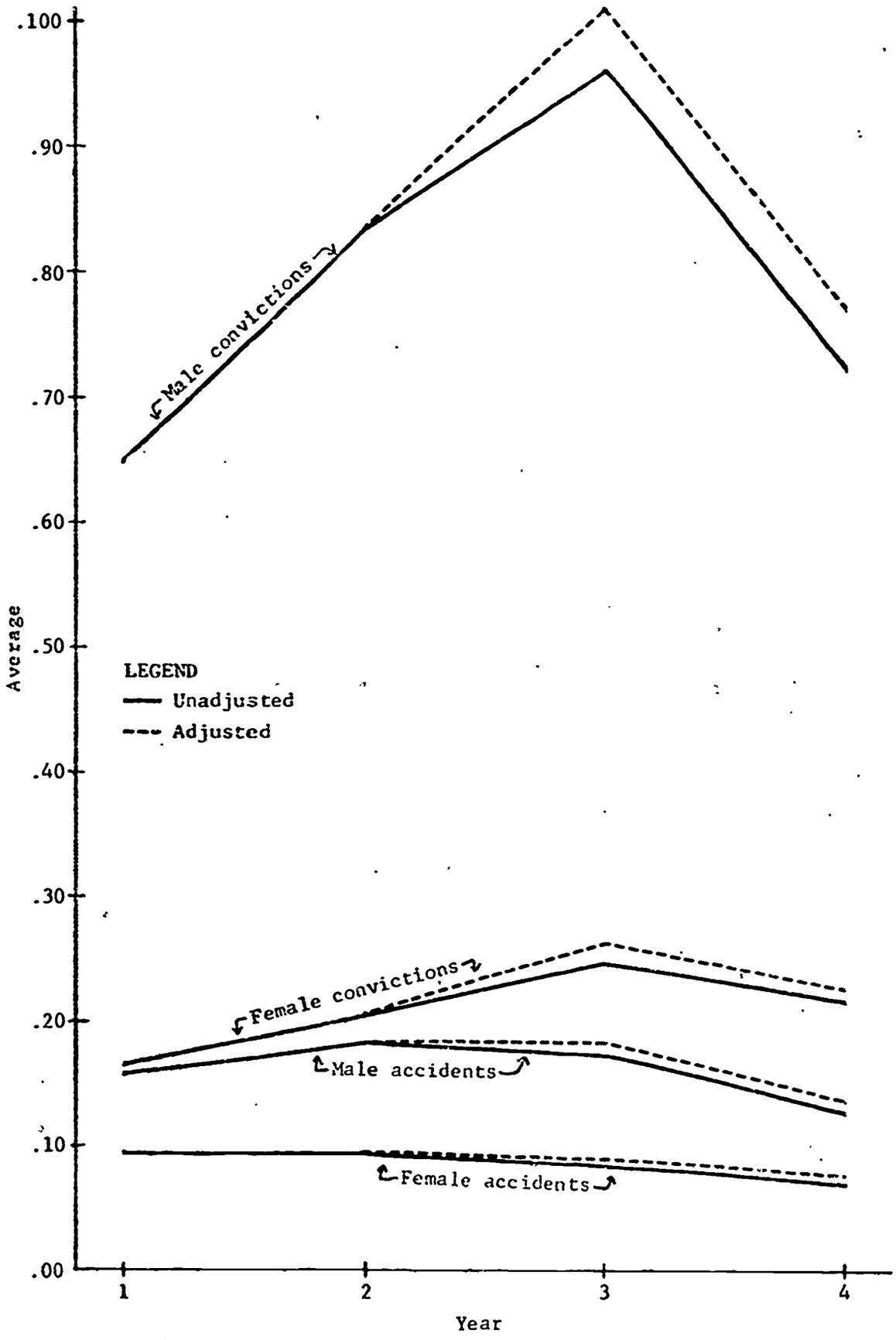



Fig. 8-Average Number of Accidents and Convictions by Sex and Year With the Third and Fourth Years Adjusted for License Gap

# CHAPTER 4

## PREDICTION OF DRIVING RECORD

In this chapter we shall present the correlations between driver record and biographical data. Accidents and convictions will be predicted from driver record, biographical data, and fatal and injury accident characteristics. The chapter concludes with the prediction of miscellaneous driving variables.

### Prediction from Driver Record

This section will first deal with the prediction of driver record from concurrent driver record data, then with prediction from non-concurrent data.

The correlation coefficients are presented in Appendices B and C. The intercorrelations among the accidents, convictions, and types of violations were mostly positive and statistically significant.

The prediction from concurrent data involved: (1) the prediction of first year accidents from first year convictions and types of violations, and (2) the prediction of four year accidents from four year convictions and types of violations.

The correlation coefficients between Accidents 1 year and Convictions 1 year were 0.21 for males and 0.20 for females. The average number of accidents by number of convictions is presented in Table 36 for males and Table 37 for females. The average number of accidents increased steadily

TABLE 36

Average Number of Accidents by Number of Convictions in the First Year of Driving for Males

(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5+ |
| Average number of accidents..... | 0.092 (5,117) | 0.240 (1,766) | 0.290 (692) | 0.314 (299) | 0.448 (134) | 0.381 (113) |

as the number of convictions increased. For example, males with five or more convictions had 4 times as many accidents as those with no convictions.

TABLE 37
Average Number of Accidents by Number of Convictions in the First Year of Driving for Females
(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | |
|---|---|---|---|
| | 0 | 1 | 2+ |
| Average number of accidents..... | 0.071 (4,992) | 0.253 (681) | 0.281 (121) |

The correlation coefficients between Accidents 1-4 years and Convictions 1-4 years were 0.29 for males and 0.26 for females. The mean accidents by number of convictions is presented in Tables 38 and 39, and plotted in Figures 9 and 10. The average number of accidents increased sharply with increasing convictions.

TABLE 38
Average Number of Accidents by Number of Convictions in the First Four Years of Driving for Males
(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ |
| Average number of accidents..... | 0.287 (1,577) | 0.449 (1,536) | 0.572 (1,264) | 0.713 (992) | 0.761 (744) | 0.912 (522) | 0.947 (416) | 1.048 (268) | 1.030 (200) | 1.133 (180) | 1.171 (422) |

TABLE 39
Average Number of Accidents by Number of Convictions in the First Four Years of Driving for Females
(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5+ |
| Average number of accidents | 0.212 (3,130) | 0.398 (1,496) | 0.555 (662) | 0.672 (293) | 0.642 (112) | 0.970 (101) |

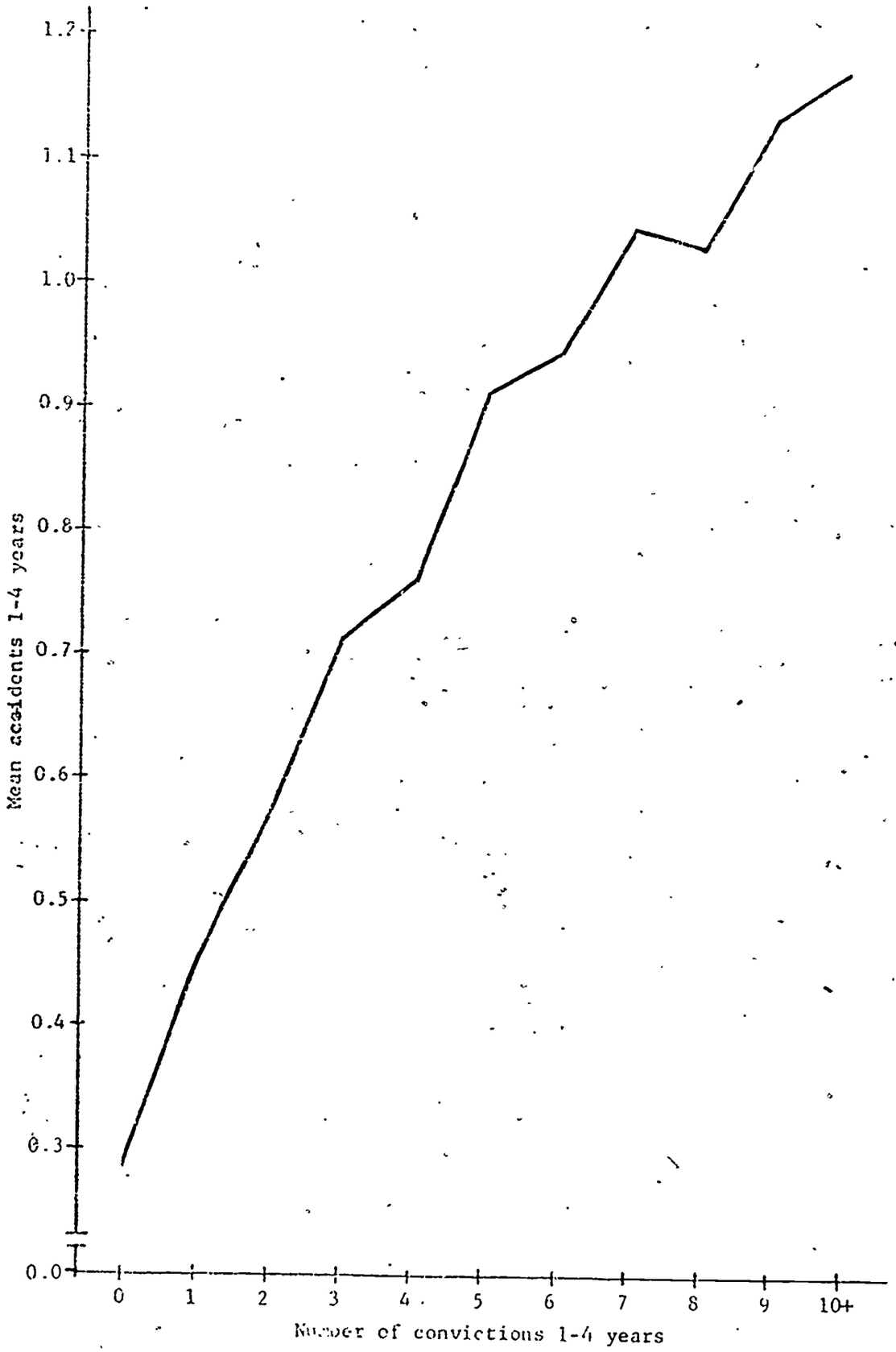



Fig. 9-Mean Accidents 1-4 Years by Number of Convictions 1-4 Years for Males

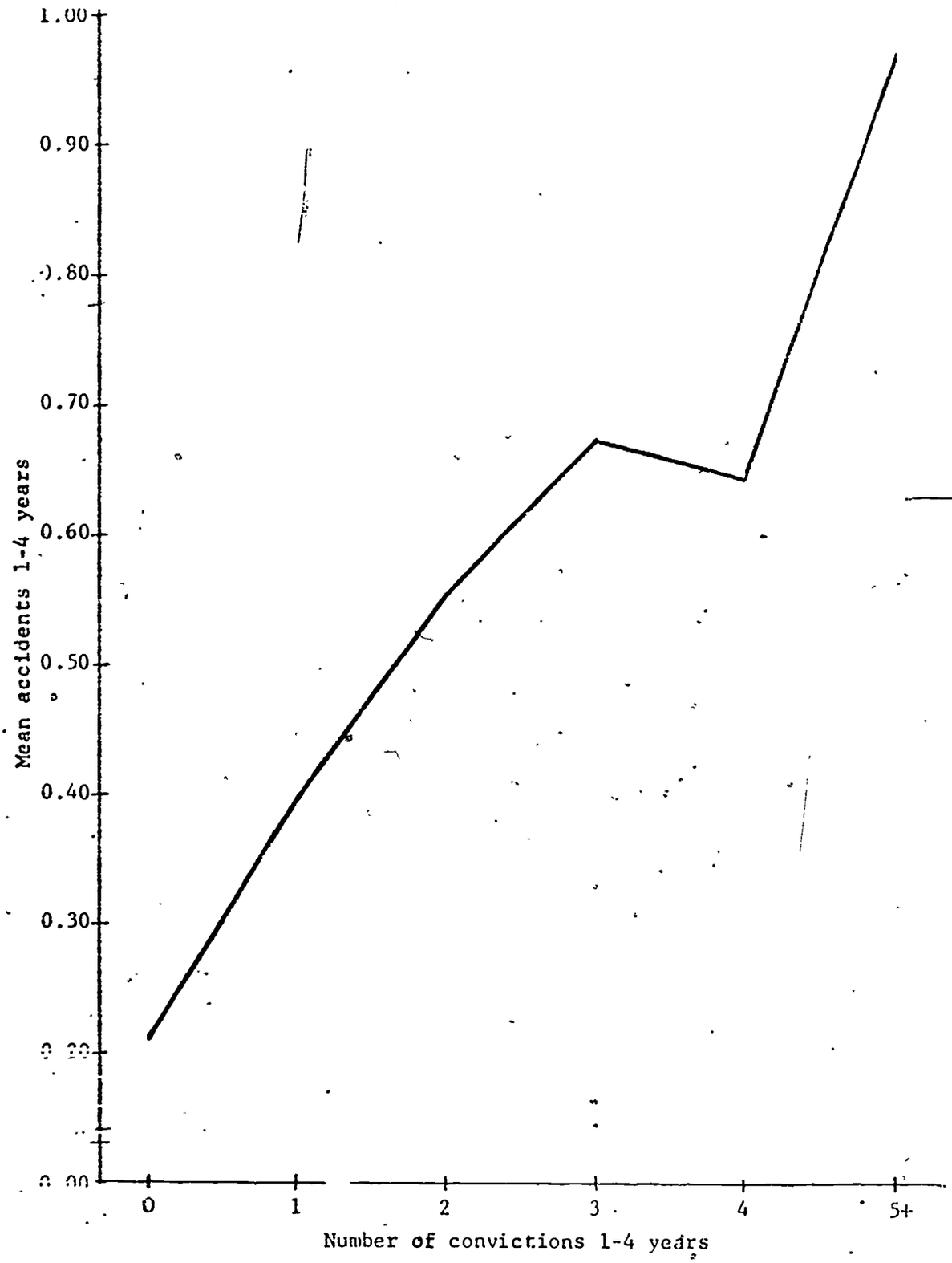



Fig. 10-Mean Accidents 1-4 Years by Number of Convictions 1-4 Years for Females

The multiple regression equations for predicting four year accident record from convictions, types of violations, and original license data are presented in Table 40. Variables which did not enter the equations

TABLE 40

Multiple Regression Equations (Beta Coefficients) for Predicting Four Year Accident Record from Concurrent Driver Record and Original License Data

| Variable | Beta coefficients | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 1-4 | | Fatal/ injury accidents 1-4 | | Property accidents 1-4 | | Single vehicle accidents 1-4 | | Part/ fault accidents 1-4 | | Accident cost 1-4 | | Accident rate 1-4 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Fresno county.. ..... | | -04 | | | | -04 | | | | | -03 | -03 | -09 | |
| Sonoma county ..... | 03 | | | | 04 | | 04 | 04 | | | | | | |
| Sacramento county..... | 05 | 03 | 04 | 03 | -04 | | | | 03 | 04 | 03 | | | 03 |
| Stanislaus county ..... | | | | | | | | | | 03 | | | -03 | |
| Los Angeles county ..... | | | | | | | | | | | | | -04 | |
| Single orig license.. ... | | | | | | | | | | | | -03 | | |
| Drive test score ..... | | | | | | | | | | | | | -03 | |
| Age licensed... ..... ... | -03 | | | | -03 | | | | | | | -03 | -02 | |
| Traffic density..... | | | | | | | -03 | | | | | | | 05 |
| Conv instruct permit..... | | | | | | | | 05 | | | | | | |
| Acc instruct permit..... | | | 02 | | | | | | 03 | | | | | |
| Lane violation 1-4 yrs.. | 04 | | 05 | | | | 05 | | 05 | | 04 | | | |
| Following viol 1-4 yrs... | | 05 | | 05 | | 03 | | 03 | | | | 05 | | 05 |
| Passing violation 1-4 yrs | | | | | | | | | | | | | | 04 |
| Right-of-way viol 1-4 yrs | 08 | 06 | 09 | | 04 | 06 | | | 10 | 06 | 08 | 04 | 06 | 05 |
| Speed violation 1-4 yrs.. | 05 | | 07 | | | | | | 04 | | 04 | | | |
| Drunk driv viol 1-4 yrs.. | 03 | | 03 | | | | | | 03 | | 02 | | 03 | 05 |
| Reckless dr viol 1-4 yrs. | | | 03 | | | | | | 05 | | 06 | | | 03 |
| Driving w/o lic viol 1-4 yrs. | | | | | | | | | | | | | -04 | 03 |
| Hit and run viol 1-4 yrs. | 06 | | 03 | | 06 | | | | 03 | | 04 | | 06 | |
| FTA/FTP viol 1-4 yrs.. .. | -08 | -04 | -06 | | -06 | -05 | -03 | | -06 | | -07 | | -08 | -05 |
| Equipment viol 1-4 yrs... | -06 | -06 | | -05 | -06 | -04 | | -04 | -04 | | -05 | -06 | -04 | -05 |
| Misc moving viol 1-4 yrs.. | | | 02 | | | | | | | | | | | |
| Misc non-mov viol 1-4 yrs | -05 | -06 | | | -07 | -06 | | | | -04 | | | -10 | -07 |
| Convictions 1-4 yrs..... | 33 | 30 | 14 | 19 | 32 | 24 | 13 | 08 | 17 | 16 | 22 | 21 | 41 | 27 |
| Length lic gap 1-4 yrs... | -06 | -04 | -03 | | -06 | -04 | | | | | -04 | | | |
| Single lic renewal..... | | | -03 | | | | | | | | -02 | | | |
| Multiple correlation (R)= | 35 | 30 | 26 | 19 | 27 | 25 | 15 | 10 | 25 | 18 | 28 | 23 | 34 | 29 |

Note.--Decimal points omitted.

were not included in the Table, but may be inferred by comparing the Table with Appendix A. The highest multiple correlations obtained for total accidents, 0.35 for males and 0.30 for females, rather than for any accident type, accident cost, or accident rate. The beta coefficients were much larger for convictions 1-4 years than for the other variables. The beta weights for the remaining variables tended to be uniformly low. The multiple correlations were only slightly higher than the simple (zero order) correlations with convictions, indicating that knowledge of the other variables added little to the predictability of accidents over knowledge of number of convictions alone.

When all variables were entered (F = 0) into the equations for total accidents, the multiple R's were 0.35 for males and 0.31 for females, indicating how little all remaining variables could add to the equations presented in Table 40.

Equations were run to determine the value of type of violations compared to number of convictions as a predictor of accidents. This would indicate how much better a point system for determining negligent operator status would be rather than simply counting the number of convictions. The multiple correlations for predicting accidents 1-4 years from types of violations 1-4 years were 0.33 for males and 0.29 for females, which was such a slight gain over the correlation between accidents and convictions, that even an optimally weighted point system could not be justified. Contrary results for non-concurrent prediction are presented later.

The non-concurrent prediction involved: (1) the prediction of one and four year accidents and convictions from original license data, (2) the prediction of the same variables from original license data and accident and conviction record prior to licensing, and (3) the prediction of third and fourth year driver record from prior driver record.

The regression equations for predicting driver record from original license data are presented in Table 41. The multiple correlations for

TABLE 41
Multiple Regression Equations (Beta Coefficients) for Predicting Driver Record from Original License Data

| Variable | Beta coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Accidents 1 | | Accidents 1-4 | | Convictions 1 | | Convictions 1-4 | |
| | M | F | M | F | M | F | M | F |
| Fresno county..... | -04 | | -04 | | | 07 | | 05 |
| Sacramento county..... | | | | | -08 | | | |
| Los Angeles county..... | | | | | 08 | 12 | 35 | 28 |
| Height..... | -05 | | | | -04 | | -07 | |
| Weight..... | 03 | | | 03 | | | | 04 |
| Single orig license..... | | | | | | -04 | | -03 |
| Drive test score..... | -03 | | -03 | | -03 | | -05 | -03 |
| Age licensed..... | | | -06 | -03 | | 03 | -04 | |
| Length instr permit..... | | -05 | | -05 | -04 | -06 | -08 | -11 |
| Instruct permit..... | | 03 | | 04 | -04 | | | 05 |
| Traffic density..... | | 05 | | 08 | | | -22 | -11 |
| Multiple correlation (R). | 06 | 06 | 07 | 09 | 16 | 15 | 21 | 21 |

Note.--Decimal points omitted.

convictions were relatively high considering the limited type of data used. Accidents, however, were quite unpredictable from information readily available at the time of licensing. Los Angeles county and

Traffic Density correlated 0.92 for males, which increased their beta coefficients for Convictions 1-4, and resulted in opposite signs.

The same variables were also predicted from original license data plus accident and conviction record prior to licensing, as presented in Table 42. Only the correlations for male convictions increased substantially. There were high correlations between driving record on instruction

TABLE 42
Multiple Regression Equations (Beta Coefficients) for Predicting Driver Record From Original License Data and Driver Record Prior to Licensing

| Variable | Beta coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Accidents 1 | | Accidents 1-4 | | Convictions 1 | | Convictions 1-4 | |
| | M | F | M | F | M | F | M | F |
| Fresno county | -04 | | -04 | | | 06 | | 05 |
| Sacramento county | | | | | | | -08 | |
| Los Angeles county | | | | | 24 | 12 | 11 | 27 |
| Height | -05 | | | | -03 | | -05 | |
| Weight | 03 | | | 03 | | | | 04 |
| Single orig license | | | | | | -04 | | -03 |
| Drive test score | -03 | | -03 | | -03 | | -05 | -03 |
| Age licensed | | | -06 | -03 | | 03 | -04 | |
| Length instr permit | | -05 | | -05 | -03 | -06 | -08 | -11 |
| Instruct permit | | 03 | | 04 | -03 | | | 05 |
| Traffic density | | 05 | | 08 | -01 | | | -11 |
| Conv instruct permit | | 04 | | | -06 | | | 04 |
| Acc instruct permit | -05 | | | | | | | |
| Convictions 6 mos pr | 06 | | 03 | | 03 | 05 | 19 | |
| Accidents 6 mos pr | 07 | | 03 | | 04 | | 08 | |
| Multiple correlation (R) | 10 | 07 | 09 | 09 | 29 | 16 | 29 | 22 |

Note.--Decimal points omitted.

permit and 6 months prior, so that only the 6 months prior variables were permitted to enter the equations subsequently presented.

Third and fourth year accidents were predictable to a low degree from prior driving record. The correlations between Accidents 3-4 and Accidents 1-2 were 0.04 for both males and females. This means that few of those having accidents in the third and fourth years had accidents in the first two years. The correlations between Accidents 3-4 and Convictions 1-2 were 0.08 for males and 0.06 for females. The crosstables are presented in Tables 43 and 44.

The correlations between Convictions 3-4 and Accidents 1-2 were 0.15 for males and 0.09 for females. The correlations between Convictions 3-4 and Convictions 1-2 were 0.40 for males and 0.25 for females. Thus, convictions were better predictors of both future accidents and future

TABLE 43

Average Number of Accidents and Convictions in the Third and Fourth Years of Driving by the Number of Accidents in the First Two Years of Driving for Males

(Figures in parentheses are the sample size)

| Item | Number of accidents - 1-2 yrs | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3+ |
| Average number of accidents - 3-4 yrs.. | 0.284 (5,831) | 0.327 (1,885) | 0.344 (345) | 0.483 (60) |
| Average number of convictions - 3-4 yrs | 1.499 (5,831) | 2.083 (1,885) | 2.489 (345) | 3.133 (60) |

TABLE 44

Average Number of Accidents and Convictions in the Third and Fourth Years of Driving by the Number of Accidents in the First Two Years of Driving for Females

(Figures in parentheses are the sample sizes)

| Item | Number of accidents - 1-2 yrs | | |
|---|---|---|---|
| | 0 | 1 | 2+ |
| Average number of accidents - 3-4 yrs | 0.148 (4,802) | 0.175 (891) | 0.257 (101) |
| Average number of convictions - 3-4 yrs | 0.427 (4,802 | 0.598 (891) | 0.891 (101) |

convictions than were prior accidents. The crosstables are presented in Tables 45 and 46.

The multiple regression equations for predicting third and fourth year driver record from the prior driver record are presented in Table 47. The multiple correlations for accidents were quite low, but double those of the simple correlations with prior convictions. The multiple correlations for convictions were only slightly greater than the simple correlations with prior convictions. Prior convictions and length of license gap were the most important predictors of total accidents and convictions.

TABLE 45
Average Number of Accidents and Convictions in the Third and Fourth Years of Driving by the Number of Convictions in the First Two Years of Driving for Males
(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| Average number of accidents..... | 0.236 (3,260) | 0.293 (1,961) | 0.349 (1,189) | 0.404 (693) | 0.339 (404) | 0.354 (254) | 0.518 (160) | 0.365 (200) |
| Average number of convictions..... | 0.983 (3,260) | 1.529 (1,961) | 1.913 (1,189) | 2.458 (693) | 3.037 (404) | 3.102 (254) | 3.987 (160) | 4.405 (200) |

TABLE 46
Average Number of Accidents and Convictions in the Third and Fourth Years of Driving by the Number of Convictions in the First Two Years of Driving for Females
(Figures in parentheses are the sample sizes)

| Item | Number of convictions | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3+ |
| Average number of accidents..... | 0.141 (4,237) | 0.171 (1,163) | 0.245 (277) | 0.239 (117) |
| Average number of convictions..... | 0.365 (4,237) | 0.614 (1,163) | 0.844 (277) | 1.521 (117) |

The equations predicting accidents in the third and fourth years from the number of types of violations in the first two years are presented in Table 48. The multiple R for males was 0.112 as opposed to the simple correlation of 0.084 with prior convictions, representing a 79 percent increase in explained variance. The corresponding figures for females were 0 087, 0.063 and 88 percent. Consequently, an optimally weighted point system would be superior to the number of convictions for predicting future accidents. Practical problems with using points proportional to the regression coefficients include the complexity, and the zero and negative coefficients. A similar analysis will be done for drivers of all ages in the next California Driver Record Study. The use of all data on the driver record in addition to convictions and types of violations yielded even higher correlations of 0.16 for males and 0.14 for females (Table 47).

In summary, accidents can only be predicted to a low degree from driver record data.

TABLE 47

Multiple Regression Equations (Beta Coefficients) for Predicting Third and Fourth Year Driver Record From the First Two Year Driver Record and Original License Data

| Variable | Beta coefficients | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 3-4 | | Fatal/ injury accidents 3-4 | | Property accidents 3-4 | | Single vehicle accidents 3-4 | | Part/ fault accidents 3-4 | | Accident cost 3-4 | | Accident rate 3-4 | | Convictions 3-4 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Fresno county | | | | | | | | | | | -02 | | -05 | | | |
| Sonoma county | | | | | | | 03 | | | | | | | | | |
| Los Angeles county | | | | | | | | | | | | | | | 07 | 15 |
| Height | | | | | | | | | | | | | | | -03 | |
| Weight | | | | | | | | | | 03 | | | | | | |
| Single orig license | | | | | | | | | | | | | | | | -03 |
| Drive test score | | -03 | | | | | | | | | | | -03 | -03 | -03 | -04 |
| Age licensed | -05 | | | | -05 | | | 03 | | | | | -02 | | -07 | -03 |
| Length instr permit | | | | | | | | | | | | | | | -04 | -05 |
| Traffic density | | 04 | | | | 03 | | | | | | 03 | | 05 | | -09 |
| Conv instruct permit | | | | | | | | 05 | | | | | | | | |
| Acc instruct permit | | | 04 | | | | | | 04 | | 03 | | | | | |
| Sign violation 1-2 yrs | | | | | | 04 | | | | | | | | | | -04 |
| Lane viol 1-2 yrs | | | | | | | 02 | | | | | | | | | |
| Following viol 1-2 yrs | | | | 05 | | | | | | 04 | | 04 | | | | |
| Passing violation 1-2 yrs | | | | | | | | | | | | | | | | 03 |
| Right-of-way viol 1-2 yrs | | | 03 | | | | 04 | | 03 | | | | | | | -07 |
| Turning viol 1-2 yrs | | | | | | | | | | | | | | | -02 | |
| Speed violation 1-2 yrs | | | | | 05 | 03 | | 04 | | | | | | | 06 | |
| Reckless dr viol 1-2 yrs | | | | | | | | | | | | | | | 03 | |
| Driv w susp viol 1-2 yrs | -03 | | | | | | | | | | | | -02 | | | |
| FTA/FTP violation 1-2 yrs | -04 | -03 | -04 | | | | | | -04 | | -05 | | -05 | -03 | -02 | -04 |
| Equipment viol 1-2 yrs | | | | | | | | | | | -03 | | | | 03 | 06 |
| Misc non-mov viol 1-2 yrs | | | | | | | | | | | | | | | 07 | 03 |
| Convictions 6 mos pr | | | -02 | | | | | | | | | | | | 03 | |
| Convictions 1 yr | | | | | | | | | | | | | | | -05 | |
| Convictions 2 yr | | | | 05 | | | | | | 04 | | 05 | | 04 | | |
| Convictions 1-2 yrs | 12 | 07 | 10 | | | | 04 | | 08 | | 13 | | 12 | 06 | 31 | 25 |
| Accidents 6 mos pr | | | | | | | | | | | | | | | 04 | |
| Accidents 1 yr | | | 04 | | | | | | | | | | 03 | | | |
| Accidents 2 yr | | | | | | | | | -04 | | -03 | | | | | |
| Accidents 1-2 yrs | | | | | | | | | | | | | | | 06 | 04 |
| Fatal/injury acc 1-2 yrs | -03 | 06 | -04 | | | | | -13 | | | | | -06 | | | |
| Property acc 1-2 yrs | 04 | | | | 03 | | | | 07 | | 05 | | | | | |
| Single veh acc 1-2 yrs | | -05 | | -04 | | | | | | -05 | | -05 | | -05 | -03 | |
| Accident cost 1-2 yrs | | | | 08 | | | | 17 | | 08 | | 08 | | 08 | | |
| Length lic gap 1-4 yrs | -10 | -08 | -06 | -03 | -09 | -07 | -03 | | -04 | | -07 | -05 | -06 | -04 | -09 | -09 |
| Single lic renewal | | 05 | | 03 | | 05 | | | | | | 03 | | 04 | -04 | 08 |
| Multiple correlation (R) | 16 | 14 | 13 | 11 | 12 | 11 | 08 | 11 | 12 | 10 | 14 | 12 | 14 | 13 | 44 | 32 |

Note.--Decimal points are omitted.

TABLE 48

Regression Equations (Unstandardized Regression Coefficients) for Predicting Accidents 3-4 Years from Violation Types 1-2 Years

| Sex | Equation |
|---|---|
| Male | |
| Accidents 3-4 years = | 0.05 Speed violation 1-2 years +0.07 Lane placement violation 1-2 years -0.05 FTA and FTP violation 1-2 years +0.07 Right-of-way violation 1-2 years +0.02 Sign violation 1-2 years -0.06 Driving while suspended violation 1-2 years +0.03 Turning violation 1-2 years -0.40 Drug violation 1-2 years +0.01 Equipment violation 1-2 years +0.08 Hit and run violation 1-2 years +0.03 Following-too-close violation 1-2 years -0.04 Reckless driving violation 1-2 years +0.03 Miscellaneous moving violation 1-2 years +0.05 Drunk driving violation 1-2 years -0.00 Miscellaneous non-moving violation 1-2 years -0.00 Passing violation 1-2 years |
| Female | |
| Accidents 3-4 years = | 0.07 Sign violation 1-2 years +0.05 Speed violation 1-2 years -0.10 FTA and FTP violation 1-2 years +0.10 Following-too-close violation 1-2 years +0.11 Passing violation 1-2 years +0.35 Reckless driving violation 1-2 years +0.04 Turning violation 1-2 years +0.02.Equipment violation 1-2 years +0.03 Right-of-way violation 1-2 years -0.25 Driving while suspended violation 1-2 years -0.03 Lane placement violation 1-2 years +0.01 Miscellaneous non-moving violation 1-2 years +0.05 Hit and run violation 1-2 years +0.03 Miscellaneous moving violation 1-2 years +0.00 Drunk driving violation 1-2 years +0.00 Drug violation 1-2 years |

## Prediction from Biographical Data

First will be discussed the correlations of the biographical variables with four year driving record, with crosstables presented for some variables. Then the regression equations for predicting four year driving record will be presented.

The correlation coefficients of biographical variables with four year accidents and convictions are presented in Table 49. Most variables were statistically significant in the expected direction.

The correlations with Accidents 1-4 years were uniformly low. For males, only seven variables had correlations greater than 0.100 in absolute magnitude, the largest being -0.153 with Citizenship Grade, indicating that having accidents was associated with worse citizenship grades. Females had only 4 correlations with accidents over 0.100, the largest being -0.123 with Citizenship Grade.

The correlations with Convictions 1-4 years were considerably higher. Males had many coefficients over 0.200, the highest being -0.436 with Citizenship Grade. Females had only a few coefficients over 0.200, the highest being -0.264 with Citizenship Grade. These correlations with Citizenship Grade were of the same order of magnitude as those between Convictions 1-2 and Convictions 3-4.

Crosstables of each biographical variable were made with Accidents 1-4 years and Convictions 1-4 years. The results were plotted and visually inspected for non-linearity. There was a negligible degree of curvilinearity in the data.

Space does not permit presenting crosstables of all statistically significant variables. Crosstables with both accidents and convictions 1-4 years will be presented for variables of particular interest, or for those variables for which either sex had a correlation of 0.100 or greater with accidents, or 0.200 or greater with convictions. Non-significant results will not be included in the tables. In the following descriptions of the findings presented in Table 49, the term rate refers to the mean or average number of accidents and convictions.

The number of accidents and convictions by county is presented in Table 50. There was little variation in the accident rate for males. The female accident rate was highest in Los Angeles county, and lowest in Fresno county, which appears to reflect differences in traffic density. The conviction rate was highest in Los Angeles and lowest in Sacramento county for both sexes, probably reflecting differences in degree of enforcement of the traffic laws, as well as other demographic factors, such as differences in socio-economic level.

Those 198 females who were married at the time of licensing averaged 1.060 convictions, as opposed to an average of 0.823 convictions for those who were single.

Short men and fat ladies had more convictions than their counterparts. Higher scores on the DMV licensing drive test were associated with lower accident rates for males and lower conviction rates for both sexes. The

TABLE 49
Correlation Coefficients Between Biographical Variables and Four Year Accidents and Convictions by Sex

| Variable | Accidents 1-4 | | Convictions 1-4 | | Variable | Accidents 1-4 | | Convictions 1-4 | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | | Male | Female | Male | Female |
| Fresno county | -039* | -045* | -001 | 031* | Vehicle weight | 026 | -052* | 053* | -026* |
| Sonoma county | 017 | -020 | -023* | -046* | Vehicle year | 031* | 048* | -062* | 020 |
| Sacramento county | 007 | 001 | -151* | -134* | Vehicle mileage | 088* | 105* | 158* | 181* |
| Stanislaus county | -010 | -025 | -014 | -046* | Equipped seat belts | 016 | 022 | -093* | -016 |
| Los Angeles county | 022* | 064* | 153* | 153* | Wear seat belts | -050* | -016 | -115* | -081* |
| Height | -019 | 007 | -048* | 018 | Married | 066* | -048* | 150* | -037* |
| Weight | 004 | 020 | -016 | 034* | Divorced/separated | 026 | 024 | 079* | 049* |
| Single orig license | 005 | -006 | -019 | -034* | Number of children | 047* | -030* | 131* | -026 |
| Drive test score | -024* | -012 | -046* | -047* | Number of brothers | -009 | -043* | 071* | -009 |
| Age licensed | -055* | -021 | -013 | 016 | Number of older sibs | 018 | -012 | 059* | 013 |
| Length inst permit | 030* | -025 | -075* | -098* | Parents alive | -031* | 003 | -038* | -043* |
| Instruction permit | 018 | 012 | -071* | -027* | Parents married | -062* | -026 | -122* | -106* |
| Traffic density | 030* | 072* | 102* | 104* | Student | -115* | -040* | -228* | -073* |
| Birth location | -010 | 022 | -040* | -010 | Housewife | 000 | -022 | [illegible] | -040* |
| Home status | -006 | 021 | 088* | 047* | Grade completed | -111* | -061* | -305* | -110* |
| Year left school | -042* | 031* | -248* | 025 | Occupational goal | -047* | -039* | -194* | -076* |
| Transfer | 011 | -007 | 139* | 009 | Social mobility | -040* | -045* | -028 | -028 |
| Dropout | 040* | -037* | 201* | 044* | Unemployed | 044* | 008 | 086* | 037* |
| College transcript | -032* | 012 | -210* | -037* | Social activities | -006 | 030* | -044* | -004 |
| Driver training grade | 057 | 034 | -020 | -070 | Academic activities | -070* | -004 | -134* | -071* |
| Grade point average | -128* | -071* | -373* | -197* | Student activities | -019 | -016 | -097* | -043* |
| GPA trend | -040* | -028 | -082* | -027 | Intramural activities | 009 | 007 | -029* | 035* |
| Citizenship grade | -153* | -123* | -436* | -26 | Varsity letters | -032* | 000 | -065* | 000 |
| Absences | 077* | 071* | 301* | 146* | Non-varsity letters | -018 | 000 | -055* | 000 |
| Non-language IQ | -052* | -016 | -160* | -050* | Safety self-rating | 132* | 092* | 126* | 104* |
| Achievement test | -056* | -019 | -227* | -090* | Drinking | 030* | 057* | 058* | 092* |
| IQ discrepancy | -004 | -004 | 002 | 017 | Number of cigarettes | 103* | 110* | 184* | 157* |
| Achievement index | -120* | -082* | -342* | -213* | Number of jobs | 078* | 080* | 219* | 113* |
| Rural school | -025 | -039* | -068* | -076* | Year own car | -082* | -091* | -179* | -094* |
| Quest response date | 045* | 035* | 120* | 046* | Hours driving | 072* | 075* | 109* | 124* |
| Attitude | 067* | 018 | 225* | 112* | Percent motorcycle | 023 | 028 | 108* | 044* |
| Driver training safety | 056* | 056* | 101* | 087* | Armed forces service | -026* | 000 | -046* | 000 |
| Driver train quality | 050* | 019 | 020 | 056* | Response bias | 005 | 022 | 071* | 050* |
| Driver education | -011 | 003 | -036* | -009 | Driver train not offer | 014 | -004 | -025* | -007 |
| Driver ed quality | 032* | 021 | -017 | 007 | Driver trsin not taken | 007 | 034* | 116* | 063* |
| Mileage work | 061* | 054* | 106* | 086* | Driver train taken | -014 | -031* | -100* | -057* |
| Mileage errands | 055* | 039* | 095* | 090* | Driv train taken w off | -010 | -036* | -117* | -065* |
| Mileage other | 066* | 071* | 126* | 152* | Parents occupstion | -028* | 026 | -088* | 004 |
| Annual milesge | 087* | 078* | 158* | 161* | School data missing | 020 | 030* | 075* | 066* |
| Total mileage | 091* | 106* | 204* | 200* | Length licens* gap 1-4 OL | -092* | -063* | -019 | -034* |
| Prior mileage | 030* | 043* | 111* | 052* | Quest data missing | -006 | 017 | 076* | 058* |
| Mileage T score | 085* | 096* | 189* | 175* | Single lic renewal | -057* | 036* | -157* | 036* |

*$p < .05$.

Note.--Decimal points are omitted.

TABLE 50
Average Number of Accidents and Convictions in the First Four Years of Driving by County and Sex

| Sex and item | County | | | | |
|---|---|---|---|---|---|
| | Fresno | Sonoma | Sacramento | Stanislaus | Los Angeles |
| Male | | | | | |
| Accidents.... | 0.573 | 0.686 | 0.650 | 0.613 | 0.662 |
| Convictions.. | 3.167 | 2.912 | 2.250 | 3.026 | 3.823 |
| Female | | | | | |
| Accidents.... | 0.285 | 0.306 | 0.345 | 0.298 | 0.396 |
| Convictions.. | 0.912 | 0.648 | 0.532 | 0.657 | 1.087 |

older a male was at licensing, the lower his accident rate. The longer both sexes held an instruction permit, the fewer were the number of convictions. The longer men held an instruction permit, the more accidents they had. Males who were born in the county in which they went to high school had a higher conviction rate than those born elsewhere. Coming from a broken home was associated with increased conviction rates for both sexes. Having had an instruction permit was associated with fewer convictions for both sexes. Increased traffic density was associated with increased accidents and convictions for both sexes, as may be seen in the results by county presented previously.

The average number of accidents and convictions by year of leaving high school is presented in Table 51. For males, there was a steady

TABLE 51
Mean Accidents and Convictions by Year Leaving School and Sex

| Sex and item | Year | | | |
|---|---|---|---|---|
| | 8-9 | 10 | 11 | 12 |
| Male | | | | |
| Number of subjects. | 284 | 379 | 400 | 4,665 |
| Accidents..... | 0.764 | 0.686 | 0.637 | 0.613 |
| Convictions..... | 5.465 | 4.598 | 4.192 | 2.623 |
| Female | | | | |
| Number of subjects. | 68 | 167 | 200 | 3,559 |
| Accidents..... | 0.309 | 0.233 | 0.300 | 0.339 |

decline in the number of accidents and convictions with increased schooling. High school graduates had only half as many traffic convictions as those who left school in the 8th or 9th grades. Increased schooling for females was accompanied by a slightly increased accident rate. Males who transferred out of the high school where we collected data had a higher accident rate. Dropping out of high school was associated with increased accident and conviction frequency, as shown in Table 52. There was a very

TABLE 52
Mean Accidents and Convictions by Dropout Status and Sex

| Item | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | Dropout | Non-dropout | Dropout | Non-dropout |
| Number of subjects.. | 597 | 5,094 | 216 | 5,766 |
| Accidents..... | 0.725 | 0.615 | 0.240 | 0.339 |
| Convictions..... | 4.919 | 2.776 | 0.995 | 0.763 |

marked difference in the conviction rates for males. Having a transcript sent to college was associated with a lower accident rate for males as seen in Table 53, and lower conviction rates for both sexes.

TABLE 53
Mean Accidents and Convictions by College Transcript Status and Sex

| Item | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | Transcript | No transcript | Transcript | No transcript |
| Number of subjects.. | 3,493 | 2,198 | 2,544 | 1,438 |
| Accidents..... | 0.606 | 0.660 | - | - |
| Convictions..... | 2.458 | 3.864 | 0.743 | 0.834 |

The results for grade point average are presented in Table 54. There were dramatic decreases in accidents and convictions with better grades. For males, those whose grade point average increased during high school had better accident and conviction records than those with decreasing averages.

The results for citizenship grade, the best predictor of driver record, are presented in Table 55, and plotted in Figures 11 and 12. Those with low citizenship grades had several times as many accidents and convictions as those with high grades. The mean citizenship grade by number of

TABLE 54
Mean Accidents and Convictions by Grade Point Average and Sex

| Sex and item | Grade point average | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31-35 | 36-40 |
| Male | | | | | | | |
| Number of subjects | 214 | 566 | 1,339 | 1,730 | 1,163 | 530 | 181 |
| Accidents..... | 0.719 | 0.780 | 0.716 | 0.656 | 0.506 | 0.477 | 0.303 |
| Convictions..... | 6.210 | 4.777 | 3.731 | 2.766 | 2.016 | 1.437 | 1.116 |
| Female | | | | | | | |
| Number of subjects | 29 | 156 | 548 | 1,119 | 1,164 | 721 | 252 |
| Accidents..... | 0.241 | 0.326 | 0.395 | 0.372 | 0.337 | 0.277 | 0.166 |
| Convictions..... | 0.724 | 1.128 | 1.155 | 0.917 | 0.663 | 0.528 | 0.305 |

TABLE 55
Mean Accidents and Convictions by Citizenship Grade and Sex

| Sex and item | Citizenship grade | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66+ |
| Male | | | | | | | | | |
| Number of subjects... | 134 | 160 | 299 | 480 | 580 | 662 | 661 | 377 | 101 |
| Accidents..... | 0.731 | 0.812 | 0.826 | 0.750 | 0.689 | 0.582 | 0.479 | 0.440 | 0.317 |
| Convictions..... | 7.097 | 4.787 | 4.839 | 3.825 | 3.351 | 2.432 | 1.845 | 1.297 | 1.099 |
| Female | | | | | | | | | |
| Number of subjects... | 109 | 121 | 181 | 305 | 373 | 613 | 502 | 272 | 23 |
| Accidents..... | 0.513 | 0.454 | 0.458 | 0.409 | 0.394 | 0.342 | 0.292 | 0.231 | 0.217 |
| Convictions..... | 1.550 | 1.586 | 1.309 | 1.003 | 0.849 | 0.676 | 0.505 | 0.485 | 0.391 |

accidents is presented in Table 56. The differences were low..

TABLE 56
Mean Citizenship Grade by Number of Accidents and Sex

| Item | Number of accidents | | | | | | |
|---|---|---|---|---|---|---|---|
| | Male | | | | Female | | |
| | 0 | 1 | 2 | 3+ | 0 | 1 | 2+ |
| Number of subjects. | 1,937 | 1,049 | 359 | 109 | 1,769 | 596 | 134 |
| Citizenship grade.. | 51.28 | 48.93 | 47.26 | 46.59 | 50.72 | 48.41 | 47.45 |

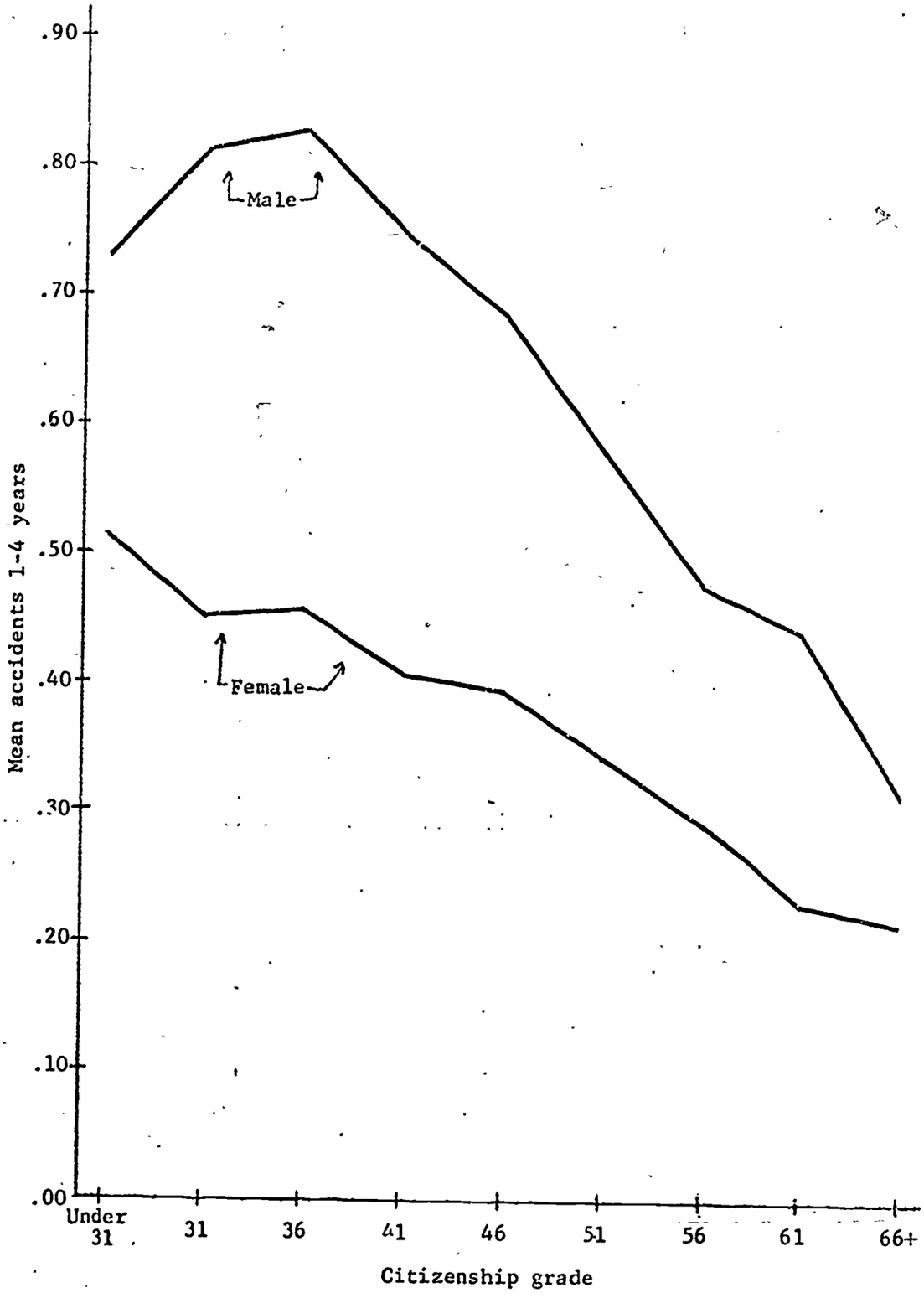



Fig. 11-Mean Accidents 1-4 Years by Citizenship Grade and Sex

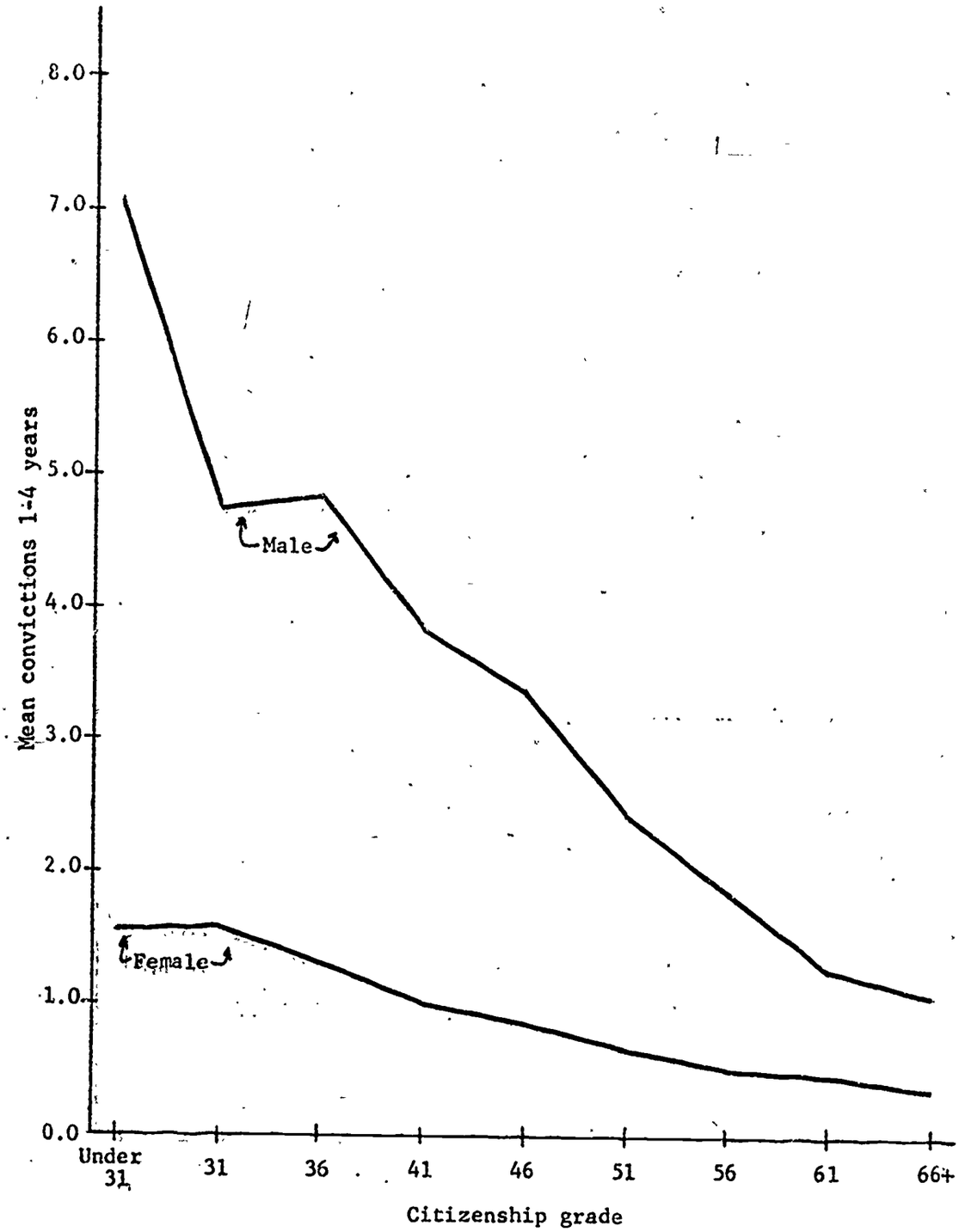



Fig. 12-Mean Convictions 1-4 Years by Citizenship Grade and Sex

The more frequent the number of absences from high school, the higher the accident and conviction rates, as seen in Table 57.

TABLE 57
Mean Accidents and Convictions by Average Number of Absences per Year and by Sex

| Sex and item | Absences | | | | | |
|---|---|---|---|---|---|---|
| | 0-49 | 50-99 | 100-149 | 150-199 | 200-249 | 250+ |
| Male | | | | | | |
| Number of subjects. | 1,689 | 1,369 | 846 | 462 | 262 | 445 |
| Accidents..... | 0.514 | 0.606 | 0.725 | 0.679 | 0.718 | 0.730 |
| Convictions..... | 2.009 | 2.706 | 3.275 | 3.944 | 4.233 | 4.944 |
| Female | | | | | | |
| Number of subjects. | 1,017 | 1,014 | 690 | 407 | 223 | 298 |
| Accidents..... | 0.294 | 0.323 | 0.323 | 0.376 | 0.422 | 0.463 |
| Convictions..... | 0.564 | 0.753 | 0.803 | 0.909 | 1.072 | 1.218 |

The higher the non-language IQ, the lower the accident rate was for males, and the lower the conviction rate for both sexes. Having a non-language IQ more than 14 points higher than a language IQ was not associated with driver record for either sex. The higher the score on an achievement test the lower were the accident rate for males and the conviction rates for both sexes, as seen in Table 58. The results for achievement

TABLE 58
Mean Accidents and Convictions by Achievement Test Scores by Sex

| Sex and item | Score | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-65 | 66+ |
| Male | | | | | | | | |
| Number of subjects | 371 | 551 | 760 | 972 | 940 | 860 | 519 | 273 |
| Accidents..... | 0.679 | 0.656 | 0.679 | 0.666 | 0.617 | 0.607 | 0.520 | 0.516 |
| Convictions..... | 4.375 | 3.867 | 3.393 | 3.130 | 2.719 | 2.496 | 1.907 | 1.626 |
| Female | | | | | | | | |
| Number of subjects | 87 | 236 | 479 | 724 | 824 | 719 | 440 | 210 |
| Convictions..... | 0.988 | 0.868 | 0.935 | 0.770 | 0.851 | 0.700 | 0.609 | 0.548 |

index were even better, as seen in Table 59. High achievement index means that the grade point average was high relative to Total IQ. These results, as well as the superiority of Grade Point Average over both

TABLE 59
Mean Accidents and Convictions by Achievement Index by Sex

| Sex and item | Achievement index | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-16 | 17-19 | 20-22 | 23-25 | 26-28 | 29-31 | 32+ |
| Male | | | | | | | |
| Number of subjects | 651 | 820 | 1,145 | 1,188 | 858 | 403 | 170 |
| Accidents..... | 0.773 | 0.793 | 0.644 | 0.575 | 0.532 | 0.411 | 0.494 |
| Convictions..... | 5.095 | 4.023 | 2.940 | 2.430 | 1.979 | 1.593 | 1.594 |
| Female | | | | | | | |
| Number of subjects | 163 | 322 | 564 | 884 | 889 | 583 | 314 |
| Accidents..... | 0.380 | 0.378 | 0.432 | 0.345 | 0.305 | 0.262 | 0.252 |
| Convictions..... | 1.258 | 1.167 | 1.101 | 0.820 | 0.608 | 0.492 | 0.417 |

Non-language IQ and Achievement Test, and the superiority of citizenship grade over grade point average, tend to indicate that the degree of socialization is more important than "native intelligence" in determining driving behavior.

Attending a rural school was associated with fewer accidents for females, and fewer convictions for both sexes.

In general, the above results tend to confirm the hypothesis that better school (social) adjustment is correlated with better driver record.

The later subjects returned the mail questionnaire, the higher their accident and conviction record.

A higher attitude score was correlated with a higher conviction rate for both sexes, and a higher accident rate for males, as seen in Table 60.

TABLE 60
Mean Accidents and Convictions by Attitude Score by Sex

| Sex and item | Attitude score | | | | |
|---|---|---|---|---|---|
| | 0-1 | 2-3 | 4-5 | 6-7 | 8+ |
| Male | | | | | |
| Number of subjects..... | 123 | 697 | 1,983 | 1,832 | 422 |
| Accidents..... | 0.512 | 0.571 | 0.620 | 0.670 | 0.791 |
| Convictions..... | 1.463 | 2.246 | 2.562 | 3.381 | 4.749 |
| Female | | | | | |
| Number of subjects..... | 99 | 520 | 1,796 | 1,776 | 212 |
| Convictions..... | 0.535 | 0.621 | 0.718 | 0.865 | 1.264 |

All mileage variables were positively correlated with accidents and convictions for both sexes. The results for the best predictor, Total Mileage, are presented in Tables 61 and 62.

TABLE 61
Mean Accidents and Convictions by Total Mileage for Males

| Item | Mileage (in thousands) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-19 | 20-39 | [illegible] | 60-79 | 80-99 | 100-119 | 120+ |
| Number of subjects. | 699 | 1,093 | 1,134 | 652 | 240 | 391 | 413 |
| Accidents..... | 0.488 | 0.530 | 0.660 | 0.712 | 0.842 | 0.662 | 0.831 |
| Convictions..... | 1.967 | 2.246 | 2.763 | 3.258 | 3.717 | 3.829 | 4.402 |

TABLE 62
Mean Accidents and Convictions by Total Mileage for Females

| Item | Mileage (in thousands) | | | | |
|---|---|---|---|---|---|
| | 0-19 | 20-39 | 40-59 | 60-79 | 80+ |
| Number of subjects.. | 1,740 | 1,037 | 573 | 180 | 185 |
| Accidents..... | 0.273 | 0.360 | 0.436 | 0.439 | 0.519 |
| Convictions..... | 0.528 | 0.820 | 1.131 | 1.267 | 1.314 |

The percentage distribution of vehicle weight is presented in Table 63.

TABLE 63.
Percentage Distribution of Vehicle Weight by Sex

| Vehicle weight | Male | Female |
|---|---|---|
| Motorcycles..... | 2.12 | 0.09 |
| Foreign compacts..... | 10.92 | 14.38 |
| American compacts..... | 13.14 | 19.09 |
| Standard american cars... | 55.86 | 51.57 |
| Moderately expensive cars | 8.95 | 9.72 |
| Luxury cars..... | 2.86 | 3.65 |
| Trucks and buses..... | 6.15 | 1.49 |
| All weights..... | 100.00 | 99.99 |

$x^2 = 295.10$, 6 df, $p < .001$.

Heavier vehicle weight was associated with fewer accidents for females and more convictions for males.

The percentage distribution of vehicle year is presented in Table 64.

TABLE 64
Percentage Distribution of Vehicle Year by Sex

| Vehicle year | Male | Female |
|---|---|---|
| Prior to 1955..... | 13.56 | 8.92 |
| 1956..... | 7.46 | 4.14 |
| 1957..... | 8.46 | 4.95 |
| 1958..... | 5.10 | 3.74 |
| 1959..... | 6.30 | 6.80 |
| 1960..... | 6.95 | 7.81 |
| 1961..... | 6.69 | 8.32 |
| 1962..... | 8.09 | 10.40 |
| 1963..... | 9.11 | 11.97 |
| 1964..... | 9.39 | 10.91 |
| 1965..... | 11.55 | 12.30 |
| 1966..... | 5.57 | 7.76 |
| 1967..... | 1.77 | 1.99 |
| All years..... | 100.00 | 100.01 |

$x^2 = 204.30$, 12 df, $p < .001$.

Driving newer vehicles was associated with fewer convictions for males, but, paradoxically, with increased accidents for both sexes. Males who drove cars equipped with seat belts had fewer convictions. The more frequently the seat belt was worn, the fewer the accidents for males, and the fewer the convictions for both sexes.

The relationships of driver record with marital status at the time of receiving the mail questionnaire were in the opposite direction for males and females. Married males had more accidents and convictions than single males; whereas, single females had a worse record than those married. Those who were divorced or separated had worse conviction records than others. The more children a man had the worse was his driver record; the more children a female had, the fewer accidents she had.

Females coming from large families had fewer accidents than their counterparts. Males from larger families had more convictions. The more older sibs a male had, the higher was his conviction rate. The driver record by birth order is presented in Table 65. For both sexes, the eldest child had the best accident record, while the only child had the worst. This ordering also held for female convictions. Except for female accidents,

TABLE 65
Mean Accidents and Convictions by Birth Order and Sex

| Item | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Only child | Eldest child | Other child | Only child | Eldest child | Other child |
| Number of subjects... | 458 | 1,823 | 2,704 | 410 | 1,661 | 2,285 |
| Accidents..... | 0.705 | 0.607 | 0.655 | 0.407 | 0.317 | 0.340 |
| Convictions..... | 2.777 | 2.663 | 2.893 | 0.822 | 0.746 | 0.800 |

having parents who were alive and married was associated with a better driver record, as seen in Table 66. For convictions for both sexes and

TABLE 66
Mean Accidents and Convictions by Parental Status and Sex

| Sex and item | Parental status | | | |
|---|---|---|---|---|
| | Deceased | Married | Separated | Divorced |
| Male | | | | |
| Number of subjects... | 500 | 3,815 | 130 | 583 |
| Accidents..... | 0.720 | 0.612 | 0.730 | 0.747 |
| Convictions..... | 3.330 | 2.750 | 4.161 | 3.821 |
| Female | | | | |
| Number of subjects... | 407 | 3,417 | 63 | 496 |
| Convictions..... | 0.953 | 0.717 | 1.222 | 1.076 |

accidents for males, those with parents married had the best records, followed by those whose parents were deceased, with those with divorced or separated parents having the worst record.

College students had a much better driver record than non-students, as seen in Table 67. Housewives had fewer accidents and convictions than other females. Grade completed was one of the better predictors, as seen in Table 68. The higher the occupational goal sought, the better the driver record for both sexes. Males who were upwardly mobile socially in relation to their parents had better accident and conviction records. Unemployment was associated with higher accidents for males and a higher conviction rate for both sexes.

TABLE 67
Mean Accidents and Convictions by College Student Status and Sex

| Item | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | Student | Non-student | Student | Non-student |
| Number of subjects..... | 2,087 | 2,841 | 1,511 | 2,818 |
| Accidents..... | 0.527 | 0.723 | 0.303 | 0.355 |
| Convictions..... | 2.106 | 3.548 | 0.657 | 0.844 |

TABLE 68
Mean Accidents and Convictions by Grade Completed and Sex

| Sex and item | Grade completed | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 8-9 | 10 | 11 | 12 | 13 | 14 | 15 | 16+ |
| Male | | | | | | | | |
| Number of subjects. | 109 | 114 | 243 | 1,381 | 1,178 | 1,434 | 491 | 96 |
| Accidents..... | 0.844 | 0.649 | 0.740 | 0.747 | 0.694 | 0.542 | 0.456 | 0.479 |
| Convictions..... | 5.514 | 5.614 | 5.362 | 3.577 | 2.866 | 2.116 | 1.896 | 1.667 |
| Female | | | | | | | | |
| Number of subjects. | 39 | 90 | 128 | 1,456 | 837 | 1,172 | 522 | 144 |
| Accidents..... | 0.282 | 0.377 | 0.328 | 0.368 | 0.414 | 0.292 | 0.258 | 0.243 |
| Convictions..... | 1.538 | 0.877 | 1.031 | 0.889 | 0.870 | 0.655 | 0.580 | 0.639 |

Females who participated in social activities in high school averaged more accidents than non-participants. Participation in academic activities was related to fewer accidents for males, and fewer convictions for both sexes. Participation in student activities went with a lower conviction rate for both sexes. Males who took part in intramural activities had fewer convictions, while the opposite was true for females. Number of varsity letters was correlated with a lower accident and conviction rate for males. Having non-varsity letters was predictive of a lower conviction rate for males. In general, participation in school activities was associated with good driving record.

The percentage distribution for safety self-rating are presented in Table 69. Most drivers thought rather well of themselves. This variable was included more to see the distribution of responses, rather than for postdictive purposes, due to the obvious circularity involved. The driver record by safety self rating is presented in Table 70. The low correla-

TABLE 69
Percentage Distribution of Safety Rating

| Safety rating | Male | Female |
|---|---|---|
| Extremely safe..... | 10.89 | 8.12 |
| Above average..... | 52.00 | 51.47 |
| About average..... | 31.33 | 35.91 |
| Below average..... | 5.19 | 4.18 |
| Very unsafe..... | 0.60 | 0.32 |
| All ratings..... | 100.01 | 100.00 |

$\chi^2 = 42.38$, 4 df, $p < .001$.

TABLE 70
Mean Accidents and Convictions by Safety Self Rating and Sex

| Sex and item | Self rating | | | |
|---|---|---|---|---|
| | Quite unsafe | About average | Quite safe | Extremely safe |
| Male | | | | |
| Number of subjects... | 291 | 1,577 | 2,617 | 548 |
| Accidents..... | 0.849 | 0.769 | 0.583 | 0.444 |
| Convictions..... | 3.567 | 3.544 | 2.617 | 2.631 |
| Female | | | | |
| Number of subjects... | 197 | 1,574 | 2,256 | 356 |
| Accidents..... | 0.487 | 0.390 | 0.306 | 0.233 |
| Convictions..... | 1.203 | 0.901 | 0.699 | 0.623 |

lation between self rating and accident record appears to indicate that accident involvement did not markedly affect a person's self-perception.

The percentage distribution of drinking rating is presented in Table 71. Hardly anybody admitted drinking more than average, indicating they were "faking good," or misperceiving themselves. The driver record by drinking rating is presented in Table 72. The more a person drank alcoholic beverages, the worse was his driver record. The greater the number of cigarettes smoked, the worse the driver record, as seen in Table 73.

TABLE 71
Percentage Distribution of Drinking Rating by Sex

| Drinking rating | Sex | |
|---|---|---|
| | Male | Female |
| Never drinks | 25.52 | 33.41 |
| Much less average | 31.45 | 40.20 |
| Little less average | 14.58 | 12.36 |
| Average | 20.54 | 11.91 |
| Little more average | 6.46 | 2.06 |
| Much more average | 1.46 | 0.07 |
| All ratings | 100.01 | 100.01 |

$x^2 = 372.41$, 5 df, $p < .001$.

TABLE 72
Mean Accidents and Convictions by Drinking Rating

| Sex and item | Drinking rating | | | | | |
|---|---|---|---|---|---|---|
| | Never drinks | Much less average | Little less average | average | Little more average | Much more average |
| Male | | | | | | |
| Number of subjects | 1,280 | 1,577 | 731 | 1,030 | 324 | 73 |
| Accidents | 0.611 | 0.638 | 0.644 | 0.668 | 0.651 | 0.863 |
| Convictions | 2.760 | 2.889 | 3.060 | 3.158 | 3.151 | 4.000 |
| Female | | | | | | |
| Number of subjects | 1,462 | 1,759 | 541 | 521 | 90 | 3 |
| Accidents | 0.290 | 0.352 | 0.338 | 0.399 | 0.444 | 0.333 |
| Convictions | 0.673 | 0.797 | 0.791 | 0.976 | 1.300 | 2.333 |

TABLE 73
Mean Accidents and Convictions by Number of Cigarettes Smoked and Sex

| Sex and item | Number of cigarettes smoked | | | | |
|---|---|---|---|---|---|
| | 0 | 1-9 | 10-19 | 20-24 | 25+ |
| Male | | | | | |
| Number of subjects | 2,841 | 423 | 653 | 744 | 360 |
| Accidents | 0.564 | 0.714 | 0.730 | 0.735 | 0.836 |
| Convictions | 2.405 | 3.567 | 3.703 | 3.595 | 4.100 |
| Female | | | | | |
| Number of subjects | 2,850 | 430 | 490 | 474 | 141 |
| Accidents | 0.292 | 0.358 | 0.416 | 0.476 | 0.475 |
| Convictions | 0.651 | 0.870 | 1.080 | 1.073 | 1.333 |

The more full-time jobs a subject held during the past year, the worse his driving record, as seen in Table 74.

TABLE 74
Mean Accidents and Convictions by Number of Jobs Held in the Past Year and by Sex

| Sex and item | Number of jobs | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3+ |
| Male | | | | |
| Number of subjects | 950 | 3,077 | 730 | 224 |
| Accidents | 0.546 | 0.634 | 0.758 | 0.799 |
| Convictions | 2.104 | 2.842 | 3.971 | 5.040 |
| Female | | | | |
| Number of subjects | 1,516 | 2,317 | 425 | 91 |
| Accidents | 0.285 | 0.357 | 0.383 | 0.571 |
| Convictions | 0.626 | 0.834 | 1.007 | 1.308 |

The earlier a person had his own car, the worse his driving record. This obviously reflected exposure differences. On the other hand, a teenager may be less careful when driving his own car than when driving his parents'. The number of hours driven in the past week was positively correlated with higher accident and conviction rates for both sexes. The percentage of

driving done on a motorcycle was associated with higher conviction rates for both sexes. Service in the armed forces was associated with better driver record for males, probably reflecting lower exposure. For subjects on whom we had school data, failure to respond to the mail questionnaire was correlated with higher conviction rates for both sexes. The higher a male's parents' occupational socio-economic status, the better his accident and conviction record. Failure to obtain school data on subjects was associated with higher accident rates for females and higher conviction rates for both sexes. The longer the length of the license gap, the better the conviction rate for females, and the better the accident rate for both sexes.

Failure to respond to the mail questionnaire was related to higher conviction rates for both sexes.

Single marital status at the time of license renewal was associated with a better driving record for males and a worse driving record for females.

The equations for predicting driver record during the first four years of driving from biographical data are presented in Table 75. As can be seen, the multiple correlation coefficients (R) for predicting accidents were all quite low. The largest multiple correlations were for total four year accidents -- 0.25 for males and 0.23 for females. Thus, even though the majority of biographical variables had significant correlations with the criterion, the overall magnitude of the relationship between biographical data and accident record was small. It should be recalled that the simple zero order correlation coefficient between citizenship grade and four year accidents was -0.15 for males and -0.12 for females.

That the accident sub-types -- fatal and injury, property damage, single vehicle, partly-at-fault, and drunk driving -- had lower R's than total accidents would be expected on purely statistical grounds, since they necessarily had lower means than total accidents, and consequently were less reliable and more nearly Poisson distributed.

That (direct) accident cost did not have a higher R than total accidents may surprise some. The means of determining cost in this report, namely giving the average cost to each accident by type, was admittedly crude, and cannot be considered a conclusive determination of the relative merits of the two variables as criterion measures. Accident cost had correlations with accidents 1-4 of 0.70 for males and 0.72 for females. The regression equations and the multiple correlation coefficients were similar for the two variables.

Similar comments may be made about accident rate as a predictor, since accident rate correlated 0.98 with accidents 1-4 for both sexes. This high correlation was due to the low correlation of 0.08 for males and 0.09 for

TABLE 75

Multiple Regression Equations (Beta Coefficients) for Predicting Four Year Driver Record From Biographical Data

| Variable | Beta coefficients | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 1 | | Accidents 1-4 | | Fatal/ injury accidents 1-4 | | Property damage accidents 1-4 | | Single vehicle accidents 1-4 | | Partially at fault accidents 1-4 | | Accident cost 1-4 | | Accident rate 1-4 | | Drunk driving accidents 1-4 | | Convic-tions 1 | | Convic-tions 1-4 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Fresno county | -04 | | -04 | | | | | | | | | | -04 | | -08 | | | | | 07 | | |
| Sonoma county | | | | | | | | | 04 | 04 | | | | | | | | | | | | |
| Sacramento county | | | | | | | | | | | | | | | | | | | -09 | | | |
| Stanislaus county | | | | | | | | | | | | | | | | | 04 | | | | | |
| Los Angeles county | | 04 | | | | | | | | | | | | | | | | | 07 | 13 | 34 | 11 |
| Height | | | | | | | | | | | | | | | | | | | | | -03 | |
| Drive test score | | | -04 | | | | | | -04 | | | | | | -03 | | | | | | | |
| Age licensed | | | 05 | | 03 | | 05 | | | | | | 05 | | -04 | | | | 04 | 06 | | -04 |
| Length instr permit | | | | 05 | | | | 04 | | | | | | | | 05 | | | | | -26 | |
| Traffic density | | | | | | | | | | | | | | | | | | | -04 | | -04 | |
| Birth location | | | -05 | | | | | | | | | | -04 | | | | | | | 04 | | |
| Home status | | | | | | | | | | | -04 | | | 04 | | | -05 | | -11 | | -06 | |
| Year left school | | | | | | | | | | | | | | | | | | | | | | -03 |
| Transfer | | | | -05 | | | | -06 | 04 | | | | | | | -07 | | | | | | |
| Dropout | | | 07 | 05 | | | 07 | | | | | | | 04 | 04 | 07 | | | | | | 10 |
| College transcript | | | | | | | | | | | | | | | -05 | | | | -03 | | -05 | |
| Grade point average | | | | | | | | | | | | | | | | | | | | | | |
| GPA trend | | | | | | | | | | | | | | | | | | | | | | |
| Citizenship grade | -10 | -12 | -10 | -11 | -10 | -09 | -07 | -04 | -04 | -07 | -08 | -07 | -10 | -11 | -10 | -11 | | -09 | -17 | -17 | -27 | -19 |
| Absences | | | | | | 06 | | | | | | | | 05 | | | | | 08 | | | |
| Non language IQ | | | | | | | | | | | | | | | | | | | 04 | | 05 | |
| Achievement test | | 05 | | | | | | | | | | | | | | | | | | | | |
| IQ discrepancy | | | | | | | | | | | | | | | | | | | -05 | | | |
| Achievement index | | | | | | | | | | | | | | | | | | | | | | -12 |
| Rural school | | | | | | | | | | | | | | | | | | | -07 | | -11 | -06 |
| Quest response date | | | | | | | | | | | | | | | | 04 | | | | | 03 | |
| Attitude | 04 | | 04 | | | | 04 | | | | | | | | 04 | | | | 08 | 04 | 14 | 09 |
| Mileage errands | 04 | | | | | | | | | | | | | | | | | | .04 | | | 07 |
| Mileage other | | | | | | | | | | | | | | | | | | | | | | |

Note.--Decimal points omitted.

TABLE 75 (Continued)

Multiple Regression Equations (Beta Coefficients) for Predicting Four Year Driver Record From Biographical Data

| Variable | Beta coefficients | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 1 | | Accidents 1-4 | | Fatal/ injury accidents 1-4 | | Property damage accidents 1-4 | | Single vehicle accidents 1-4 | | Partially at fault accidents 1-4 | | Accident cost 1-4 | | Accident rate 1-4 | | Drunk driving accidents 1-4 | | Convic-tions 1 | | Convic-tions 1-4 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Annual mileage | | | 04 | | 04 | | | | | | 04 | | 04 | | | | | | | | 07 | |
| Total mileage | | | | | | 07 | | | | 06 | | 05 | | 07 | | | | | | 05 | 04 | 09 |
| Prior mileage | | | | | | | | | | | | -04 | | | | | | | | | | |
| Vehicle weight | | | | | | | | | | | | | | | | -05 | | | | | | |
| Vehicle year | | | 04 | 05 | | | 04 | 05 | | | | | | | | | | | | | | |
| Vehicle mileage | | | 05 | 08 | | | 06 | 06 | | | | | | | | | | | | | 06 | 07 |
| Equipped seat belts | | | 04 | | | | 04 | | | | | | | | 05 | | | | | | | |
| Wear seat belts | | | | | | | | | | | -04 | | | | | | | | | | | -04 |
| Married | | | | -06 | | -04 | | -05 | | | | | | -06 | | -07 | | | 07 | | | |
| Number of brothers | | | | | | | | -05 | | | | | | | | | | | | | | |
| Parents alive | | | | | | | | | | | | | | | | | -03 | | 04 | | | |
| Parents married | | | -06 | | -04 | | | | | | | | -06 | | -04 | | | | -07 | | -06 | -04 |
| Student | | | -12 | | -10 | | -07 | | -09 | | | | -11 | | -13 | | | | -09 | | -14 | |
| Housewife | | | | | | | | | | | | | | | | | | | | | -03 | |
| Grade completed | | | -06 | -09 | | | -05 | -06 | | | | | | -07 | | -10 | | | | | -06 | |
| Social mobility | | | | | -04 | | | | | | -04 | | | | | | | | | | | |
| Unemployed | | | | | | | | | | | | | | | 03 | | | | | | 03 | |
| Academic activities | | | | 04 | | | | | | | | | | 05 | | 05 | | | | 04 | | |
| Drinking | | | | | | | | 04 | 05 | | | | | | | | | | | | | |
| Number of cigarettes | 04 | 05 | 06 | 06 | 04 | | 04 | 05 | | | 04 | | 06 | 04 | 06 | 06 | | | | 09 | 04 | 06 |
| Number of jobs | | | | 04 | | | | 05 | | | | | | | | | | | | | 08 | 05 |
| Year own car | | -05 | | -06 | | | -04 | -05 | | | | -04 | | - | | -06 | 04 | | -13 | -08 | -06 | -03 |
| Hours driving | | | | | | | | | | | | | | 04 | | | -03 | | | | | |
| Percent motorcycle | | | | | 03 | | | | | | | | | | | | | | 05 | | 09 | |
| Armed forces service | | | -14 | | -09 | | -09 | | -08 | | | | -12 | | -13 | | | | -10 | | -24 | |
| Driver training taken | | | | | | | | | | -04 | | | | | | | | | | | | |
| Quest data missing | | | 07 | | 05 | | | | 06 | | | | 06 | | 05 | | | | 09 | | 15 | 05 |
| Single lic renewal | -05 | | | | | | | | | | | | | | | | | | | | | 06 |
| Multiple correlation (R) | 16 | 15 | 25 | 23 | 19 | 15 | 19 | 20 | 14 | 12 | 15 | 10 | 21 | 20 | 23 | 21 | 09 | 09 | 46 | 28 | 60 | 42 |

Note.--Decimal points omitted.

females between accidents 1-4 and mileage T score. It is obvious statistically that "adjusting" accidents for mileage under such circumstances can only have a negligible influence. Exposure variables were not allowed to enter the regression equations for accident rate to avoid any spurious correlation that might obtain from having mileage being represented in both the dependent variable and among the independent variables. For both sexes, the correlation coefficient between accident rate and mileage T score was not statistically significant, as should be the case when adjusting for mileage. When accidents are adjusted by dividing by raw mileage (accidents/mile), the resulting rate is overadjusted for mileage, with the result that there is a statistically significant correlation between mileage and accident rate (Burg, 1967). The statistical and practical aspects of rates merit further investigation.

The magnitude of the multiple correlation coefficients for four year convictions were much higher, and of an order of magnitude we had hoped to attain -- 0.60 for males and 0.42 for females.

Most of the biographical variables entered one or more equations. Those variables not entering any equation are not shown in the Table. Citizenship grade and number of cigarettes smoked entered most of the equations. One or another of the exposure variables entered most equations. Armed forces service was a good predictor for males. In most instances, the predictors had beta coefficients of the same sign as their simple r's.

The stepwise regression equations for accidents 1-4 are presented in Table 76 for males and Table 77 for females. The beta's tended to have the

TABLE 76

Stepwise Regression Equation for Predicting Male Accidents 1-4 Years from Biographical Data

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Citizenship grade..... | Add | 0.153 | 86.639 | -0.099 | -0.153 |
| Annual mileage..... | Add | 0.169 | 18.234 | 0.039 | 0.087 |
| Student..... | Add | 0.179 | 14.025 | -0.115 | -0.115 |
| Armed forces service..... | Add | 0.201 | 30.366 | -0.139 | -0.026 |
| Length inst permit..... | Add | 0.210 | 14.060 | 0.050 | 0.030 |
| Number of cigarettes..... | Add | 0.215 | 8.892 | 0.059 | 0.103 |
| Attitude..... | Add | 0.220 | 7.132 | 0.045 | 0.067 |
| Parents married..... | Add | 0.224 | 6.833 | -0.064 | -0.062 |
| Equipped seat belts..... | Add | 0.228 | 6.998 | 0.035 | 0.016 |
| Vehicle mileage..... | Add | 0.232 | 6.928 | 0.048 | 0.088 |
| Home status..... | Add | 0.235 | 6.027 | -0.047 | -0.006 |
| Fresno county..... | Add | 0.238 | 5.853 | -0.039 | -0.038 |
| Age licensed..... | Add | 0.241 | 5.291 | -0.038 | -0.055 |
| Quest data missing..... | Add | 0.245 | 6.024 | 0.067 | -0.006 |
| College transcript..... | Add | 0.248 | 5.928 | 0.066 | -0.032 |
| Grade completed..... | Add | 0.251 | 6.515 | -0.061 | -0.111 |
| Vehicle year..... | Add | 0.253 | 4.404 | 0.036 | 0.031 |

TABLE 77

Stepwise Regression Equation for Predicting Female Accidents 1-4 Years from Biographical Data

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Citizenship grade..... | Add | 0.123 | 47.534 | -0.108 | -0.123 |
| Vehicle mileage..... | Add | 0.156 | 29.706 | 0.075 | 0.105 |
| Traffic density..... | Add | 0.174 | 18.162 | 0.054 | 0.072 |
| Number of cigarettes..... | Add | 0.186 | 14.133 | 0.065 | 0.110 |
| Year own car..... | Add | 0.196 | 12.760 | -0.063 | -0.091 |
| Dropout..... | Add | 0.204 | 10.269 | -0.052 | -0.037 |
| Vehicle year..... | Add | 0.211 | 8.678 | 0.047 | 0.048 |
| Number of jobs..... | Add | 0.216 | 6.888 | 0.039 | 0.080 |
| Married..... | Add | 0.220 | 6.103 | -0.060 | -0.048 |
| Grade completed..... | Add | 0.225 | 6.966 | -0.088 | -0.061 |
| College transcript..... | Add | 0.229 | 6.101 | 0.053 | 0.012 |
| Academic activities..... | Add | 0.232 | 5.178 | 0.043 | -0.004 |

same sign as the simple r's and be of similar magnitude.

In the equations for accidents, several of the variables related to aspects of driving, such as mileage. One of the purposes of this study was to determine how well driving record could be predicted prior to driving. Consequently, the regression equations were rerun with all driving-related variables excluded. The multiple correlation coefficients were 0.19 for males and 0.21 for females.

The equations for accidents 1-4 were also run with only the school data allowed to enter. The resulting R's were 0.15 for males (only citizenship grade entered the equation) and 0.15 for females. The equations were also run with only the questionnaire data allowed to enter. The resulting R's were 0.23 for males and 0.20 for females. These results tend to suggest that the various school variables were measuring essentially one major factor, which was best represented by citizenship grade. The higher R's for the questionnaire data were probably due to either the more varied nature of the variables considered, or to the fact that driving related variables such as mileage were included.

The number of drunk driving violations for the first four years of driving was also predicted from biographical data. The R's were 0.11 for both sexes.

## Prediction from Both Driving Record and Biographical Data

The regression equations for predicting four year accidents from biographical data and four year concurrent conviction data are presented in Tables 78 and 79. The R's were only slightly higher than those for driver record alone.

TABLE 78
Stepwise Regression Equation for Predicting Male Accidents
1-4 Years from Biographical Data and
Concurrent Driver Record

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Convictions 1-4 yrs..... | Add | 0.289 | 327.83 | 0.359 | 0.289 |
| FTA/FTP violations 1-4 yrs..... | Add | 0.309 | 47.26 | -0.084 | 0.058 |
| Equipment violations 1-4 yrs..... | Add | 0.318 | 22.47 | -0.079 | 0.136 |
| Length license gap 1-4 yrs..... | Add | 0.325 | 19.96 | -0.074 | -0.092 |
| Right-of-way violations 1-4 yrs.. | Add | 0.332 | 18.42 | 0.077 | 0.149 |
| Student..... | Add | 0.338 | 15.64 | -0.078 | -0.115 |
| Hit/run violations 1-4 yrs..... | Add | 0.343 | 13.11 | 0.059 | 0.083 |
| Number of cigarettes..... | Add | 0.346 | 9.57 | 0.065 | 0.103 |
| Sacramento county..... | Add | 0.349 | 7.68 | 0.056 | 0.007 |
| Armed forces service..... | Add | 0.352 | 8.60 | -0.105 | -0.026 |
| Equipped seat belts..... | Add | 0.354 | 6.70 | 0.041 | 0.017 |
| Misc non-moving viol 1-4 yrs..... | Add | 0.356 | 5.75 | -0.066 | 0.116 |
| Parents married..... | Add | 0.358 | 5.73 | -0.061 | -0.062 |
| Home status..... | Add | 0.360 | 6.39 | -0.046 | -0.006 |
| Questionnaire data missing..... | Add | 0.362 | 5.26 | 0.075 | -0.006 |
| Length instruction permit..... | Add | 0.364 | 5.78 | 0.041 | 0.030 |
| Lane violations 1-4 yrs..... | Add | 0.366 | 5.50 | 0.041 | 0.138 |
| Grade completed..... | Add | 0.367 | 4.19 | -0.086 | -0.111 |
| College transcript..... | Add | 0.370 | 8.00 | 0.055 | -0.032 |
| Intramural activities..... | Add | 0.371 | 4.05 | 0.032 | 0.009 |
| Sonoma county..... | Add | 0.372 | 4.02 | 0.032 | 0.017 |
| Absences..... | Add | 0.374 | 3.97 | -0.037 | 0.077 |

TABLE 79
Stepwise Regression Equation for Predicting Female Accidents
1-4 Years from Biographical Data and
Concurrent Driver Record

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Convictions 1-4 yrs..... | Add | 0.258 | 221.25 | 0.255 | 0.258 |
| Misc non-moving viol 1-4 yrs..... | Add | 0.274 | 29.05 | -0.067 | 0.043 |
| Number of cigarettes..... | Add | 0.283 | 16.92 | 0.058 | 0.110 |
| Equipment violations 1-4 yrs..... | Add | 0.291 | 14.61 | -0.061 | 0.035 |
| Year own car..... | Add | 0.297 | 12.22 | -0.057 | -0.091 |
| Right-of-way viols 1-4 yrs..... | Add | 0.302 | 9.59 | 0.060 | 0.144 |
| Following violations 1-4 yrs..... | Add | 0.306 | 8.81 | 0.052 | 0.110 |
| Length license gap 1-4 yrs..... | Add | 0.310 | 7.67 | -0.047 | -0.063 |
| Citizenship grade..... | Add | 0.313 | 7.55 | -0.056 | -0.123 |
| Dropout..... | Add | 0.317 | 8.88 | -0.045 | -0.037 |
| Fresno county..... | Add | 0.320 | 5.99 | -0.041 | -0.045 |
| Vehicle year..... | Add | 0.322 | 4.55 | 0.036 | 0.048 |
| Number of jobs..... | Add | 0.324 | 4.37 | 0.036 | 0.080 |

The equations for predicting third and fourth year driver record from biographical data and prior driver record are presented in Table 80.

TABLE 80
Multiple Regression Equations (Beta Coefficients) for Predicting Third and Fourth Year Driver Record From the First Two Year Driver Record and Biographical Data

| Variable | Beta coefficients | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 3-4 | | Fatal/ injury accidents 3-4 | | Property damage accidents 3-4 | | Single vehicle accidents 3-4 | | Partially at fault accidents 3-4 | | Accident cost 3-4 | | Accident rate 3-4 | | Drunk driving accidents 3-4 | | Convictions 3-4 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Fresno county | | | | | | | | | | | | | -04 | | | | | |
| Sonoma county | | | | | | | 03 | | | | | | | | | | | |
| Los Angeles county | | | | | | | | | | | | | | | | | 14 | 17 |
| Age licensed | -04 | | | | -04 | | | | | | | | | | | | -04 | |
| Traffic density | | | | | | | | | | | | | | | | | -09 | -10 |
| Home status | -04 | | | | | | | | | | | | | | | | | -04 |
| Year left school | | | | | | | | | | | | | | | | | -05 | |
| Dropout | | -07 | | -05 | | | | | | | | -06 | | -06 | -04 | | | |
| College transcript | 06 | | | | | | | | | | | | 07 | | | | | 06 |
| GPA trend | | | | | | | | | | | | | -04 | | | | | |
| Citizenship grade | -05 | -05 | -05 | | | | | -04 | -05 | | -04 | | -06 | -04 | | -10 | -21 | -11 |
| Absences | | | | | | | | | | | | | -04 | | 06 | | | |
| Achievement index | | | | -06 | | | | | | | | -06 | | | | | | |
| Rural school | | | | | | | | | | | | | | | | | -05 | |
| Quest response date | | | | | | | | -04 | | | | | | | | | | |
| Attitude | | | | | 03 | | | | | | | | | | | | 12 | 06 |
| Mileage work | | 05 | | | | 06 | | | | | | | | | | | | |
| Mileage other | | | | | | | | | | | | | | | | | | 06 |
| Annual mileage | 04 | | | | | | | | | | | | | | | | 07 | |
| Total mileage | | 04 | | 05 | | | | 05 | | 05 | | 06 | | | | | | |
| Vehicle weight | | -04 | | | | | | | | | | -04 | | -04 | | | | |
| Vehicle year | 04 | | | | 04 | | | | | | | | 04 | | | | | 03 |
| Vehicle mileage | | | | | 05 | | | | | | | | | | | | 05 | 08 |
| Married | | -10 | | -07 | | -06 | | | | | | -09 | | -10 | | | | |
| Divorced/separated | | | | | | | | | | 04 | | | | | | | | |
| Number of children | -04 | | | | -05 | | | | | | | | -05 | | | | -06 | |
| Number of brothers | | | | | | -04 | | | | | -04 | | | | | | | |
| Parents alive | | | | | | | -04 | | -04 | | | | | | | | | |
| Parents married | -07 | | -04 | | | | | | | 04 | -04 | | -05 | | | | -03 | -09 |
| Student | -09 | | | | -08 | | | | | | -06 | | -10 | | | | 10 | -05 |
| Housewife | | | | | | | | | | | | | | | | | | -06 |
| Grade completed | -05 | -07 | | -06 | | | | | | | | -07 | -06 | -06 | | | | -08 |
| Occupational goal | | -05 | | | | -05 | | | | | | | | -04 | | | | |
| Unemployed | 04 | | | | | | | | | | | | 03 | | | | 04 | |
| Academic activities | | 05 | | | | | | | | | | | | 04 | | | 04 | |
| Intramural activities | | | | 04 | | | | | | | | | | | | | | |
| Varsity letters | | | | | | 04 | | | | | | | | | | | | |
| Drinking | | | | | | | 03 | | | | | | | | | | | 04 |
| Number of cigarettes | | | | | | | | | | | 04 | | | | | | | |
| Number of jobs | | | 04 | | | 05 | 04 | | | | | | | 04 | | | 09 | |
| Year own car | | | | | | | | | | | | | | | 04 | | | |
| Percent motorcycle | | | 04 | | | | | | | | | | | | | | 07 | |
| Armed forces service | -14 | | -04 | | -10 | | -04 | | | | -10 | | -18 | | | | -18 | |
| Sign violation 1-2 yrs | | | | | | 04 | | | | | | | | | | | | -05 |
| Following viol 1-2 yrs | | | | 05 | | | | | | 05 | | 04 | | | | | | |
| Right-of-way viol 1-2 yrs | | | | | | | 04 | | | | | | | | | | | -06 |
| Speeding viol 1-2 yrs | | | | | 04 | | | | | | | | | | | | 05 | |
| Drunk driv viol 1-2 yrs | | | | | | | | | | | | | | | 10 | | | |
| Reckless dr viol 1-2 yrs | | | | | | | | | | 06 | | | | | | | 03 | |
| Driv w susp viol 1-2 yrs | 04 | | | | | | | | | | | | | | | | | |
| FTA/FTP viol 1-2 yrs | -04 | | -04 | | | | | | | | -05 | | -05 | | | | | -04 |
| Equipment viol 1-2 yrs | | | | | | | | | | | | | | | | | | 06 |
| Misc non-mov viol 1-2 yrs | | | | | | | | | | | | | | | | | 07 | |
| Convictions 6 mos pr | | | | | | | | 05 | | | | | | | | | | |
| Convictions 1-2 yrs | 08 | 04 | 07 | | | | 04 | | 05 | | 07 | | 07 | 04 | | -04 | 13 | 21 |
| Accidents 6 mos pr | | | | | | | | | | | | | | | | | 03 | |
| Fatal/injury acc 1-2 yrs | -04 | | | | | | | -12 | | | | | -06 | | | | | |
| Property acc 1-2 yrs | | | | | | | | | 04 | | | | | | | 04 | 05 | |
| Single veh acc 1-2 yrs | | | | -05 | | | | | | -05 | | -05 | | -06 | | | | |
| Accident cost 1-2 yrs | | | | 08 | | | | 16 | | 07 | | 08 | | 08 | | | | |
| Length license gap 1-4 yrs | -11 | -07 | -07 | | -08 | -06 | | | -04 | | -09 | -04 | -07 | | | | -13 | -11 |
| Quest data missing | 06 | | | | | | | | | | 04 | | 11 | | | | 08 | 04 |
| Single lic renewal | | | | | | | | | | | | | | | | | | 10 |
| Multiple correlation (R) | 22 | 19 | 15 | 15 | 17 | 15 | 10 | 12 | 12 | 13 | 17 | 17 | 21 | 17 | 12 | 10 | 54 | 39 |

Note.--Decimal points omitted.

The R's were generally lower than those for predicting four year driver record from biographical data, but were higher than those for prior driver record alone. The stepwise regression equations for predicting third and fourth year accidents are presented in Tables 81 and 82. A summary of the

TABLE 81
Stepwise Regression Equation for Predicting Male Accidents 3-4 Years from Biographical Data and Prior Driver Record

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Length lic gap 1-4 yrs... | Add | 0.109 | 43.49 | -0.111 | -0.110 |
| Convictions 1-2 ..... | Add | 0.141 | 29.39 | 0.076 | 0.064 |
| Armed forces service..... | Add | 0.154 | 13.91 | -0.143 | -0.072 |
| Student..... | Add | 0.168 | 16.53 | -0.090 | -0.040 |
| Age licensed..... | Add | 0.176 | 10.68 | -0.042 | -0.062 |
| Citizenship grade..... | Add | 0.182 | 8.40 | -0.047 | -0.068 |
| Parents married..... | Add | 0.188 | 7.54 | -0.067 | -0.051 |
| Annual mileage..... | Add | 0.193 | 7.43 | 0.042 | 0.061 |
| Number of children..... | Add | 0.197 | 5.38 | -0.044 | -0.005 |
| FTA/FTP 1-2 yrs..... | Add | 0.200 | 4.79 | -0.042 | -0.011 |
| Unemployed..... | Add | 0.203 | 4.93 | 0.035 | 0.041 |
| Vehicle year..... | Add | 0.206 | 4.85 | 0.037 | 0.034 |
| Fat/inj acc 1-2 yrs..... | Add | 0.209 | 4.32 | -0.036 | -0.009 |
| Quest data missing..... | Add | 0.212 | 4.39 | 0.063 | -0.035 |
| College transcript..... | Add | 0.215 | 4.74 | 0.056 | 0.020 |
| Home status..... | Add | 0.217 | 4.10 | -0.038 | -0.014 |
| Driving w susp 1-2 yrs... | Add | 0.220 | 4.06 | -0.036 | -0.00[illegible] |
| Grade completed..... | Add | 0.222 | 4.18 | -0.048 | -0.039 |

TABLE 82
Stepwise Regression Equation for Predicting Female Accidents 3-4 Years From Biographical Data and Prior Driver Record

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Total mileage..... | Add | 0.081 | 20.43 | 0.044 | 0.081 |
| Married..... | Add | 0.113 | 19.75 | -0.101 | -0.078 |
| Length lic gap 1-4 yrs... | Add | 0.131 | 13.54 | -0.069 | -0.073 |
| Grade completed..... | Add | 0.146 | 13.28 | -0.074 | -0.024 |
| Dropout..... | Add | 0.157 | 10.06 | -0.065 | -0.058 |
| Convictions 1-2 yrs..... | Add | 0.165 | 8.77 | 0.043 | 0.063 |
| Mileage work..... | Add | 0.171 | 6.82 | 0.049 | 0.079 |
| Citizenship grade..... | Add | 0.177 | 5.71 | -0.054 | -0.050 |
| Academic activities..... | Add | 0.182 | 6.16 | 0.050 | 0.023 |
| Occupational goal..... | Add | 0.186 | 5.19 | -0.046 | -0.043 |
| Vehicle weight..... | Add | 0.190 | 4.80 | -0.039 | -0.048 |

R's obtained for predicting accidents from various sets of data is presented in Table 83.

TABLE 83

Summary of the Multiple Correlation Coefficients (R's) Obtained From Predicting Accidents and Convictions From Various Sets of Data by Sex

| Item | Accidents | | Convictions | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Predicting four year record from original license data..... | .07 | .09 | .21 | .21 |
| Predicting four year record from original license data and driver record prior to licensing..... | .09 | .09 | .29 | .22 |
| Predicting four year accidents from concurrent driver record... | .35 | .30 | -- | -- |
| Predicting four year driver record from biographical data..... | .25 | .23 | .60 | .42 |
| Predicting four year accidents from biographical data and concurrent driver record..... | .37 | .32 | -- | -- |
| Predicting third and fourth year record from prior record..... | .16 | .14 | .44 | .32 |
| Predicting third and fourth year driver record from prior driver record and biographical data.... | .22 | 19 | .54 | .39 |

## Prediction from Fatal and Injury Accident Characteristics

Characteristics of accidents are sometimes used for various purposes. For example, driver improvement analysts in the California Department of Motor Vehicles use CHP accident reports to determine responsibility for fatal accidents, and take that factor into account in determining negligent operator status. Consequently, it was decided to determine the value of fatal and injury accident characteristics for predicting future accidents and convictions. The analysis was limited to the 1489 males and the 525 females who had fatal and injury accidents.

Also, it was desired to determine various accident types, thereby replicating the work of Allen (1965), and extending it to include biographical variables. However, at the last minute, when we attempted to do this, our factor analysis computer program would not work. Consequently, some correlation and regression results are presented instead. We hope to do the factor analyses later and publish them separately.

Due to limitations of space, it was not feasible to present the entire 120 variable correlation matrix. Only the section including accidents, convictions, and fatal and injury accident characteristics is presented in Table 84. Apart from accidents and convictions, all variables were

TABLE 84
Correlation Matrix for Fatal and Injury Accident Characteristics by Sex
(Males above the diagonal, females below)

| Variable | Convictions 1-4 yrs | Accidents 1-4 yrs | Rural | Highway | Freeway | Four or more lanes | Motorcycle | Car | Truck or bus | Weekend | Injury accident | Clear weather | Daylight | Straight-level road | Pedestrian | Intersection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 yrs..... | - | 23 | -00 | -02 | -01 | 04 | 03 | -02 | -00 | 07 | 06 | 07 | -09 | 00 | 02 | -05 |
| Accidents 1-4 yrs..... | 30 | - | 02 | 02 | 02 | 04 | -06 | -03 | 05 | 04 | -01 | -03 | 03 | 03 | 03 | -02 |
| Rural..... | 03 | 04 | - | 92 | 00 | -25 | -01 | -11 | 06 | 04 | -05 | -11 | -09 | -22 | -10 | -18 |
| Highway..... | 02 | 06 | 89 | - | 13 | -22 | -04 | -10 | 07 | 03 | -04 | -12 | -10 | -25 | -10 | -24 |
| Freeway..... | 02 | 06 | -09 | 10 | - | 30 | -08 | -02 | 04 | 02 | -03 | -03 | -09 | -08 | -06 | -11 |
| Four or more lanes..... | 10 | 07 | -29 | -21 | 25 | - | -02 | 09 | -04 | 00 | 01 | 06 | -04 | 13 | 04 | 01 |
| Motorcycle..... | 04 | 07 | -01 | -02 | -05 | -01 | - | -32 | -09 | -08 | 02 | 07 | 11 | 00 | -05 | 11 |
| Car..... | -00 | -07 | -01 | -01 | -02 | 02 | -36 | - | -36 | 06 | 08 | -07 | -04 | 11 | -02 | 12 |
| Truck or bus..... | 01 | 00 | 08 | 03 | 02 | -01 | -03 | -23 | - | -05 | -07 | 00 | 06 | 04 | -05 | 00 |
| Weekend..... | 06 | 05 | 05 | 08 | 09 | 04 | -01 | -01 | -09 | - | -02 | -02 | -22 | -03 | -03 | -11 |
| Injury accident..... | 01 | 02 | -01 | -01 | 03 | 04 | 02 | -02 | 04 | -06 | - | -02 | 05 | 00 | -18 | 03 |
| Clear weather..... | 02 | 06 | -17 | -17 | -00 | 00 | 07 | -03 | -04 | -04 | -01 | - | 06 | 05 | 05 | -00 |
| Daylight..... | 01 | 03 | -03 | -04 | -11 | -05 | 04 | -00 | 03 | -14 | 03 | -10 | - | 06 | 02 | 16 |
| Straight-level road..... | -03 | 03 | -18 | -20 | -10 | 15 | -05 | 15 | -02 | 02 | 05 | 04 | 03 | - | 05 | 25 |
| Pedestrian..... | -04 | -09 | 02 | 02 | -05 | -06 | -03 | -16 | 01 | -03 | -38 | 07 | 02 | 08 | - | -14 |
| Intersection..... | -04 | -06 | -10 | -15 | -22 | -03 | 08 | 08 | -01 | -00 | 11 | -03 | -01 | 19 | -16 | - |
| Non-intersection..... | 05 | 05 | -03 | 00 | 12 | 19 | -12 | 11 | 10 | -03 | 07 | 01 | 10 | 09 | -16 | -66 |
| Single vehicle..... | -00 | 06 | 17 | 19 | 16 | -18 | 08 | -18 | -13 | 06 | -05 | -01 | -13 | -41 | -08 | -35 |
| Speed zone 36+ ..... | 03 | 09 | 33 | 42 | 42 | -04 | -04 | -01 | 04 | 03 | -08 | -05 | -06 | -21 | -04 | -21 |
| Vehicle < 5 years old... | -00 | -00 | 02 | -02 | -05 | -04 | 07 | -04 | -01 | 03 | 04 | -06 | -04 | 02 | -03 | -03 |
| Driver violation..... | 12 | 04 | 07 | 08 | -00 | -04 | 03 | 05 | -00 | 06 | 08 | -02 | 01 | -04 | -12 | 06 |
| Physical defect..... | 02 | 12 | 07 | 11 | 29 | 11 | -02 | 01 | -03 | 10 | 01 | -00 | -11 | -02 | 10 | -09 |
| Driver drunk..... | 02 | 06 | -05 | 08 | 23 | 00 | -01 | 01 | -02 | 07 | 01 | 03 | -09 | 03 | -01 | -06 |
| Vehicle defect..... | 01 | 02 | 06 | 08 | 00 | 01 | -03 | 02 | -02 | -03 | 02 | -09 | -01 | -13 | -03 | -12 |
| Speed over 20 MPH..... | 03 | 07 | 09 | 12 | 13 | 00 | -10 | 03 | 04 | 03 | -07 | 07 | -10 | -14 | -06 | -22 |
| Speeding..... | 02 | 00 | 03 | 01 | -07 | -14 | -05 | -03 | -05 | 08 | -04 | 02 | -07 | -04 | -05 | 03 |
| Speed violation CHP..... | 13 | 05 | 17 | 20 | 04 | -11 | -03 | -01 | 00 | 02 | 01 | -03 | -00 | -13 | -09 | -21 |
| Right-way viol CHP..... | -02 | -05 | -04 | -02 | -06 | -01 | 12 | 05 | 00 | -02 | 04 | -04 | -01 | 07 | -07 | 38 |
| Following viol CHP..... | 04 | 05 | -06 | -08 | -02 | 15 | -04 | 03 | 04 | 01 | 03 | 11 | -03 | 06 | -04 | -12 |
| Passing viol CHP..... | -04 | 01 | 08 | 08 | -02 | -06 | -01 | 01 | -02 | 00 | 01 | 03 | -03 | -16 | -01 | -06 |
| Turning viol CHP..... | 02 | 03 | -01 | -01 | 07 | 03 | 11 | 02 | -01 | 01 | 02 | 01 | 10 | 02 | -03 | 03 |
| Sign violation CHP..... | -00 | 03 | -05 | -07 | -06 | 00 | -04 | 03 | -07 | 02 | 02 | -04 | 02 | 05 | -04 | 24 |
| Misc violation CHP..... | 03 | 00 | 00 | 00 | 05 | -03 | -04 | -03 | 01 | 10 | 03 | -03 | -02 | -04 | 07 | -14 |

Note.--Correlations of $\pm$ .05 and $\pm$ .09 are statistically significant at the .05 level for males and females, respectively. Decimal points are omitted.

TABLE 84 (Continued)
Correlation Matrix for Fatal and Injury Accident Characteristics by Sex
(Males above the diagonal, females below)

| Variable | Non-intersection | Single vehicle | Speed zone 36+ | Vehicle < 5 years old | Driver violation | Physical defect | Driver drunk | Vehicle defect | Speed over 20 MPH | Speeding | Speed violation CHP | Right-way viol CHP | Following viol CHP | Passing viol CHP | Turning viol CHP | Sign violation CHP | Misc violation CHP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 yrs.... | 01 | 04 | -07 | -03 | 12 | 04 | 04 | 02 | -02 | 09 | 07 | -01 | 04 | 03 | 05 | 00 | 03 |
| Accidents 1-4 yrs..... | -00 | 01 | 03 | -01 | 06 | -01 | -04 | 01 | -03 | -03 | 04 | 00 | 01 | -01 | 02 | -03 | 04 |
| Rural..... | -02 | 26 | 48 | -03 | 09 | 09 | 09 | 11 | 11 | -05 | 12 | -03 | -12 | 11 | 03 | -01 | 04 |
| Highway..... | 04 | 26 | 55 | -04 | 08 | 10 | 10 | 09 | 12 | -05 | 13 | -08 | -12 | 11 | 05 | -01 | 04 |
| Freeway..... | 06 | 08 | 36 | 02 | 02 | 11 | 02 | 06 | 09 | -05 | 03 | -06 | 05 | .00 | 01 | -04 | 05 |
| Four or more lanes..... | 14 | -19 | -04 | 03 | -08 | 01 | -05 | -03 | -03 | -11 | -12 | 04 | 09 | -05 | 03 | 04 | -08. |
| Motorcycle..... | -05 | -03 | -10 | 27 | -07 | -06 | -05 | 03 | -07 | -07 | -10 | 02 | 02 | 04 | 02 | -03 | -00 |
| Car..... | 15 | -29 | -09 | -13 | -00 | 01 | 04 | -10 | -04 | 02 | -04 | 02 | 02 | -00 | 01 | 04 | -02 |
| Truck or bus..... | 10 | -09 | 08 | 02 | 04 | 03 | -04 | 00 | 00 | 04 | -00 | 01 | -01 | 00 | 05 | -00 | 05 |
| Weekend..... | 06 | 07 | 05 | -03 | 00 | 05 | 04 | -01 | 04 | 03 | 05 | -04 | -02 | -01 | 00 | -05 | 02 |
| Injury accident..... | 07 | -03 | -08 | 00 | -02 | -05 | -06 | -04 | -06 | -05 | -02 | 03 | 03 | 02 | -00 | -02 | -05 |
| Clear weather..... | -03 | 01 | -08 | 05 | -00 | 02 | -02 | -02 | -02 | 06 | -06 | 06 | 01 | -01 | 03 | -01 | -00 |
| Daylight..... | -05 | -12 | -10 | 08 | -02 | -09 | -11 | 01 | -12 | -04 | -04 | 06 | 04 | 02 | -01 | -01 | -08 |
| Straight-level road.... | 05 | -35 | -24 | 01 | -14 | 00 | -04 | -07 | -11 | -07 | -22 | 09 | 01 | -06 | 02 | 04 | -04 |
| Pedestrian..... | -16 | -11 | -13 | -02 | -04 | -00 | -03 | 01 | -04 | -01 | -09 | 15 | -03 | -03 | -03 | -01 | -02 |
| Intersection..... | -56 | -40 | -23 | 04 | -10 | -10 | -06 | -04 | -13 | -01 | -27 | 26 | -05 | -01 | -01 | 19 | -11 |
| Non-intersection ..... | - | -45 | -00 | -03 | -01 | -02 | -02 | -05 | -08 | -00 | 04 | -15 | 14 | 01 | 04 | -13 | 06 |
| Single vehicle..... | -35 | - | 31 | -01 | 14 | 13 | 10 | 11 | 24 | 02 | 30 | -18 | -09 | 01 | -02 | -06 | 06 |
| Speed zone 36+..... | 06 | 23 | - | -04 | 05 | 07 | 05 | 10 | 19 | -17 | 10 | -13 | -02 | 09 | 04 | -04 | 05 |
| Vehicle < 5 years old.. | 06 | -02 | -03 | - | -01 | 01 | -02 | -05 | 02 | 00 | 02 | -00 | 04 | 03 | -03 | -06 | -03 |
| Driver violation..... | -10 | 11 | 04 | 02 | - | 09 | 10 | 05 | 04 | 25 | 52 | 29 | 18 | 11 | 16 | 16 | 24 |
| Physical defect..... | -09 | 19 | 12 | -05 | 03 | - | -02 | -01 | 08 | 02 | 09 | -03 | -03 | 02 | 03 | -03 | 07 |
| Driver drunk..... | 01 | 07 | 11 | 00 | 07 | 31 | - | -03 | 06 | 09 | 07 | -04 | -03 | -02 | -02 | 03 | 15 |
| Vehicle defect..... | 02 | 15 | 00 | -05 | 02 | -02 | -01 | - | 00 | 03 | -01 | -03 | -01 | 02 | -02 | -01 | 16 |
| Speed over 20 MPH..... | 06 | 24 | 22 | 01 | -04 | 04 | 06 | 08 | - | 24 | 29 | -34 | -04 | 03 | 02 | 00 | -00 |
| Speeding..... | -07 | 07 | -09 | 07 | 21 | -03 | -02 | 00 | 21 | - | 36 | -05 | -05 | 03 | -05 | -03 | -03 |
| Speed violation CHP.... | 06 | 26 | 10 | -04 | 50 | 01 | 05 | 04 | 18 | 30 | - | -21 | -13 | -08 | -11 | -12 | -17 |
| Right-way viol CHP..... | -25 | -14 | -08 | 02 | 41 | -04 | -02 | -07 | -31 | -05 | -18 | - | -07 | -04 | -06 | -07 | -10 |
| Following viol CHP..... | 19 | -08 | -00 | 07 | 24 | -02 | -01 | -04 | 07 | -06 | -10 | -08 | - | -03 | -04 | -04 | -06 |
| Passing viol CHP..... | 01 | 07 | 03 | 00 | 07 | -01 | -00 | -01 | 06 | -02 | -03 | -02 | -01 | - | -02 | -02 | -04 |
| Turning viol CHP..... | -01 | -01 | 11 | 04 | 16 | -02 | -01 | -03 | -13 | -04 | -07 | -06 | -03 | -01 | - | -04 | -05 |
| Sign violation CHP .... | -16 | -08 | -04 | 00 | 21 | -02 | -01 | -03 | 05 | -00 | -09 | -07 | -04 | -01 | -03 | - | -05 |
| Misc violation CHP..... | 03 | 11 | -01 | -00 | 25 | 16 | 13 | 17 | 06 | 12 | -11 | -09 | -05 | -01 | -04 | -04 | - |

Note.--Correlations of ± .05 and ± .09 are statistically significant at the .05 level for males and females, respectively. Decimal points are omitted.

dichotomized and coded 0, 1, with the 1 being the code for the name of the variable, e.g., for Rural, 0 = Non-rural and 1 = Rural. The means and standard deviations are presented in Appendix A. For subjects with more than one fatal and injury accident in their first four years of driving, the earliest was used.

The manner of coding the variables is obvious in most cases from the names and from the codes shown in the tables in Chapter 3. The following should clarify any ambiguities -- Highway included county roads. Motorcycle, Car, Truck or Bus were coded as to whether or not such a vehicle was involved in the accident. The contrary of Injury Accident was Fatal Accident. Pedestrian, Intersection, Non-intersection and Single Vehicle types were mutually exclusive. The Intersection and Non-intersection referred to multiple vehicle accidents only. The CHP after the violation types was to distinguish them from violation types previously referred to.

Presented and discussed will be correlations of 0.10 or greater except for the correlations between accident characteristics and biographical data for females, where values of approximately 0.13 are required for statistical significance. Most correlations were quite low.

Driver violation and speed violation CHP were the only two variables with correlations (positive) with convictions 1-4 years over 0.10 for males. For females, only driver violation correlated over 0.10 with convictions. These correlations were obviously spuriously high, since many of those with driver violations received convictions for same. The multiple regression equations for predicting convictions 1-4 from accident characteristics are presented in Table 85. The order of the independent variables is the same as the order

TABLE 85
Regression Equations (Beta Coefficients) for Predicting Convictions 1-4 Years from Fatal and Injury Accident Characteristics by Sex

| Sex | Equation |
|---|---|
| Male | |
| | Convictions 1-4 = 0.14 Driver violation -0.08 Daylight -0.09 Speed zone 36+ +0.07 Clear weather +0.06 Injury accident -0.06 Right-of-way viol CHP +0.06 Weekend |
| Female | |
| | Convictions 1-4 = 0.14 Speed violation CHP +0.12 Four or more lanes |

of entry into the equation, as is the case for all tables presented in this format. The multiple R's were 0.21 for males and 0.17 for females.

Physical defect had a correlation of 0.12 with accidents 1-4 for females. The regression equations are presented in Table 86. The R's were

TABLE 86

Regression Equations (Beta Coefficients) for Predicting Accidents 1-4 Years from Fatal and Injury Accident Characteristics by Sex

| Sex | Equation |
|---|---|
| Male | |
| | Accidents 1-4 = 0.07 Driver violation -0.06 Motorcycle -0.06 Speeding |
| Female | |
| | Accidents 1-4 = 0.13 Physical defect -0.12 Pedestrian -0.09 Car |

0.10 for males and 0.18 for females. Since all subjects had at least one accident, namely the one under consideration here, predicting accidents 1-4 was identical to predicting the number of accidents the subjects had in addition to the one presently being considered. When accidents 1-4 was predicted from biographical data, driver record, and fatal and injury accident characteristics, no accident characteristic entered the equations.

It should be pointed out that these R's were for concurrent prediction. If the equations were used for true prediction, that is predicting accidents and convictions subsequent to the accident presently being considered the multiple R would shrink considerably. Consequently, it may be concluded that the characteristics of fatal and injury accidents are of no practical value in predicting future accidents and convictions.

Now will be discussed some of the correlations, with regression equations presented in some instances. The correlations and regressions among the accident characteristics are obviously indices of concomitant variation, rather than true prediction.

For males, having had a motorcycle involved in the accident was associated with the accident's occurring in the daytime, at an intersection where the speed limit was 35 mph or less, in a vehicle less than five years old, and involving speed violations less frequently than average. Female accidents involving a motorcycle were associated with another vehicle's being involved outside an intersection, with travelling at a speed less than 21 mph, and involving right-of-way and turning violations more frequently.

When discussing the correlations of accident characteristics with biographical variables, the correlation coefficients will be shown in parentheses after each description of the relationship.

Males involved in motorcycle accidents drove motorcycles a greater percentage of the time (0.29), and drove vehicles with less weight (-0.14).

For females, having a motorcycle involved in the accident was associated with a greater percentage of motorcycle riding (0.17), a higher non-language IQ (0.15), a higher achievement test score (0.16), wearing seat belts more frequently (0.17), and being unemployed more often (0.14). These findings are difficult to interpret.

The correlational results for single vehicle accidents reflect the findings in Chapter 3. The regression equations are presented in Table 87.

TABLE 87
Regression Equations (Beta Coefficients) for Predicting Single Vehicle Accidents from Fatal and Injury Accident Characteristics by Sex

| Sex | Equation |
|---|---|
| Male | |
| Single vehicle accidents = | -0.20 Straight-level road -0.36 Car +0.19 Speed violation CHP +0.16 Speed zone 36+ -0.23 Truck or bus -0.12 Motorcycle -0.12 Four or more lanes +0.09 Physical defect +0.09 Speed over 20 MPH +0.05 Misc violation CHP -0.08 Speeding +0.05 Driver drunk -0.05 Daylight +0.05 Clear weather -0.05 Right-of-way viol CHP |
| Female | |
| Single vehicle accidents = | -0.28 Straight-level road +0.17 Speed violation CHP +0.18 Physical defect +0.13 Speed over 20 MPH -0.18 Truck or bus -0.18 Car -0.14 Four or more lanes +0.10 Vehicle defect +0.09 Speed zone 36+ -0.08 Daylight |

The R's were 0.62 for males and 0.60 for females, indicating a moderately high degree of specificity for the circumstances surrounding single vehicle accidents.

For males, being a driver in a single vehicle accident was associated with living in a county with low traffic density (-0.13), being a dropout (0.10), and drinking more (0.09). For females, having a single vehicle accident, rather than another type, was associated with higher total mileage (0.14) and the number of jobs held in the previous year (0.13).

The regression equations are presented in Table 88. The R's were 0.25 for males and 0.26 for females.

For males, being in violation was correlated with not being on a straight level road, not involving two vehicles at an intersection, involving only a single vehicle, and being drunk. For females, driver violation was associated with less often involving a pedestrian, less often involving

TABLE 88
Regression Equations (Beta Coefficients) for Predicting Single Vehicle Accident From Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Single vehicle accident = | -0.15 Traffic density +0.09 Home status +0.10 Equipped seat belts +0.09 Drinking -0.09 Non-language IQ -0.09 Vehicle weight -0.10 Sacramento county |
| Female | |
| Single vehicle accident = | 0.18 Sonoma county +0.13 Total mileage -0.12 Social mobility |

two vehicles not at an intersection, more frequently involving a single vehicle, and with the subject being physically defective or drunk.

For males, being a driver in violation was associated with leaving high school before graduation (-0.11), and doing a lesser percentage of his driving on a motorcycle (-0.10). For females, it was associated with being a dropout (0.15).

The R's for predicting driver violation from other accident characteristics were 0.20 for males and 0.19 for females. For predicting driver violation from biographical data, the R's were 0.20 for both sexes.

For males, having a physical defect was associated with the accidents' occurring on a highway, involving a single vehicle, and not being an intersection accident. For females, it was associated with highways, four or more lanes, nighttime, pedestrian accidents, and drunk driving.

For males, having participated in academic activities in high school was the only correlate of physical defect (0.10). For females, low citizenship grades were associated with physical defect (-0.21).

For males, being a drunk driver tended to occur on highways, at night, in a single vehicle accident. Females tended to be involved in drunk driving accidents more on the freeways than elsewhere. The regression equations are presented in Table 89. The R's were 0.22 for males and 0.35 for females.

There were no biographical correlates over 0.10 for males. For females being involved in a drunk driving accident, rather than another type of accident, was correlated with being a dropout (0.14), lower grade point average (-0.15), lower citizenship grades (-0.25), and lower achievement

TABLE 89

Regression Equation (Beta Coefficients) for Predicting Drunk Driving From Fatal and Injury Accident Characteristics by Sex

| Sex | Equation |
|---|---|
| Male | |
| Drunk driving = | -0.09 Daylight +0.07 Driver violation +0.08 Highway +0.07 Speeding -0.06 Vehicle < 5 years old +0.08 Single vehicle +0.06 Car -0.05 Physical defect |
| Female | |
| Drunk driving = | 0.27 Physical defect +0.16 Freeway |

index (-0.14). The regression equations are presented in Table 90. The multiple R's were 0.18 for males and 0.25 for females.

TABLE 90

Regression Equations (Beta Coefficients) for Predicting Drunk Driving From Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Drunk driving = | 0.12 Stanislaus County Hours driving +0.09 Year own car -0.08 |
| Female | |
| Drunk driving = | -0.25 Citizenship grade |

Pedestrian accidents were more often fatal. For females fatal accidents occurred less often between two vehicles at intersections. For females, being involved in a fatal accident was associated with broken home status (-0.22), higher vehicle mileage (-0.14), and having had more jobs (-0.16). Males involved in fatal accidents participated in intramural sports in high school less (0.11).

In summary, there were only low intercorrelations among the accident characteristics, and the multiple correlations for accident characteristics were generally low. Single vehicle accidents tended to occur under fairly specific circumstances, such as on curves.

## Prediction of Miscellaneous Driving Variables

In this section shall be presented data on how well such variables as mileage, seat belt usage, and year own car may be predicted from other biographical data. Some of the percentage distributions for those variables

not previously shown will be presented.

The regression equations for Drive Test Score are presented in Table 91. Rather surprisingly, height and weight were among the best predictors.

TABLE 91
Regression Equations (Beta Coefficients) for Predicting Drive Test Score from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Drive test score = | -0.32 Height +0.17 Weight +0.07 Grade point average -0.34 Fresno county -0.66 Traffic density +0.42 Los Angeles county -0.12 Stanislaus county -0.06 Number of brothers +0.06 Intramural activities +0.06 Parents occupation -0.07 Vehicle year +0.05 Vehicle mileage +0.05 Equipped seat belts -0.05 Absences -0.04 Attitude |
| Female | |
| Drive test score = | -0.12 Height +0.09 Grade point average +0.08 Sonoma county +0.05 Stanislaus county -0.07 Attitude -0.06 Fresno county +0.06 Prior mileage -0.05 Driver train not taken |

The R's were 0.32 for males and 0.22 for females. The equations for age licensed are presented in Table 92. The R's were 0.39 for males and 0.40 for females. Year own car was the best predictor, but it was not allowed to enter the equation due to the circularity involved. The equations for length of instruction permit are presented in Table 93. The R's were 0.35 for males and 0.29 for females.

The regression equations for total mileage are presented in Table 94. The R's were 0.36 for males and 0.31 for females. The percentage distribution for wearing seat belts (for those with cars having seat belts only) is presented in Table 95. Men wore seat belts more frequently than women. The regression equations are presented in Table 96. The R's were 0.33 for males and 0.28 for females. Those with poor attitudes wore seat belts less. The percentage distribution for year own car is presented in Table 97. Males had their own car earlier than females. The regression equations are presented in Table 98. The R's were 0.37 for males and 0.27 for females. Males did 4.7 percent and females 0.6 percent of their driving on a motorcycle. The equation predicting percentage motorcycle driving are presented in Table 99. The R's were 0.11 for males and 0.16 for females. The regression equations for predicting length of license

TABLE 92

Regression Equations (Beta Coefficients) for Predicting Age Licensed from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Age licensed = | 0.14 Number of brothers +0.11 Birth location +0.12 Height -0.10 Single lic renewal +0.19 Citizenship grade -0.41 Grade point average -0.07 Student activities +0.21 Grade completed -0.07 Parents occupation +0.07 School data missing +0.06 Armed forces service -0.07 College transcript +0.06 Home status -0.05 Intramural activities +0.07 Traffic density +0.16 Achievement index -0.05 Hours driving -0.08 Student -0.05 Number of jobs +0.05 Academic activities +0.05 Dropout -0.04 Percent motorcycle -0.04 Absences -0.03 Social activities |
| Female | |
| Age licensed = | 0.11 Number of children -0.15 Student +0.32 Grade completed -0.15 Single orig license +0.10 Number of brothers +0.10 Birth location -0.10 College transcript -0.05 Student activities -0.08 Parents occupation +0.06 Traffic density +0.09 Married -0.07 Grade point average +0.07 Year left school -0.06 Social activities -0.04 Vehicle year +0.04 Home status -0.05 Prior mileage -0.05 Non-language IQ -0.04 Sonoma county +0.04 Driver training taken +0.04 Total mileage -0.04 Attitude +0.04 School data missing |

TABLE 93

Regression Equations (Beta Coefficients) for Predicting Length Instruction Permit from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Length instr permit = | 0.04 Grade completed -0.10 Weight -0.10 Number of brothers -0.05 Quest data missing +0.06 Non-language IQ +0.07 Parents married -0.08 Fresno county -0.08 Year own car +0.07 Citizenship grade -0.05 School data missing -0.05 Birth location +0.05 Single lic renewal +0.05 Parents occupation -0.05 Height +0.04 Sonoma county +0.04 Percent motorcycle +0.04 College transcript -0.04 Quest response date -0.05 Rural school +0.03 Vehicle year -0.04 Los Angeles county |
| Female | |
| Length instr permit = | 0.12 Citizenship grade -0.10 Fresno county +0.06 Single orig license +0.05 Parents married -0.07 Social mobility -0.06 Birth location -0.07 Weight -0.06 Number of brothers -0.05 Los Angeles county -0.05 Quest data missing -0.06 Number of children -0.04 Driver training taken +0.04 Sonoma county -0.03 Vehicle mileage -0.04 Quest response date -0.04 Home status |

TABLE 94

Regression Equations (Beta Coefficients) for Predicting Total Mileage from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Total mileage = | -0.12 Grade point average -0.13 Year own car +0.10 Married -0.09 Los Angeles county +0.11 Vehicle weight +0.07 Number of cigarettes +0.06 Percent motorcycle -0.07 Student +0.05 Varsity letters +0.05 Vehicle year |
| Female | |
| Total mileage = | -0.16 Year own car +0.08 Number of cigarettes -0.10 Student -0.13 Housewife -0.08 Parents married -0.08 Grade point average -0.06 Los Angeles county +0.06 Age licensed +0.06 IQ discrepancy +0.06 Drinking +0.05 Weight +0.05 Vehicle year +0.04 Transfer |

TABLE 95

Percentage Distribution of the Frequency of Wearing Seat Belts

| Wear seat belts | Male | Female |
|---|---|---|
| Never..... | 9.68 | 14.15 |
| Occasionally..... | 24.53 | 32.17 |
| Half the time..... | 13.35 | 14.62 |
| Most of the time..... | 24.24 | 19.21 |
| Always..... | 28.20 | 19.84 |
| All frequencies..... | 100.00 | 99.99 |

$x^2 = 131.70$, 4 df, $p < .001$.

TABLE 96

Regression Equations (Beta Coefficients) for Predicting Wear Seat Belts from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| Wear seat belts = | -0.14 Attitude -0.09 Number of cigarettes +0.09 Academic activities -0.05 Married -0.10 Drinking +0.16 Armed forces service +0.06 Parents occupation -0.08 Non-varsity letters -0.06 Vehicle year +0.09 Student -0.08 Quest data missing +0.05 Mileage work -0.05 Quest response date -0.05 Stanislaus county +0.05 Student activities +0.04 Rural school -0.05 Number of brothers -0.04 College transcript +0.04 Year own car |
| Female | |
| Wear seat belts = | -0.09 Attitude +0.08 Citizenship grade +0.07 Traffic density +0.07 Height -0.07 Number of cigarettes +0.09 Student +0.06 Parents occupation -0.06 School data missing +0.04 Intramural activities +0.04 Unemployed +0.04 Drive test score -0.07 Number of children +0.04 Age licensed -0.06 Vehicle mileage +0.05 Annual mileage +0.05 Housewife |

TABLE 97

Percentage Distribution of Year Own Car

| Year | Male | Female |
|---|---|---|
| Sophomore..... | 12.55 | 4.55 |
| Junior..... | 27.32 | 18.49 |
| Senior..... | 21.56 | 19.64 |
| After high school..... | 38.57 | 57.33 |
| All years..... | 100.00 | 100.01 |

$x^2 = 423.78$, 3 df, $p < .001$.

TABLE 98

Regression Equations (Beta Coefficients) for Predicting Year Own Car from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| | Year own car = -0.18 Absences -0.10 Total mileage +0.10 Citizenship grade -0.16 Year left school -0.06 Prior mileage +0.05 Occupational goal -0.05 Student activities +0.08 Vehicle year +0.07 Number of brothers -0.05 Home status -0.05 Social activities +0.04 Wear seat belts -0.04 Single orig license -0.04 Transfer +0.05 Non-language IQ +0.05 Quest data missing -0.05 Annual mileage +0.04 Height -0.03 Drinking -0.03 Equipped seat belts -0.03 Percent motorcycle +0.05 College transcript +0.05 Traffic density |
| Female | |
| | Year own car = -0.11 Total mileage -0.14 Absences -0.07 Single orig license -0.06 Hours driving -0.06 Student activities +0.06 Driver training taken +0.06 Vehicle year -0.05 Mileage other +0.05 Number of brothers -0.04 Prior mileage +0.04 Quest response date -0.04 Intramural activities |

TABLE 99

Regression Equations (Beta Coefficients) for Predicting Percent Motorcycle from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| | Percent motorcycle = 0.05 Prior mileage +0.05 Length instr permit +0.04 Mileage other +0.04 Traffic density -0.05 Citizenship grade -0.04 Number of children |
| Female | |
| | Percent motorcycle = 0.15 Mileage errands +0.04 Number of cigarettes +0.19 Mileage other +0.04 Height -0.07 Citizenship grade +0.05 Non-language IQ -0.04 Absences -0.30 Annual mileage +0.16 Mileage work +0.04 Number of jobs |

gap are presented in Table 100. The R's were 0.33 for both sexes.

TABLE 100

Regression Equations (Beta Coefficients) for Predicting License Gap 1-4 from Biographical Data by Sex

| Sex | Equation |
|---|---|
| Male | |
| | License gap 1-4 = -0.10 Length instr permit +0.06 Armed forces service +0.17 Transfer +0.14 Dropout +0.08 Age licensed +0.07 Birth location +0.07 Single lic renewal +0.05 Home status. +0.04 Number of cigarettes -0.05 Hours driving -0.05 Achievement index +0.04 Student activities |
| Female | |
| | License gap 1-4 = 0.09 Age licensed +0.17 Transfer +0.26 Single lic renewal +0.16 Married +0.08 Number of children +0.10 Dropout -0.07 Parents married -0.07 Vehicle mileage +0.05 Birth location -0.05 Citizenship grade +0.04 Number of brothers |

In summary, miscellaneous driving variables were predictable to only a low degree from other biographical variables.

# CHAPTER 5
# EVALUATION OF DRIVER EDUCATION AND TRAINING

In this chapter will be presented miscellaneous results relating to driver training and driver education, an evaluation of the effectiveness of classroom driver education, an evaluation of behind-the-wheel driver training, and a cost-benefit analysis of both courses.

## Method

The method section will deal with the definitions of behind-the-wheel driver training status and the date completed driver training. Classroom driver education status was determined from the mail questionnaire. The driver record data for the driver education was keyed to the date licensed, as most students completed driver education prior to licensing.

One source of data on whether or not a subject took behind-the-wheel driver training was the data collected at the public high schools. Subjects were coded in three categories: (1) the school did not offer driver training, (2) the school offered driver training, but the subject did not take it or complete it, and (3) the subject took and completed the course.

The second source of data on driver training status was the mail questionnaire, which asked whether or not they had attended a school which offered on-the-road driver training, whether they had completed such a course, and the name of the school.

An edit check was made to determine the inter-consistency between the driver training status as determined from the school data and from the questionnaire data. There were 430 discrepancies between the two sets of data.

In 286 cases subjects stated on the questionnaire that they had completed driver training, but the school data indicated that they had not. These errors could be either coding errors or errors in the school records.

In 114 cases, subjects stated that they had completed driver training at a different high school than the one at which their school data was collected. The reasons for these discrepancies could have resulted from two circumstances. Those students who attended another high school prior to attending the school at which their school data was collected could have taken driver training at the first school, but the fact was not noted on the transcript to the second school, or the fact was not transferred from the transcript to the records of the second school. Secondly, those students who transferred from the high school at which the study data was collected could have taken driver training at another high school.

In 30 cases the subjects stated on the questionnaire that they had not completed a course in driver training, but the school data indicated that they had. One explanation for this was two instances in which subjects remarked on the questionnaire that they had completed <u>part</u> of the course, but not all of it.

In order to determine whether the school or the questionnaire data was the more accurate the following procedure was followed. From the group

of 286 cases, the names of two subjects were sent to each of 5 high schools where the school data was obtained, and the schools were asked to verify the driver training status of each student. One high school failed to respond to our letter. Three of the others reported that all 6 subjects had completed driver training and that their records had been in error. The other school reported that both subjects had completed driver training and their records were not in error, so that the error had been made in coding the data. The questionnaire data seemed to be more accurate than the school data, so that all discrepancies were resolved in favor of the questionnaire data.

There still remained 1,600 subjects whose school record indicated no driver training, but on whom no questionnaire data was available, so that some of these subjects were undoubtedly misclassified. Consequently, in order to improve the accuracy of the data, a post-card questionnaire (five waves) was sent to the 1,600 subjects in that category in June 1969.

The post card asked for driver training status and the month and the year they completed driver training. Of the 597 respondents, 105, or 17.6 percent, indicated that they had completed driver training. There were 555 non-respondents and 448 non-recipients. This low response rate (37 percent) reflected the fact that these questionnaires were sent only to those who failed to respond to the initial series of four questionnaires. Extrapolating the 17.6 percent taking driver training to the remaining 1,003 non-respondents and non-recipients yields an estimate of 176 subjects who remained incorrectly classified as not having taken driver training, when they in fact did. Calculations were made to determine what effects such a misclassification would have on the accident means in the first year after completing driver training. The effect would be less than one unit in the third decimal place (within rounding error) for either sex, so that the effect was negligible and the error introduced may be disregarded.

In the event of a conflict between the school and questionnaire data as to whether a subject should be classified as not having taken driver training or not having been offered driver training, the subject was classified as not having taken driver training, as a comparison of the school and questionnaire data indicated that this was more accurate.

Those 60-70 subjects who did not take driver training and who failed to complete the 9th grade were excluded from the analysis on the basis that they had not had a reasonable opportunity to take driver training. In retrospect, this exclusion appears debatable.

Also excluded from the analysis were those 198 subjects who: (1) transferred out of the high schools where data was collected before taking driver training, and (2) failed to respond to any mail questionnaire. These subjects were excluded since it was not feasible to determine whether they took driver training at the high school they transferred to, so that they could not be accurately classified.

The above exclusions were not considered too serious due to the small numbers involved. A more serious limitation was the exclusion of all those 13 percent of the total sample for whom we had neither school data nor questionnaire data, since their driver training status was unknown. Included in this group would be questionnaire non-respondents and non-recipients who either: (1) attended non-public high schools, (2) did not attend high school at all, or (3) attended public high schools outside the districts sampled. This limitation will be discussed further later.

The classification of driver training status may be summarized as follows:

(1) Driver training taken
  (a) School or questionnaire data indicated taken
(2) Driver training not taken
  (a) Not in previous classification (1)
  (b) School or questionnaire data indicated not taken
(3) Driver training not offered
  (a) Not in previous classifications (1) and (2)
  (b) School or questionnaire data indicated not offered
  (c) Not in next classification (4)
(4) Excluded from analysis
  (a) Neither school nor questionnaire data was available
  (b) Did not take driver training and failed to complete the 9th grade
  (c) Transferred out of high school without completing driver training and did not respond to the mail questionnaires.

The number of subjects in each classification used in the analysis is presented in Table 101. The numbers in the all statuses category represented

TABLE 101

Distribution of Number of Subjects by Driver Training Status and Sex

(Figures in parentheses are percent of column totals)

| Driver training status | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| Not offered..... | 453 (6.59) | 441 (8.47) | 894 (7.40) |
| Not taken..... | 2,445 (35.56) | 1,907 (36.63) | 4,352 (36.02) |
| Taken..... | 3,978 (57.85) | 2,858 (54.90) | 6,836 (56.58) |
| All statuses..... | 6,876 (100.00) | 5,206 (100.00) | 12,082 (100.00) |

$x^2 = 19.715$, 2 df, $p < .001$

85 percent of the total male sample, 90 percent of the total female sample, and 87 percent of the total sample. A slightly greater percentage of males than females took driver training. An estimate of any bias introduced by lack of knowledge of driver training status may be obtained by comparing the driving records of those included and excluded from the analysis. The results are presented in Table 102. The "OL" meant the

TABLE 102

Number of Accidents and Convictions per 1,000 Drivers by Whether or Not they are Included in the Analysis of the Effectiveness of Driver Training by Sex

| Status | Sex | | | |
|---|---|---|---|---|
| | Male | | Female | |
| | Convictions 1 OL | Accidents 1 OL | Convictions 1 OL | Accidents 1 OL |
| Included in analysis..... | 585 | 151 | 152 | 93 |
| Excluded..... | 1,002 | 203 | 270 | 123 |

driver record was keyed to the date originally licensed; when the record was keyed to the date completed driver training, "DT" was substituted. The record with respect to original license was used, since the corresponding data with respect to date completed driver training was never developed for those excluded from the analysis. Those excluded from the driver training analysis had higher accident and conviction means than those included. For statistical reasons, the difference in Table 102 which was least likely to be statistically significant was that for female accidents. A t-test on this difference was highly significant ($t = 19.48$, $p < .001$); consequently, we may infer that all differences shown were statistically significant. These biases will be taken into account in the results.

With both the school and questionnaire data difficulties arose in determining the date driver training was completed.

For the school data, the month and date the course was completed was coded. It was difficult to obtain the exact date in many instances, in which case the following procedures were used. Many schools only indicated the school year in which driver training was taken, in which case the month was coded June. Other schools only indicated what semester driver training was taken, in which case the last month of the semester was coded. Courses taken in summer school were coded as September. In the few cases in which no date at all was available, the date was taken as of the end of the subject's junior year. For drop-outs and transfers, the date completed driver training was never coded as being after the date of dropping-out or transfering. It is estimated that, on the average, the date coded was approximately two to three months subsequent to the actual date completed.

The purpose of using later dates was to avoid using the driver record prior to completion of the course, since this record could not be an effect of taking the course.

The month of driver training completion was not specifically requested on the initial mail questionnaires sent to all subjects, so for those subjects who did not state the month, the month was assumed to be December, for the reasons given above. For those who did not give any date, December, 1963 was used.

On the postcard questionnaire to obtain information on the driver training status of non-respondents to the initial questionnaires, both the month and year of completion were asked.

When both school and questionnaire data as to date completed driver training were available, the earlier date was used.

When the date completed driver training was prior to the date of original licensing, the date completed driver training was set equal to the date of original licensing for the analyses shown below. The reasons for this were that, as described earlier, there were very few accidents on a subjects' records prior to licensing, and during this period most driving was probably done with a parent present, with a resulting limitation of a subject's freedom to drive as he pleased.

As will be seen, comparative analyses were also done of the accident and conviction record during the first year after licensing, irrespective of the driver training date. Analyses were also done, but are not shown, of the driving record in the first six months after completing driver training (with the original license date as the earliest date completed driver training); the differences in the driving records of the groups were similar to those in the first year after completing driver training.

Those who did not take, or were not offered, driver training had no completion date, so it was necessary to assign them a matched date, in order to permit comparison of the driving records over a comparable period of time. The matching procedure was as follows.

A computer program was written to create a tape with the following data on it: Drivers license number, day birthdate, month birthdate, year birthdate, day date licensed, month date licensed, year date licensed, best grade completed, sex, county, and date completed driver training (where applicable). Best grade completed (through the 12th grade) was defined as follows. For those for whom we had school data, and who were high school graduates or dropouts, the grade completed was taken from the school data. For the remaining subjects the questionnaire data was used.

The data was then sorted into two tapes, A and B. Tape A consisted of all subjects with the numbers 0, 2, 4, 5 and 9 in column 5 of their drivers license number; Tape B of those with 1, 3, 6, 7 and 8. These numbers were derived from a table of random numbers. Tape A was then sorted on all the variables listed above, except for date completed driver training, so that the data was in drivers license number order within day date licensed order within ... etc. ... Tape B was sorted in the same manner, except that drivers license number was sorted in reverse order, to balance

for order effects. The purpose of the sort was to provide an approximate matching on the variables sorted. Two persons with exactly the same values for all the variables would be contiguous on the tape, irrespective of their driver training status. The purpose of matching on these variables were: (1) to obtain the best possible matched date in relation to the matching variables, particularly date licensed, and (2) to reduce the possibility that the matching would be unsuccessful within any of the groups formed on the basis of these variables, in the event we wished to analyze the effects of driver training within any such group (for example, the analysis was done separately by sex). It also insured comparability of the groups with respect to the matched date coming before the original license date.

Another computer program was then written which read Tapes A and B and produced a Tape C which contained the drivers license number and the matched date driver training for those without driver training as follows. If the record read was that of a subject who had completed driver training, the program stored the date completed driver training. If the record read had another driver training status, the most recently stored completion date was assigned to the record read.

The average date completed driver training for those who took driver training was April 24, 1963, with a standard deviation of 10.9 months. The average matched date completed driver training for the other subjects was May 18, 1963, with a standard deviation of 12.2 months. Both the difference of 24 days in the average and the difference of 1.3 months in the standard deviation were statistically significant (t and F tests), although considering the fact that the unit of measurement used in matching was months, the differences were quite slight. These differences in average date were calculated prior to adjusting the date completed driver training to equal the date of original license for those completing driver training prior to licensing. Since most subjects completed driver training prior to licensing, the effect of this latter adjustment was to reduce the difference in dates between the groups considerably.

For those taking driver training, the percentage distribution of the year completed driver training (as coded without any adjustments) is shown in Table 103 in relation to the date of original licensing. Most took driver training within one year of licensing. Males were considerably more likely to take driver training after licensing than females. These results are subject to the limitations described above.

Since the coded date completed driver training was, on the average, probably later than the actual date completed driver training, the coded date may be considered an upper bound on the true date. Also, the date of original licensing may be considered a lower bound to the true date. Consequently, since the analysis for accidents and convictions used both dates, the results obtained for the two different dates bracket the results which would

TABLE 103

Percentage Distribution of Date Completed Driver Training in Relation to Date Original License for those Taking Driver Training by Sex

| Driver training was completed... | Sex | |
|---|---|---|
| | Male (N = 3,978) | Female (N = 2,858) |
| More than 2 years prior to original license..... | 1.13 | 1.78 |
| 1-2 years prior..... | 6.59 | 11.97 |
| 0-1 year prior..... | 45.02 | 53.11 |
| 1 day - 1 year after original license..... | 33.51 | 26.52 |
| 1-2 years after..... | 10.73 | 5.49 |
| More than 2 years after..... | 3.02 | 1.12 |
| Total..... | 100.00 | 99.99 |

$x^2 = 188.96$, 5 df, $p < .001$.

be obtained if the true date were known.

In summary, the matching on dates completed driver training was successful, and the analysis will adequately take into account errors in the date completed driver training, so that the results below may be considered to be without serious error or bias from this source

## Miscellaneous Results

This section will look at the number taking classroom driver education, grade in driver training, and ratings on driver education and driver training.

At the time that the subjects were attending high school, classroom driver education was a course required for graduation, and was usually taken in the 10th grade. Consequently, it was anticipated that virtually all subjects would have taken driver education, so data on driver education status was not collected at the high school. Second thoughts about this led to including a question on the mail questionnaire asking if they had completed classroom driver education. The results, cross-classified by driver training status, are presented in Table 104. The driver training not offered category had the lowest percentage taking driver education, probably reflecting the fact that many of these subjects attended non-public schools which did not offer driver education. A much higher percentage of

TABLE 104
Percentage Distribution of Driver Education Status by Driver Training Status by Sex

| Driver training status | Percentage taking driver education | |
|---|---|---|
| | Male | Female |
| Not offered | 64 | 63 |
| Not taken | 85 | 89 |
| Taken | 97 | 96 |
| All statuses | 91 | 91 |

the not taken group and almost 100 percent of the taken group took driver education. The difference between the Not Taken and Taken groups probably reflects the much higher dropout rate among the not taken group, as would be expected, since driver education was required for graduation. Among the not taken group, 17.3 percent of the males and 7.7 percent of the females were dropouts. Adding these percents to the percents taking driver education yields total percents of 102.3 and 96.7, both close to 100 percent, as would be expected.

Most schools did not give grades in behind-the-wheel driver training so that we had grades on only 525 females and 622 males. The percentage distribution of grades is shown in Table 105.

TABLE 105
Percentage Distribution of Driver Training Grade by Sex

| Grade | Sex | |
|---|---|---|
| | Male | Female |
| A | 18 | 10 |
| B | 57 | 54 |
| C | 24 | 34 |
| D | 1 | 2 |
| All grades | 100 | 100 |

$x^2 = 20.69$, 3 df, $p<.001$.

Males received higher grades than females. There were no statistically significant correlations (See Appendices B and C) between driver training grade and accident and conviction record, with the exception of a correla-

tion for females of -0.11, indicating that the higher the grade, the fewer the convictions. Due to the small samples involved, these overall negative results should not be considered conclusive. The results were in relation to the date of original license rather than the date completed driver training, as the latter results were never computed, due to an oversight.

The mail questionnaire asked for a rating of the classroom driver education. The percentage distribution is presented in Table 106. The

TABLE 106
Percentage Distribution of Driver Education Quality by Sex

| Quality | Sex | |
|---|---|---|
| | Male | Female |
| Excellent | 15 | 13 |
| Good | 41 | 42 |
| Fair | 27 | 27 |
| Not very good | 13 | 13 |
| Very poor | 5 | 5 |
| All qualities | 101 | 100 |

ratings were fairly favorable, and were similar for both sexes. The ratings were not significantly correlated with accidents and conviction record.

One question asked the subjects to evaluate the effect of driver training on the safety of their driving. These ratings, presented in Table 107,

TABLE 107
Percentage Distribution of Driver Training Safety Rating by Sex

| Rating | Sex | |
|---|---|---|
| | Male | Female |
| Much safer | 34 | 46 |
| Slightly safer | 43 | 34 |
| Little or no different | 22 | 19 |
| Less safe | 0 | 0 |
| All ratings | 99 | 99 |

$x^2 = 76.70$, 3 df, $p<.001$.

were quite favorable, with females giving better ratings. The higher the course was rated, the better was the subjects' accident and conviction record. This finding should be interpreted with caution, due to the possible circularity involved.

## Evaluation of Driver Training

This section will be divided into four sub-sections. First, the driver record of those taking driver training will be compared to that of those not taking the course. These findings should be considered tentative, subject to the findings on volunteer bias. Second, biographical differences (volunteer bias) between the groups will be analyzed. Third, the driver record differences found will be adjusted for volunteer bias. Fourth, a cost benefit analysis will be presented.

Driver record. The longitudinal trends in accidents and convictions by driver training status are presented in Table 108. It will be noted

TABLE 108

Means and Standard Deviations of Convictions and Accidents by Sex, Driver Training Status, and Year After Completing Driver Training

| Sex and driver training status | Item | Convictions | | | | | Accidents | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Year | | | | | Year | | | | |
| | | 1 | 2 | 3 | 4 | All years | 1 | 2 | 3 | 4 | All years |
| MALE | | | | | | | | | | | |
| Not offered.... | N | 453 | 451 | 425 | 349 | 349 | 453 | 451 | 425 | 349 | 349 |
| | $\bar{X}$ | 0.503 | 0.661 | 0.885 | 0.762 | 2.756 | 0.161 | 0.195 | 0.155 | 0.146 | 0.670 |
| | SD | 0.911 | 1.051 | 1.385 | 1.186 | 3.047 | 0.397 | 0.449 | 0.394 | 0.434 | 0.846 |
| Not taken..... | N | 2,445 | 2,432 | 2,274 | 1,761 | 1,761 | 2,445 | 2,432 | 2,274 | 1,761 | 1,761 |
| | $\bar{X}$ | 0.819 | 0.933 | 0.945 | 0.776 | 3.512 | 0.176 | 0.170 | 0.155 | 0.127 | 0.650 |
| | SD | 1.223 | 1.350 | 1.417 | 1.236 | 3.530 | 0.436 | 0.420 | 0.404 | 0.366 | 0.863 |
| Taken..... | N | 3,978 | 3,951 | 3,747 | 3,025 | 3,025 | 3,978 | 3,951 | 3,747 | 3,025 | 3,025 |
| | $\bar{X}$ | 0.567 | 0.778 | 0.800 | 0.599 | 2.630 | 0.151 | 0.184 | 0.165 | 0.115 | 0.599 |
| | SD | 0.955 | 1.203 | 1.210 | 0.990 | 2.767 | 0.392 | 0.431 | 0.420 | 0.345 | 0.822 |
| FEMALE | | | | | | | | | | | |
| Not offered.... | N | 441 | 440 | 433 | 390 | 390 | 441 | 440 | 433 | 390 | 390 |
| | $\bar{X}$ | 0.134 | 0.204 | 0.210 | 0.200 | 0.751 | 0.095 | 0.096 | 0.078 | 0.054 | 0.326 |
| | SD | 0.373 | 0.560 | 0.589 | 0.482 | 1.218 | 0.302 | 0.344 | 0.309 | 0.226 | 0.616 |
| Not taken..... | N | 1,907 | 1,904 | 1,845 | 1,647 | 1,647 | 1,907 | 1,904 | 1,845 | 1,647 | 1,647 |
| | $\bar{X}$ | 0.198 | 0.234 | 0.263 | 0.214 | 0.904 | 0.104 | 0.091 | 0.086 | 0.081 | 0.362 |
| | SD | 0.489 | 0.558 | 0.622 | 0.572 | 1.398 | 0.327 | 0.304 | 0.294 | 0.290 | 0.612 |
| Taken..... | N | 2,858 | 2,855 | 2,805 | 2,503 | 2,503 | 2,858 | 2,855 | 2,805 | 2,503 | 2,503 |
| | $\bar{X}$ | 0.140 | 0.185 | 0.218 | 0.207 | 0.735 | 0.085 | 0.087 | 0.083 | 0.061 | 0.314 |
| | SD | 0.397 | 0.473 | 0.544 | 0.535 | 1.146 | 0.294 | 0.299 | 0.296 | 0.254 | 0.601 |

that N decreases with increasing years. This is due to the fact that, for those subjects who completed driver training after obtaining their license, their four year subsequent driving record went past the December 31, 1967 cutoff for coding driver record data. When the full year's record was

not available for a subject for a given year, that subject was not used in the calculations for that particular year. All subjects had a complete first year of driving, and almost all a second year, with the third and fourth years showing the greatest loss of N. The trends are shown in Figures 13 and 14.

We shall look first at the two most important groups, driver training taken and driver training not taken. Statistical tests were done to determine if there were significant differences between the groups at each year, with the results shown in Table 109. For males the driver training not

TABLE 109

t Values for the Comparison of the Accident and Conviction Record of Those Taking and Not Taking Driver Training by Sex and Year After Completing Driver Training

| Item | Sex | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | All years |
| Accidents..... | M | 2.34 | -1.31 | -0.89 | 1.16 | 2.03 |
| | F | 2.09 | 0.41 | 0.40 | 2.30 | 2.50 |
| Convictions.... | M | 8.68 | 4.65 | 4.06 | 5.11 | 9.00 |
| | F | 4.32 | 3.14 | 2.52 | 0.36 | 4.08 |

Note.--t values greater than 1.96 in absolute magnitude are statistically significant at the .05 level. A positive t indicates that those not taking driver training have a higher mean than those who do take driver training.

taken group had a significantly higher accident mean in the first year after completing driver training. In the second and third years the driver training taken group had the higher means, although not significantly. In the fourth year the direction of the difference reversed, but the difference was not significant. In summary, for males, the driver training taken group had a better accident record in the first year, but there was no significant differences between the groups in the next three years.

For female accidents, the driver training taken group had a significantly lower accident mean during the first year, then had a similar rate during the second and third years, then again had a significantly lower mean during the fourth year.

Males with driver training had a uniformly superior conviction record during all four years. Females with driver training had a superior conviction record during the first three years, but there was no difference in the fourth year.

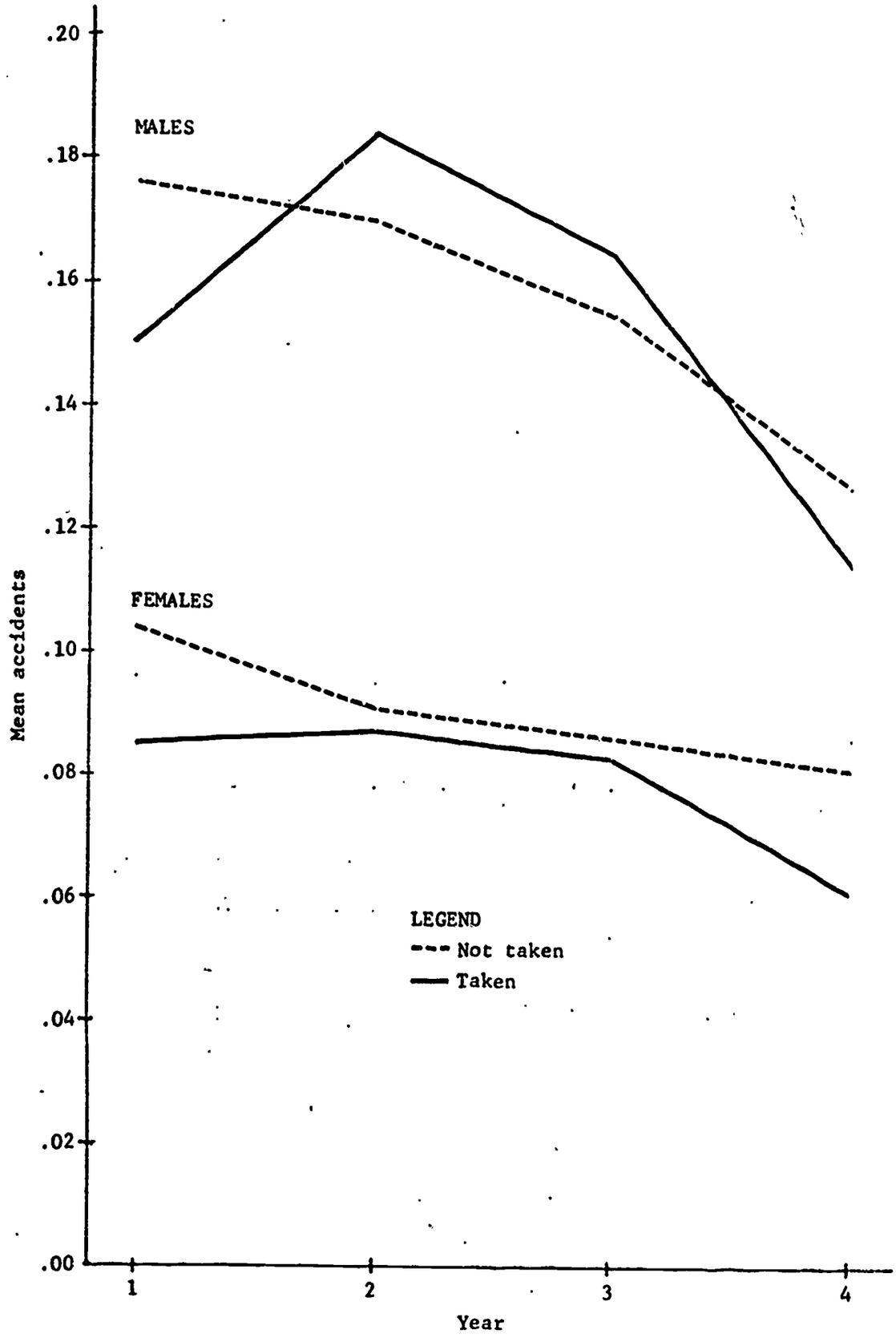



Fig. 13-Mean Accidents by Year After Completing Driver Training by Driver Training Status and Sex

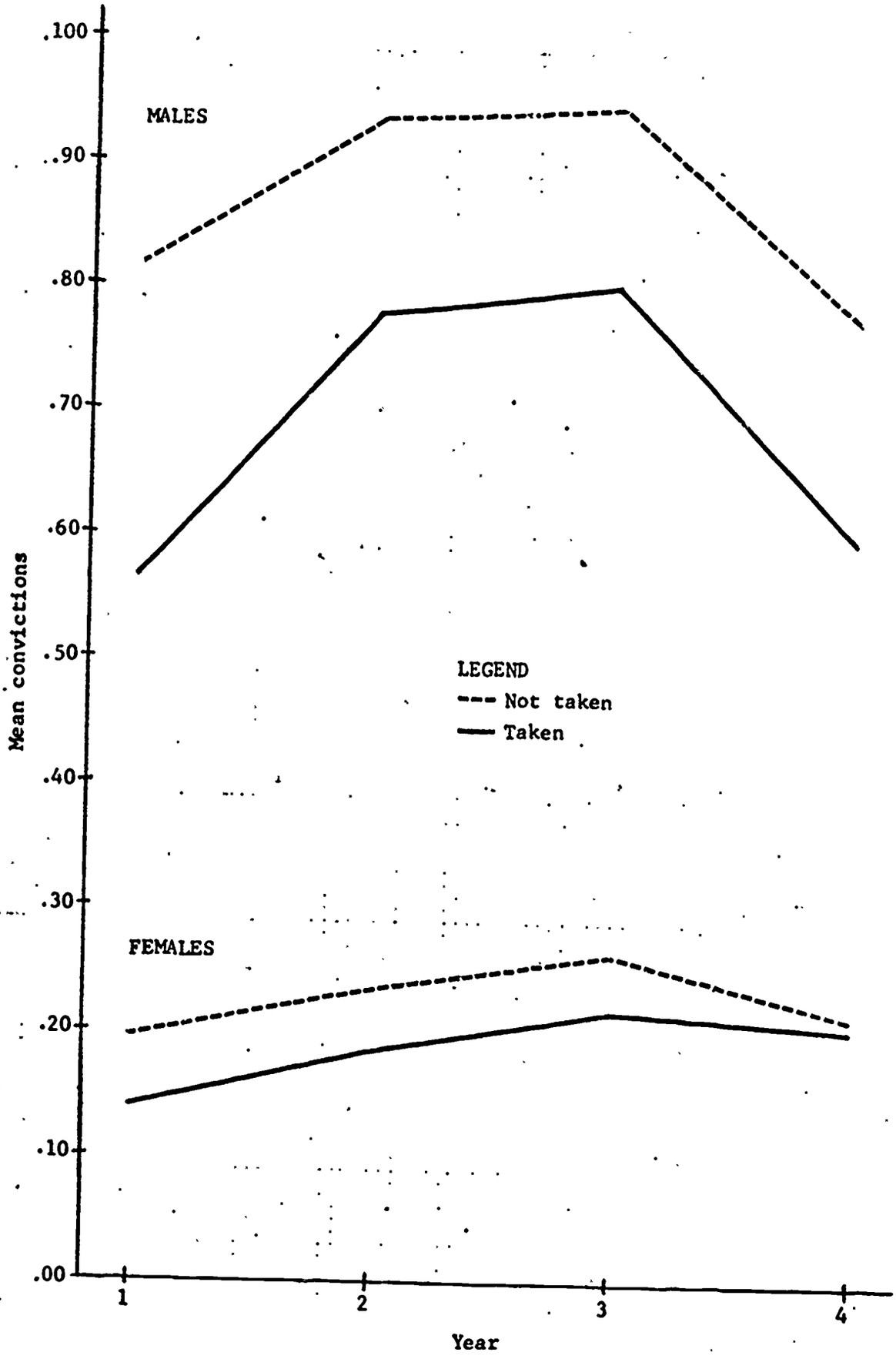



Fig. 14.-Mean Convictions by Year After Completing Driver Training by Driver Training Status and Sex

For both accidents and convictions, and for both sexes, the driver training taken group had significantly fewer accidents and convictions for the total four years combined.

The trends for the not offered group were based on a small sample and fluctuated rather erratically in relation to the other two groups' trends.

An examination of the Appendices B and C indicates the variable driver training not offered was not significantly correlated with any of the driver record variables. This means that the driving record of the not offered group was equal to the average of the other two groups. A further examination of these appendices also reveals few statistically significant correlations with biographical variables, indicating that, on the average, those not offered driver training were personally like those offered it. Two of the higher correlations point up the different characteristics of the not offered group -- they tended to either come from small, rural schools, or they tended not to take driver education, which reflected the fact that some attended private schools or did not attend high school at all. It is not particularly meaningful to discuss the driving record of such a heterogeneous group.

The not offered group was included in the analysis to permit a more precise evaluation of the role of "volunteer bias" and "selection bias" involved in taking driver training. As will be seen below, there was a moderate difference between those taking and those not taking driver training. Obviously, the not offered group were not in a position to volunteer or be selected, so excluding them from the analysis will result in greater precision. For this reason, and for the lack of differences mentioned above, the not offered group was excluded from subsequent analyses.

The first year driving record is presented in more detail in Table 110. The "No DT" group, as just mentioned, refers to those not taking driver training when it was offered to them, and does not include those not offered driver training. The coefficient r was the correlation coefficient between the variable and driver training status. Only the correlations for males convictions exceeded .10 in absolute magnitude. Driver training status was a poor predictor of accidents compared to citizenship grade and other variables. The percentage differences were calculated on the means expressed to four decimal places, with the driver training group used as a base. This explains the 7 percent difference shown for male single vehicle accidents, when the means presented are identical. Comparisons between the differences for the various items should be made in terms of the magnitudes of the correlation coefficients, since the percent difference is not a statistically valid indicator of the degree of difference.

The percent difference depends on which figure is used as the base. For male accidents, for example, if the No DT group were used as a base for the percentages, then the conclusions would be that those with driver training had 23 percent fewer accidents 1 OL and 14 percent fewer accidents 1 DT.

TABLE 110
Means and Standard Deviations of Accident Types and Convictions by Driver Training Status and Sex

| Item | Driver training status | Sex | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Male | | | | Female | | | |
| | | $\bar{X}$ | SD | Percent difference | r | $\bar{X}$ | SD | Percent difference | r |
| Accidents 1 OL..... | No DT | 0.176 | 0.430 | | | 0.108 | 0.339 | | |
| | DT | 0.135 | 0.375 | 30 | -0.050* | 0.086 | 0.295 | 26 | -0.035* |
| Accidents 1 DT..... | No DT | 0.176 | 0.436 | | | 0.104 | 0.327 | | |
| | DT | 0.151 | 0.392 | 17 | -0.030* | 0.085 | 0.294 | 23 | -0.031* |
| Accidents 6 months prior DT..... | No DT | 0.043 | 0.209 | | | 0.015 | 0.125 | | |
| | DT | 0.034 | 0.197 | 25 | -0.020 | 0.015 | 0.126 | 0 | 0.000 |
| Accident cost 1 DT (In hundreds of dollars..... | No DT | 1.791 | 6.185 | | | 1.088 | 4.718 | | |
| | DT | 1.486 | 5.652 | 21 | -0.025* | 0.722 | 3.939 | 51 | -0.042* |
| Accident rate 1 DT. | No DT | 37.862 | 87.655 | | | 22.805 | 66.701 | | |
| | DT | 31.834 | 78.960 | 19 | -0.035* | 17.901 | 57.240 | 27 | -0.039* |
| Property damage accidents 1 DT... | No DT | 0.119 | 0.355 | | | 0.070 | 0.263 | | |
| | DT | 0.107 | 0.334 | 11 | -0.017 | 0.066 | 0.259 | 5 | -0.006 |
| Fatal and injury accidents 1 DT... | No DT | 0.057 | 0.243 | | | 0.035 | 0.187 | | |
| | DT | 0.044 | 0.208 | 30 | -0.028* | 0.018 | 0.138 | 90 | -0.051* |
| Partially at fault accidents 1 DT... | No DT | 0.032 | 0.178 | | | 0.022 | 0.148 | | |
| | DT | 0.025 | 0.155 | 30 | -0.022 | 0.009 | 0.095 | 147 | -0.055* |
| Single vehicles accidents 1 DT | No DT | 0.012 | 0.106 | | | 0.010 | 0.107 | | |
| | DT | 0.012 | 0.110 | -7 | 0.004 | 0.003 | 0.059 | 200 | -0.042* |
| Convictions 1 OL... | No DT | 0.773 | 1.194 | | | 0.181 | 0.478 | | |
| | DT | 0.487 | 0.893 | 59 | -0.135* | 0.132 | 0.381 | 37 | -0.057* |
| Convictions 1 DT... | No DT | 0.819 | 1.223 | | | 0.198 | 0.489 | | |
| | DT | 0.567 | 0.955 | 44 | -0.114* | 0.140 | 0.397 | 42 | -0.065* |
| Convictions 6 months prior DT.. | No DT | 0.241 | 0.772 | | | 0.034 | 0.198 | | |
| | DT | 0.156 | 0.512 | 54 | -0.066* | 0.026 | 0.174 | 32 | -0.022 |
| Convictions 1-3 DT. | No DT | 2.700 | 2.869 | | | 0.694 | 1.111 | | |
| | DT | 2.114 | 2.389 | 28 | -0.109* | 0.543 | 0.933 | 28 | -0.073* |

*$p < .05$

Note.--Positive percent differences and negative r's indicate that those not taking driver training have a higher mean than those who take driver training.

For total accidents and convictions, the record is shown both for the year after licensing and for the year after completing driver training. The differences between the records of the female driver training groups were affected little by the date at which the record was begun. For males, however, the date used made a considerable difference. The percent difference was 17 percent for the year after completing driver training and 30 percent for the year following licensing. The true difference lies somewhere between 17 and 30 percent. The differences between the male groups on convictions were less affected by which date was used, as the trend from the first to the second year was similar for both groups (Figure 13).

Most of the differences between the groups shown in Table 110 were statistically significant in favor of the driver training group. The remaining differences were not statistically significant in favor of either group. For accidents, the highest correlations were with partially-at-fault accidents 1 DT for females, and with accidents 1 OL for males. The correlations were higher for convictions.

For males, there were no statistically significant differences between the groups for either partially-at-fault or single vehicle accidents.

The most notable failure to achieve statistical significance was for property damage accidents for both sexes, although the differences were in the expected direction. This result appears somewhat paradoxical on a priori grounds, since it might be expected that if subjects were learning something in driver training that would reduce fatal and injury accidents, it would also reduce property damage accidents. One possible, partial explanation that was considered was differential useage of seat belts. If those taking driver training used seat belts more frequently than those not taking driver training, they might have fewer fatal and injury accidents, even in the absence of any difference in total accidents. As will be seen below, males in the driver training group did have cars that were significantly more often equipped with seat belts, and did use the seat belts significantly more often than males who had not taken driver training. However, no such differences were found for females, so this factor cannot totally explain the apparent paradox. Another speculative explanation, for which only indirect evidence can be presented, is that those taking driver training were more likely to report property damage accidents than those not taking driver training. First, having taken driver training, and having a higher proportion who also took driver education, it would be expected that the driver training group would be more familiar with the legal requirements relative to reporting accidents. Secondly, as will be seen later, those taking driver training have more favorable biographical characteristics than those not taking it. These two factors together would suggest that those taking driver training might report more of their property damage accidents, so that even though they actually had fewer accidents, the

reported number would not be significantly different.

The results for the violation types are presented in Table 111. For

TABLE 111

Means and Standard Deviations of Violations in the First Year After Completing Driver Training by Type, Driver Training Status and Sex

| Type | Driver training status | Sex | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Male | | | | | Female | | | | |
| | | $\bar{X}$ | SD | Percent difference | t | p | $\bar{X}$ | SD | Percent difference | t | p |
| Sign..... | No DT | 0.125 | 0.367 | | | | 0.046 | 0.211 | | | |
| | DT | 0.092 | 0.313 | 36 | 3.74 | <.001 | 0.029 | 0.177 | 55 | 2.76 | <.001 |
| Lane placement. | No DT | 0.038 | 0.203 | | | | 0.008 | 0.097 | | | |
| | DT | 0.033 | 0.184 | 14 | 0.93 | >.500 | 0.006 | 0.077 | 42 | 0.95 | >.500 |
| Following-too-close..... | No DT | 0.011 | 0.103 | | | | 0.004 | 0.065 | | | |
| | DT | 0.008 | 0.092 | 25 | 0.83 | >.500 | 0.004 | 0.067 | -7 | 0.15 | >.500 |
| Passing..... | No DT | 0.009 | 0.097 | | | | 0.002 | 0.046 | | | |
| | DT | 0.012 | 0.113 | -20 | -0.91 | >.500 | 0.002 | 0.046 | 0 | -- | >.500 |
| Right-of-way... | No DT | 0.036 | 0.194 | | | | 0.021 | 0.147 | | | |
| | DT | 0.026 | 0.165 | 38 | 2.12 | <.050 | 0.017 | 0.130 | 23 | 0.94 | >.500 |
| Turning..... | No DT | 0.041 | 0.206 | | | | 0.013 | 0.118 | | | |
| | DT | 0.032 | 0.187 | 28 | 1.76 | >.050 | 0.012 | 0.108 | 10 | 0.36 | >.500 |
| Speed..... | No DT | 0.345 | 0.675 | | | | 0.076 | 0.293 | | | |
| | DT | 0.249 | 0.559 | 38 | 5.88 | <.001 | 0.052 | 0.240 | 46 | 2.96 | <.001 |
| Drunk driving.. | No DT | 0.001 | 0.029 | | | | 0.000 | 0.000 | | | |
| | DT | 0.002 | 0.039 | -47 | -0.83 | >.500 | 0.000 | 0.000 | 0 | -- | >.500 |
| Reckless driving.... | No DT | 0.004 | 0.064 | | | | 0.000 | 0.000 | | | |
| | DT | 0.004 | 0.063 | 2 | -- | >.500 | 0.000 | 0.019 | 0 | -- | >.500 |
| Drugs..... .... | No DT | 0.000 | 0.020 | | | | 0.000 | 0.000 | | | |
| | DT | 0.000 | 0.016 | 33 | 0.21 | >.500 | 0.000 | 0.000 | 0 | -- | >.500 |
| Driving while suspended.... | No DT | 0.012 | 0.148 | | | | 0.000 | 0.000 | | | |
| | DT | 0.002 | 0.057 | 400 | 2.94 | <.010 | 0.000 | 0.019 | 0 | -- | >.500 |
| Hit and run.... | No DT | 0.002 | 0.040 | | | | 0.001 | 0.032 | | | |
| | DT | 0.002 | 0.050 | -36 | -0.79 | >.500 | 0.001 | 0.032 | 0 | -- | >.500 |
| FTA/FTP..... | No DT | 0.055 | 0.342 | | | | 0.004 | 0.060 | | | |
| | DT | 0.016 | 0.162 | 243 | 5.30 | <.001 | 0.002 | 0.050 | 118 | 1.20 | >.500 |
| Equipment..... | No DT | 0.270 | 0.850 | | | | 0.024 | 0.216 | | | |
| | DT | 0.139 | 0.572 | 94 | 6.72 | <.001 | 0.012 | 0.138 | 110 | 2.26 | <.050 |
| Miscellaneous moving..... | No DT | 0.010 | 0.105 | | | | 0.003 | 0.056 | | | |
| | DT | 0.004 | 0.065 | 137 | 2.51 | <.050 | 0.001 | 0.032 | 210 | 1.48 | >.500 |
| Miscellaneous non-moving... | No DT | 0.143 | 0.481 | | | | 0.019 | 0.161 | | | |
| | DT | 0.079 | 0.335 | 81 | 5.76 | <.001 | 0.014 | 0.128 | 39 | 1.21 | >.500 |

Note.--A positive percent difference is the percentage by which the mean of those not taking driver training exceeds that of those taking driver training.

8 out of the 16 male types and 3 out of the female types, the differences were statistically significant in favor of those taking driver training. For the remaining types there were no statistically significant difference between the two groups. Contrary to what one might expect to be the case relative to behind-the-wheel driver training, the largest percent differences were in the non-moving violation categories (FTA/FTP, Equipment, Miscellaneous non-moving). In order to take a closer look at this, the violations were categorized by moving/non-moving status, and are presented in Table 112. The percent difference on non-moving violations between groups are

TABLE 112

Means and Standard Deviations of Moving vs. Non-Moving Violations in the First Year After Completing Driver Training by Driver Training Status and Sex

| Violation status | Driver training status | Sex | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Male | | | | | Female | | | | |
| | | $\bar{X}$ | SD | Percent difference | t | p | $\bar{X}$ | SD | Percent difference | t | p |
| Moving..... | No DT | 0.634 | 0.714 | | | | 0.175 | 0.405 | | | |
| | DT | 0.468 | 0.631 | 36 | 9.45 | <.001 | 0.126 | 0.348 | 39 | 4.32 | <.001 |
| Non-moving.. | No DT | 0.468 | 0.973 | | | | 0.047 | 0.274 | | | |
| | DT | 0.234 | 0.661 | 100 | 10.50 | <.001 | 0.027 | 0.193 | 74 | 2.77 | <.01 |

much larger for the non-moving. However, more valid indices of the relative differences are the t and p values. These values are quite close, so that it may be concluded that the differences between the driver training groups were similar for moving and non-moving violations.

It is commonly believed that there are differences in the quality of driver training programs among high schools. Consequently, the differences between the groups will be examined by school district. The present study was not designed to answer the question as to whether or not the driver record differences were actually due to differences in the quality of instruction, so the findings below should be considered suggestive rather than conclusive.

The differences between the groups among the seven largest school district are presented in Table 113. The tabulated numbers represent the differences in the means of those taking and not taking driver training. For example, if males without driver training in District A had an average of 0.100 accidents, and those with driver training had a mean of 0.078, then the tabled figure would be 0.100 - 0.078 = 0.022 = 22 per thousand. In most districts those with driver training had a superior accident record. None of the differences favoring those without training was statistically significant. We may conclude that in all districts those with driver training had a driving record equal to or superior to those

TABLE 113

Differences in Number of Accidents and Convictions per 1,000 Drivers in the First Year After Completing Driver Training Between Those Taking and Not Taking Driver Training by School District and Sex

| Item | Sex | School district | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G |
| Accidents..... | M | 22 | 76 | 19 | 51 | 32 | 118 | 11 |
| | F | 64 | 19 | -19 | 6 | -19 | 21 | 26 |
| Convictions..... | M | 600 | 293 | 346 | 206 | 145 | 208 | 285 |
| | F | -78 | 7 | 18 | 27 | 36 | 14 | 21 |

Note.--Positive differences indicate a higher mean for those not taking driver training.

without driver training. Whether or not the variations between school districts represent differences in the quality of instruction can not be determined.

In summary, the driver training group had superior driving records compared to those without the formal course. An attempt is made below to determine whether or not this was a causal relationship, or a reflection of volunteer bias.

Volunteer bias. In the previous section, considerable difference in driving record were found between those taking and those not taking driver training. In this section we shall find that there were also biographical differences between the two groups, with the driver training group having better characteristics, that is, characteristics positively correlated with better driver record.

Those biographical variables on which there were statistically significant differences between males taking and those not taking driver training are presented in Table 114. It should be emphasized that those who were not offered driver training were excluded from all analyses in this section. The r was the correlation coefficient between the variable and driver training status, so that a positive correlation indicated a higher mean for those taking driver training. There were a large number of differences, each of small magnitude. The highest correlations were -0.23 with absences and 0.23 with driver education.

As compared to those males who did not take driver training, those males who took driver training: (1) were more often from Sonoma and Stanislaus counties, and less often from Fresno, Sacramento and Los Angeles counties; (2) had a higher score on the drive test and were licensed at an earlier age; (3) held an instruction permit for a longer period of time; (4) lived in counties with lower traffic density; (5) came from a broken home less often; (6) completed more of high school; (7) were less frequently

TABLE 114

Means and Standard Deviations of Biographical Variables Which Differentiate Between Males Taking and Not Taking Drivers Training

| Variable | Driver training status | | | | r |
|---|---|---|---|---|---|
| | Driver training taken | | Driver training not taken | | |
| | $\bar{X}$ | SD | $\bar{X}$ | SD | |
| Fresno county | 0.195 | 0.396 | 0.218 | 0.413 | -0.03 |
| Sonoma county | 0.107 | 0.310 | 0.044 | 0.205 | 0.11 |
| Sacramento county | 0.224 | 0.417 | 0.295 | 0.456 | -0.08 |
| Stanislaus county | 0.132 | 0.338 | 0.056 | 0.230 | 0.12 |
| Los Angeles county | 0.343 | 0.475 | 0.387 | 0.487 | -0.04 |
| Drive test score | 83.586 | 7.844 | 82.288 | 7.763 | 0.08 |
| Age licensed | 20.542 | 25.387 | 23.159 | 27.202 | -0.05 |
| Length instruction permit | 14.750 | 9.909 | 13.506 | 10.135 | 0.06 |
| Traffic density | 117.166 | 66.978 | 127.389 | 66.032 | -0.07 |
| Home status | 1.241 | 0.568 | 1.291 | 0.622 | -0.04 |
| Year left school | 11.823 | 0.557 | 11.569 | 0.912 | 0.17 |
| Dropout | 0.056 | 0.230 | 0.173 | 0.378 | -0.19 |
| College transcript | 0.698 | 0.459 | 0.555 | 0.497 | 0.15 |
| Grade point average | 24.060 | 6.114 | 21.250 | 6.662 | 0.21 |
| Citizenship grade | 51.542 | 9.526 | 49.380 | 9.890 | 0.16 |
| Absences | 86.032 | 79.955 | 133.854 | 126.347 | -0.23 |
| Non language IQ | 105.535 | 14.444 | 101.217 | 14.811 | 0.14 |
| Achievement test | 51.541 | 9.505 | 48.509 | 9.526 | 0.15 |
| Achievement index | 23.125 | 4.904 | 21.466 | 5.404 | 0.16 |
| Rural school | 0.273 | 0.446 | 0.135 | 0.342 | 0.16 |
| Questionnaire response date | 1.533 | 1.384 | 1.828 | 1.410 | -0.10 |
| Attitude | 5.118 | 1.778 | 5.311 | 1.796 | -0.05 |
| Driver education | 0.957 | 0.156 | 0.851 | 0.356 | 0.23 |
| Driver education quality | 2.456 | 0.989 | 2.576 | 1.095 | -0.05 |
| Total mileage | 57.875 | 56.258 | 65.421 | 71.427 | -0.06 |
| Vehicle weight | 2.859 | 1.224 | 3.021 | 1.238 | -0.06 |
| Equipped seat belts | 0.717 | 0.450 | 0.660 | 0.474 | 0.06 |
| Wear seat belts | 2.448 | 1.349 | 2.205 | 1.379 | 0.08 |
| Married | 0.190 | 0.392 | 0.260 | 0.439 | -0.08 |
| Divorced/separated | 0.009 | 0.094 | 0.016 | 0.126 | -0.03 |
| Number of children | 0.105 | 0.365 | 0.175 | 0.463 | -0.08 |
| Number of brothers | 2.137 | 1.695 | 2.447 | 1.936 | -0.08 |
| Number of older sibs | 0.899 | 1.303 | 1.118 | 1.482 | -0.08 |
| Parents married | 0.777 | 0.416 | 0.712 | 0.453 | 0.07 |
| Student | 0.459 | 0.498 | 0.347 | 0.476 | 0.11 |
| Grade completed | 13.235 | 1.199 | 12.725 | 1.419 | 0.19 |
| Occupational goal | 65.265 | 21.497 | 60.180 | 23.567 | 0.11 |
| Social activities | 0.326 | 0.469 | 0.269 | 0.443 | 0.06 |
| Academic activities | 0.342 | 0.474 | 0.205 | 0.404 | 0.14 |
| Student activities | 0.445 | 0.497 | 0.369 | 0.483 | 0.07 |
| Intramural activities | 0.619 | 0.486 | 0.587 | 0.493 | 0.03 |
| Varsity letters | 0.947 | 1.604 | 0.831 | 1.497 | 0.04 |
| Non varsity letters | 0.704 | 1.280 | 0.596 | 1.188 | 0.04 |
| Drinking | 1.514 | 1.300 | 1.603 | 1.343 | -0.03 |
| Number of cigarettes | 6.568 | 10.275 | 8.367 | 11.042 | -0.08 |
| Number of jobs | 1.018 | 0.765 | 1.154 | 0.814 | -0.08 |
| Year own car | 2.893 | 1.042 | 2.744 | 1.107 | 0.07 |
| Hours driving | 11.055 | 11.765 | 12.114 | 12.221 | -0.04 |
| Parents occupation | 43.857 | 24.610 | 40.508 | 24.322 | 0.07 |
| Single license renewal | 0.923 | 0.266 | 0.873 | 0.333 | 0.08 |

a dropout; (8) had a transcript sent to college more often; (9) had a higher grade point average; (10) had fewer absences; (11) had a higher intelligence quotient (IQ); (12) scored higher on an achievement test; (13) got higher grades in relation to their IQ; (14) attended rural schools more often; (15) responded to the mail questionnaire earlier; (16) had a better attitude toward the police, the courts, and DMV; (17) took driver education more frequently; (18) rated the quality of their driver education more highly; (19) drove fewer miles in their lifetime; (20) drove lighter vehicles; (21) had cars equipped with seat belts and wore seat belts more often; (22) were more often single, and less often divorced or separated, at the time of the mail questionnaire; (23) had fewer children, fewer brothers and sisters, and fewer older sibs; (24) more often had parents who were married; (25) were more often a student, had completed more schooling, and had a higher occupational goal; (26) had taken part in more social, academic, student and intramural activities in high school; (27) had more varsity and non-varsity letters; (28) drank and smoked less; (29) held fewer jobs in the previous year; (30) had their own car at a later date; (31) drove fewer hours in the previous week; (32) had parents with higher status occupations; and finally (33) were more often single at the time of their first license renewal.

The correlations of the above variables with accidents 1 DT are presented in Appendix B. The correlation of Fresno county with Accidents 1 DT was a statistically significant -0.04, indicating that subjects from Fresno county had a lower than average accident rate. From Table 114 we also see that 21.8 percent of those not taking driver training and 19.5 percent of those taking driver training were from Fresno county. Consequently, since more of the not trained group were from Fresno county, and since Fresno county has a lower than average accident rate, we would expect the not trained group to have a lower accident mean. The reverse was true for all the other variables shown in Table 114. Either (1) the variable did not have a statistically significant relationship with Accidents 1 DT, or (2) the direction of the correlation was such that we would expect those with driver training to have a lower mean accident than those without formal training, simply on the basis of their biographical characteristics. Consequently, the previously reported differences on driver record between the groups were inflated by volunteer and selection bias. An attempt to adjust for this bias will be made in the next section.

The biographical differences for females are presented in Table 115. The results were similar to those for the males, except that the female driver training groups differed significantly on fewer variables than the males.

Driver record adjusted for volunteer bias. We have seen that those who take driver training had both better driver records and superior personal characteristics. The question remains as to whether or not the better

TABLE 115

Means and Standard Deviations of Biographical Variables Which Differentiate Between Females Taking and Not Taking Driver Training

| Variable | Driver training status | | | | r |
|---|---|---|---|---|---|
| | Driver training taken | | Driver training not taken | | |
| | $\bar{X}$ | SD | $\bar{X}$ | SD | |
| Sonoma county | 0.123 | 0.328 | 0.054 | 0.225 | 0.12 |
| Sacramento county | 0.247 | 0.431 | 0.279 | 0.449 | -0.04 |
| Stanislaus county | 0.151 | 0.358 | 0.060 | 0.237 | 0.14 |
| Los Angeles county | 0.296 | 0.456 | 0.408 | 0.492 | -0.12 |
| Single original license | 1.986 | 0.116 | 1.966 | 0.180 | 0.07 |
| Drive test score | 82.719 | 7.766 | 81.714 | 7.674 | 0.06 |
| Age licensed | 27.746 | 28.151 | 25.207 | 28.171 | 0.04 |
| Traffic density | 111.974 | 64.608 | 129.737 | 66.276 | -0.13 |
| Year left school | 11.873 | 0.471 | 11.786 | 0.636 | 0.08 |
| Dropout | 0.038 | 0.191 | 0.077 | 0.267 | -0.08 |
| Grade point average | 26.413 | 5.811 | 25.700 | 6.358 | 0.06 |
| Citizenship grade | 50.535 | 9.216 | 49.626 | 10.354 | 0.05 |
| Absences | 101.146 | 87.594 | 123.576 | 103.812 | -0.12 |
| Achievement index | 25.384 | 4.663 | 24.751 | 5.123 | 0.06 |
| Rural school | 0.284 | 0.451 | 0.095 | 0.293 | 0.23 |
| Questionnaire response date | 1.387 | 1.332 | 1.575 | 1.358 | -0.07 |
| Driver education | 0.958 | 0.200 | 0.893 | 0.309 | 0.13 |
| Driver education quality | 2.470 | 0.999 | 2.585 | 1.039 | -0.06 |
| Number of children | 0.241 | 0.527 | 0.308 | 0.631 | -0.06 |
| Number of brothers | 2.119 | 1.617 | 1.936 | 1.532 | 0.06 |
| Parents married | 0.788 | 0.409 | 0.757 | 0.429 | 0.04 |
| Housewife | 0.178 | 0.383 | 0.209 | 0.407 | -0.04 |
| Grade completed | 13.224 | 1.282 | 12.962 | 1.370 | 0.10 |
| Social mobility | 20.613 | 19.824 | 18.475 | 17.410 | 0.06 |
| Academic activities | 0.486 | 0.500 | 0.402 | 0.490 | 0.08 |
| Student activities | 0.642 | 0.479 | 0.577 | 0.494 | 0.07 |
| Number of cigarettes | 4.545 | 8.190 | 5.667 | 9.085 | -0.06 |
| Year own car | 3.358 | 0.888 | 3.226 | 0.954 | 0.07 |
| Parents occupation | 43.865 | 24.628 | 45.537 | 23.946 | -0.03 |

driver record was caused by the driver training, or was merely a consequence of the pre-existing personal differences between the groups.

Such a question could only be given a definitive, conclusive answer by repeated experiments in which subjects were randomly assigned to take or not take driver training. The present research is a quasi-experimental, or ex-post-facto type of research in which naturally occurring groups are studied. Such studies have well known limitations, such as the difficulty of distinguishing correlation from causation and disentangling (sometimes circular) causal sequences.

The best statistical method for answering the question in an ex-post-facto study is the analysis of covariance (Blalock, 1964; Campbell & Stanley, 1963; Cronbach & Furby, 1970; Elashoff, 1969; Kahneman, 1965; Meehl, 1970; Li, 1964; Linn & Werts, 1969; Lord, 1960, 1969; Werts & Linn, 1969; Winer, 1964). See also the previous references on multiple regression and the relative merits of matching versus the analysis of covariance. The analysis of covariance is used here to adjust the driver record differences by taking into account the volunteer bias, so that the resulting adjusted means represent the effect of the driver training.

Ten years ago, analysis of covariance was routinely recommended for correcting bias in ex-post-facto studies. Recently, such use of the analysis of covariance has come under increasing criticism, with doubt being expressed that definitive conclusions may ever be reached, as the method is commonly applied in the social sciences. The present author is in general agreement with this as a theoretical position. It is usually impossible to determine whether or not the adjustment via analysis of covariance is the correct one, an overadjustment, or an underadjustment. Certain configurations of results, however, may permit a more firm conclusion. These points will be illustrated later.

The literature was searched to determine which variables to use as covariates (the variables adjusted for). No answers were found. Consequently, various methods of selecting the covariates were accomplished, in order to determine the effects on the results, and to ensure that the results were not an artifact due to the method used. Correlation and regression programs were used as well as a standard analysis of covariance program. Subjects who were not offered driver training were excluded from all analyses.

Method 1 was as follows. Three regression equations were run for an analysis of covariance. The first equation was used to choose the variables to be used as covariates. It might seem reasonable to use all available variables as covariates. However, such a method would capitalize on chance, since the statistical significance of the relationship to driver training status was ignored, and this would represent an unusually stringent requirement. The above method was used in a couple of instances and will be reported under Method 5. The present approach was to use only variables which discriminated to a statistically significant degree between those

taking and not taking driver training. Consequently, a stepwise regression was done, with driver training status (not taken = 1, taken = 2) as the dependent variable predicted in a stepwise manner from a pool of statistically significant variables. The stepwise procedure was terminated when the F to enter became less than one, as this criterion maximizes the precision of the equation (Edwards, 1969; Haitovsky, 1969). The drive test score variable was not permitted to enter as it might have been causally influenced by taking driver training. The degrees of freedom used was 4,905 for males and 3,982 for females, which figures were the average N for the covariates.

The resulting equation, which is the discriminant function between the two groups, driver training taken and driver training not taken, is presented in Tables 116 for males and 117 for females. The multiple correlations

TABLE 116

Stepwise Regression Equation (Discriminant Function) for Predicting Those Taking Driver Training for Males

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Driver education..... | Add | 0.234 | 284.96 | 0.204 | 0.23 |
| Absences..... | Add | 0.312 | 229.67 | -0.116 | -0.23 |
| Rural school..... | Add | 0.354 | 158.63 | 0.152 | 0.16 |
| Grade point average..... | Add | 0.371 | 69.28 | -- | 0.21 |
| Stanislaus county..... | Add | 0.382 | 46.63 | 0.121 | 0.12 |
| Sonoma county..... | Add | 0.391 | 43.22 | 0.102 | 0.11 |
| Driver ed quality..... | Add | 0.400 | 37.54 | -0.084 | -0.05 |
| Academic activities..... | Add | 0.406 | 31.83 | 0.078 | 0.14 |
| Dropout..... | Add | 0.412 | 27.67 | -0.076 | -0.19 |
| Achievement test..... | Add | 0.415 | 16.29 | 0.048 | 0.15 |
| Varsity letters..... | Add | 0.417 | 10.44 | -0.030 | 0.04 |
| Wear seat belts..... | Add | 0.419 | 9.63 | 0.035 | 0.08 |
| Vehicle weight..... | Add | 0.421 | 5.99 | -0.028 | -0.06 |
| Parents married..... | Add | 0.422 | 5.16 | 0.027 | 0.07 |
| Number of brothers..... | Add | 0.422 | 4.05 | -0.022 | -0.08 |
| Number of jobs..... | Add | 0.423 | 2.72 | -0.019 | -0.08 |
| Los Angeles county..... | Add | 0.423 | 2.52 | 0.026 | -0.04 |
| Grade completed..... | Add | 0.424 | 2.76 | 0.029 | 0.19 |
| Grade point average..... | Drop | 0.424 | -0.99 | -- | 0.21 |
| Non-varsity letters..... | Add | 0.424 | 1.98 | -0.021 | 0.04 |
| Non-language IQ..... | Add | 0.425 | 1.73 | 0.023 | 0.14 |
| Year own car..... | Add | 0.425 | 1.50 | 0.016 | 0.07 |
| Occupational goal..... | Add | 0.425 | 1.06 | 0.016 | 0.11 |

TABLE 117
Stepwise Regression Equation (Discriminant Function) for Predicting Those Taking Driver Training for Females

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Rural school..... | Add | 0.230 | 222.45 | 0.204 | 0.23 |
| Driver education..... | Add | 0.272 | 90.85 | 0.130 | 0.13 |
| Absences..... | Add | 0.290 | 43.47 | -0.067 | -0.12 |
| Stanislaus county..... | Add | 0.304 | 36.29 | 0.119 | 0.14 |
| Grade completed..... | Add | 0.313 | 24.02 | 0.052 | 0.10 |
| Driver ed quality..... | Add | 0.322 | 26.48 | -0.076 | -0.06 |
| Sonoma county..... | Add | 0.330 | 22.53 | 0.088 | 0.12 |
| Age licensed..... | Add | 0.335 | 14.71 | 0.054 | 0.04 |
| Single orig license..... | Add | 0.339 | 12.25 | 0.046 | 0.07 |
| Sacramento county..... | Add | 0.342 | 9.51 | 0.044 | -0.04 |
| Year left school..... | Add | 0.344 | 7.62 | 0.033 | 0.08 |
| Academic activities..... | Add | 0.346 | 5.80 | 0.039 | 0.08 |
| Year own car..... | Add | 0.348 | 5.32 | 0.037 | 0.07 |
| Number of brothers..... | Add | 0.349 | 3.73 | 0.030 | 0.06 |
| Achievement index..... | Add | 0.350 | 3.18 | -0.037 | 0.06 |
| Student activities..... | Add | 0.351 | 3.60 | 0.029 | 0.07 |
| Dropout..... | Add | 0.352 | 2.30 | -0.028 | -0.08 |
| Housewife..... | Add | 0.352 | 1.39 | -0.019 | -0.04 |

of 0.425 for males and 0.352 for females indicated a moderate degree of difference between the two groups. The simple correlation coefficients r are shown to permit comparison with the beta coefficients.

It is noteworthy that driver education was the first variable to enter the equation for males and the second for females. This suggests the possibility that part of the difference in the driver record of those taking and not taking driver training could be due to the fact that more of those with the driver training took driver education. This point will be analyzed further later.

With the covariates chosen, the next step was to adjust the driver record data for volunteer bias, as follows. Equations 2 and 3 were run with F = 0, so that all independent variables would enter the equation. The second equation was used to predict the criterion measure from the covariates alone. The third equation was run with all covariates and driver training status as the independent variables. As previously, driver training status was coded: 1 = not taken, 2 = taken. In other words, in Equation 3 driver training status was added to Equation 2

to see how much it would increase the multiple correlation coefficient. The difference between the squares of these two multiple correlation coefficients was the square of the part correlation between driver training status and the driver record criterion variable. This part correlation represented the unique predictability due to driver training status. That is, the effect of driver training with the effect of volunteer bias removed. The F value for the difference between the multiple R's for Equations 2 and 3 was calculated using the usual formula for adding a variable to a regression equation. An F of 3.84 was required for the .05 level of statistical significance. The adjusted means were calculated from the usual formula, that the adjusted mean equals the unadjusted mean minus the adjustment. The adjustment was the predicted value from Equation 2. As a check, most of the analyses were also made using a standard ANCOVA computer program, described under Method 5.

The adjusted means are presented in Table 118. Looking first at the male results, we see that the adjusted mean for convictions 1 OL is the only one that was statistically significant. For females three of the adjusted means were statistically significant. Females with driver training had fewer fatal and injury accidents in their first year after completing driver training. This finding is particularly important since there is little error or bias in the reporting of such accidents. On two subtypes of fatal and injury accidents, partially-at-fault accidents and single vehicle accidents, the differences also remained statistically significant. This is fairly strong evidence for the effectiveness of behind-the-wheel driver training for females. The finding for partially-at-fault fatal and injury accidents is particularly important since the drivers responsibility for the accident is taken into account. The finding for single vehicle accidents is also important since most single vehicle accidents are the fault of the driver and represent either lack of driving skill or poor attitudes reflected in thrill-seeking and risk taking. The differences between the adjusted and unadjusted means for single vehicle and partially-at-fault accidents were quite slight. The beta coefficient for driver training status in Equation 3 for fatal and injury accidents for females was -0.038.

It should be noted that for males most of the adjusted means favored those without driver training, as indicated by the negative percent differences. Assume for the sake of the argument that driver training cannot increase accidents. Then this reversal of the direction of the differences tends to suggest that the adjustment was an overadjustment. Various factors such as ommission of relevant covariates or errors of measurement in the covariates may result in underadjustment, while other factors such as inclusion of covariates causally related to the treatment, either by selection of subjects for treatment, or by being affected by the treatment, may result in overadjustment. For example, consider the "selection" covariate "dropout" for males. This bears an obvious causal relationship with taking driver training, with fewer dropouts taking driver training. Using "dropout"

TABLE 118
Adjusted Means of Accident Types and Convictions by Driver Training Status and Sex

| Item | Driver training status | Sex | | | | | |
|---|---|---|---|---|---|---|---|
| | | Male | | | Female | | |
| | | $\bar{X}$ | Percent difference | F | $\bar{X}$ | Percent difference | F |
| Accidents 1 OL..... | No DT | 0.157 | | | 0.100 | | |
| | DT | 0.146 | 8 | 1.33 | 0.092 | 9 | 0.53 |
| Accidents 1 DT..... | No DT | 0.158 | | | 0.095 | | |
| | DT | 0.162 | -2 | 0.10 | 0.092 | 3 | 0.10 |
| Accidents 6 months prior DT..... | No DT | 0.036 | | | 0.014 | | |
| | DT | 0.038 | -5 | 0.03 | 0.016 | -12 | 0.31 |
| Accident cost 1 DT (In hundreds of dollars)... | No DT | 1.540 | | | 0.974 | | |
| | DT | 1.630 | -6 | 0.31 | 0.783 | 24 | 1.67 |
| Accident rate 1 DT..... | No DT | 33.862 | | | 20.877 | | |
| | DT | 34.273 | -1 | 0.05 | 19.167 | 9 | 0.88 |
| Property damage accidents 1 DT..... | No DT | 0.110 | | | 0.063 | | |
| | DT | 0.112 | -2 | 0.03 | 0.071 | -11 | 0.99 |
| Fatal and injury accidents 1 DT..... | No DT | 0.048 | | | 0.032 | | |
| | DT | 0.050 | -4 | 0.11 | 0.021 | 52 | 5.03* |
| Partially at fault accidents 1 DT..... | No DT | 0.027 | | | 0.020 | | |
| | DT | 0.027 | 0 | 0.01 | 0.010 | 100 | 8.01* |
| Single vehicle accidents 1 DT..... | No DT | 0.011 | | | 0.010 | | |
| | DT | 0.013 | -15 | 0.36 | 0.004 | 150 | 5.92* |
| Convictions 1 OL..... | No DT | 0.622 | | | 0.161 | | |
| | DT | 0.567 | 10 | 5.58* | 0.145 | 11 | 1.06 |
| Convictions 1 DT..... | No DT | 0.673 | | | 0.176 | | |
| | DT | 0.645 | 4 | 1.48 | 0.154 | 14 | 2.69 |
| Convictions 6 months prior DT..... | No DT | 0.189 | | | 0.029 | | |
| | DT | 0.184 | 3 | 0.15 | 0.029 | 0 | 0.00 |
| Convictions 1-3 DT..... | No DT | 2.307 | | | 0.634 | | |
| | DT | 2.324 | -1 | 0.01 | 0.583 | 9 | 3.03 |

*$p < .05$

Note.--Positive percent differences indicate that those not taking driver training have a higher mean than those who take driver training.

as a covariate in Equation 2 is, in a sense (via correlations), entering the treatment variable "driver training" in the equation as a covariate. Consequently, when "driver training" is entered into Equation 3 to

determine how much it adds to the equation, it will add less than it should, which is another way of saying the adjustment from Equation 2 is an over-adjustment. Next, consider the covariate "wears seat belts." Assume for the sake of the argument that taking driver training causes people to wear seat belts more often. Then using "wears seat belts" as a covariate will have the same effect as using "dropout." These arguments illustrate the difficulties in using analysis of covariance. It might be thought that the difficulty could be overcome by dropping "drop out" as a covariate, but this would not solve the problem, since "drop out" is correlated with the other covariates.

Another possible explanation for the reversals could be sampling error. This explanation can not be excluded, although it does not appear consistent with the consistency of the reversals.

Method 2 of doing the analysis of covariance was the same as Method 1 except that the covariates were chosen (Equation 1) with the F to enter being set at 0.00001. This resulted in using as covariates all variables which significantly differentiated (Tables 114 and 115) between the driver training groups. The results as to whether or not the adjusted means were or were not statistically significant were the same as in Method 1.

Method 3 used as covariates only school data and original license data. Only data collected at the school was used and not school related data from the mail questionnaire, such as whether or not they had taken driver education. Also excluded as covariates were age licensed, length of instruction permit, instruction permit, and drive test score. The purpose of these exclusions was to use only non-driving variables which could have been collected before driver training was taken, and consequently were not likely to have been causally affected to any appreciable degree by taking driver training. An F of 3.84 was used to select the covariates. Degrees of freedom were 5,300 for males and 3,800 for females, which represent the number of subjects for whom we had school data. The results were the same as for Method 1, with the single exception that the difference between the adjusted means for convictions 1 DT for males was statistically significant. The adjusted means for males for convictions 1 DT were 0.637 for the driver training group and 0.707 for those without training. This difference is similar to the difference for convictions 1 OL for males under Method 1. A variant of Method 3 was run using an F of 1 to select the covariates. The results for convictions 1 DT for males were similar to those just presented.

In contrast to Method 1, Method 3 did not result in any reversals of direction of the differences between the male groups, so that the results of Method 3 may be preferable with respect to convictions 1 DT for males.

Method 4 was done only for convictions 1 OL for males and fatal and injury accidents 1 DT for females. The same degrees of freedom as Method 1 were used. All biographical variables were used as covariates. Even

so, in both instances the results were the same as for Method 1. In other words, driver training status added a unique contribution to the prediction of these variables over all other biographical variables covered in this study.

Method 5 used the same covariates as Method 1, but used a standard analysis of covariance program BMDX82. If data was missing for a covariate, the mean of the covariate was substituted for it. The means substituted were calculated separately for each driver training group, so that the overall difference between the means of the two groups were not affected. The results are presented for most variables in Table 119. The standard

TABLE 119
Adjusted Means and Standard Errors of Accident Types and Convictions by Driver Training Status and Sex Using Method 5

| Item | Driver training status | Males | | | Females | | |
|---|---|---|---|---|---|---|---|
| | | $\bar{X}$ | SE | F | $\bar{X}$ | SE | F |
| Accidents 1 OL..... | No DT | 0.158 | 0.009 | | - | - | |
| | DT | 0.147 | 0.007 | 0.928 | - | - | - |
| Accidents 1 DT..... | No DT | 0.156 | 0.009 | | 0.095 | 0.007 | |
| | DT | 0.163 | 0.007 | 0.362 | 0.091 | 0.006 | 0.127 |
| Accident cost 1 DT (In hundreds of dollars)... | No DT | 1.504 | 0.129 | | - | - | |
| | DT | 1.662 | 0.098 | 0.866 | - | - | - |
| Fatal and injury accidents 1 DT..... | No DT | 0.047 | 0.005 | | 0.032 | 0.004 | |
| | DT | 0.051 | 0.004 | 0.444 | 0.020 | 0.003 | 5.625* |
| Partially at fault accidents 1 DT..... | No DT | 0.026 | 0.004 | | 0.021 | 0.003 | |
| | DT | 0.028 | 0.003 | 0.097 | 0.010 | 0.002 | 9.032* |
| Single vehicle accidents 1 DT..... | No DT | - | - | | 0.010 | 0.002 | |
| | DT | - | - | - | 0.004 | 0.002 | 6.738* |
| Convictions 1 OL..... | No DT | 0.624 | 0.021 | | - | - | |
| | DT | 0.578 | 0.016 | 2.624 | - | - | - |
| Convictions 1 DT... ..... | No DT | 0.674 | 0.022 | | 0.175 | 0.010 | |
| | DT | 0.656 | 0.017 | 0.381 | 0.155 | 0.008 | 2.214 |
| Convictions 1-3 DT..... | No DT | 2.315 | 0.052 | | - | - | |
| | DT | 2.349 | 0.039 | 0.294 | - | - | - |

*$p<.05$

error presented was the standard error of the adjusted means. The adjusted means shown were quite close to those obtained with Method 1, and the results were the same with respect to the statistical significance of the adjusted means, except that convictions 1 OL was not significant for Method 5.

The analysis of covariance tables are shown in Table 120 for male

TABLE 120
Analysis of Covariance Table for Convictions 1 OL for Males

| Source of variance | df | SS | MS | F | p |
|---|---|---|---|---|---|
| Equal cell means..... | 1 | 2.434 | 2.434 | 2.62 | >.05 |
| Zero slope..... | 21 | 719.562 | 34.265 | 36.95 | <.05 |
| Error..... | 6,400 | 5,935.106 | 0.927 | | |
| Equal slopes..... | 21 | 23.934 | 1.140 | 1.23 | >.05 |
| Error..... | 6,379 | 5,911.172 | 0.927 | | |

convictions 1 OL and in Table 121 for female fatal and injury accident 1 DT.

TABLE 121
Analysis of Covariance Table for Fatal and Injury Accidents 1 DT for Females

| Source of variance | df | SS | MS | F | p |
|---|---|---|---|---|---|
| Equal cell means..... | 1 | 0.142 | 0.142 | 5.63 | <.05 |
| Zero slope..... | 18 | 0.792 | 0.044 | 1.74 | <.05 |
| Error..... | 4,745 | 119.842 | 0.025 | | |
| Equal slopes..... | 18 | 0.702 | 0.039 | 1.55 | >.05 |
| Error..... | 4,727 | 119.139 | 0.025 | | |

For males, the regression slopes were not equal in both groups for accidents 1 OL, accidents 1 DT, fatal and injury accidents 1 DT, partially-at-fault accidents 1 DT, and accident cost 1 DT. In analysis of variance terms, this means that there was an interaction between the treatment and the covariates. In other words, the effect of driver training was not uniform across all subjects or across all programs. For example, taking driver training may have improved the driving of some subjects, but had no effect, or a negative effect, on the driving of others. This finding, if not a methodological artifact, limits the generality of the preceding analyses for males in which the equality of slopes was not tested. All slopes were equal for females.

Method 6 used the same methods as Method 5, except that the subjects were restricted to high school graduates with driver education, the largest block of subjects in the analysis. One reason for this restriction was to see if it would result in equal slopes for males. The results are presented in Table 122. The F is for the adjusted mean. The results as to statistical significance for females were the same as in all previous analyses. Males with driver training had a significantly higher adjusted mean for accident cost, but this was probably an artifact resulting from overadjustment. For

TABLE 122

Means and Adjusted Means of Accident Types and Convictions for High School Graduates Who Had Completed Driver Education by Driver Training Status and Sex

| Item | Driver training status | Sex | | | | | |
|---|---|---|---|---|---|---|---|
| | | Male | | | Female | | |
| | | $\bar{X}$ | Adjusted $\bar{X}$ | F | $\bar{X}$ | Adjusted $\bar{X}$ | F |
| Accidents 1 OL..... | No DT | 0.154 | 0.138 | | - | - | |
| | DT | 0.132 | 0.139 | 0.009 | - | - | - |
| Accidents 1 DT..... | No DT | 0.152 | 0.140 | | 0.106 | 0.100 | |
| | DT | 0.150 | 0.159 | 1.753 | 0.078 | 0.081 | 2.820 |
| Accident cost 1 DT (In hundreds of dollars)... | No DT | 1.419 | 1.173 | | - | - | |
| | DT | 1.459 | 1.563 | 4.102* | - | - | - |
| Fatal and injury accidents 1 DT..... | No DT | 0.043 | 0.035 | | 0.032 | 0.031 | |
| | DT | 0.044 | 0.047 | 2.638 | 0.015 | 0.016 | 8.066* |
| Partially at fault accidents 1 DT..... | No DT | 0.021 | 0.017 | | 0.019 | 0.019 | |
| | DT | 0.024 | 0.026 | 2.403 | 0.007 | 0.007 | 8.423* |
| Single vehicle accidents 1 DT..... | No DT | - | - | | 0.011 | 0.011 | |
| | DT | - | - | - | 0.003 | 0.003 | 9.003* |
| Convictions 1 OL..... | No DT | 0.634 | 0.529 | | - | - | |
| | DT | 0.464 | 0.508 | 0.431 | - | - | - |
| Convictions 1 DT..... | No DT | 0.699 | 0.589 | | 0.193 | 0.171 | |
| | DT | 0.545 | 0.592 | 0.019 | 0.131 | 0.143 | 3.386 |
| Convictions 1-3 DT..... | No DT | 2.389 | 2.084 | | - | - | |
| | DT | 2.008 | 2.137 | 0.480 | - | - | - |

*$p < .05$

males, the slopes were slightly different between groups for fatal and injury accidents and accident cost. For females the slopes were slightly different for fatal and injury accidents, partially at-fault accidents and single vehicle accidents. There is some evidence that small differences in slopes do not lead to serious bias (Atiqullah, 1964).

Method 7 selected the covariates from the pool of all variables except drive test score, with an F of 1. Analyses were done for Accidents 1 OL and Fatal and Injury Accidents 1 DT, with results similar to Method 1.

In conclusion, seven different methods of analysis of covariance were used, using different degrees of freedom, different sets of covariates, different computational techniques, and different sets of subjects. The results as to the statistical significance of the adjusted differences were quite uniform, with the exception of male convictions. Consequently, the results were not an artifact of the particular method employed.

Driver training status was not known for 588 females. These females average 0.034 fatal and injury accidents in their first year of driving. It will be recalled that for Method 1, the adjusted means for females for fatal and injury accidents were 0.032 for those without driver training and 0.021 for those with driver training. In order to take into account the response bias resulting from lack of knowledge of driver training, the assumption was made that all 588 females took driver training. This assumption will reduce the difference between the two groups more than the opposite assumption. Under the assumption the weighted mean of those without driver training and of those 588 assumed not to have taken DT was calculated. The result was a mean of 0.023, so that there still remained a difference of 9 fatal and injury accidents per thousand drivers in the first year of driving between those with and without driver training.

These results may either be interpreted in a purely predictive (non-causal) or a causal sense. In a purely predictive context, the results may be interpreted as indicating that, aside from convictions for males, and fatal and injury accidents, partially-at-fault accidents, and single vehicle accidents for females, knowledge of driver training status did not significantly add to the ability to predict driver record, over what would be predicted from knowledge of biographical differences (volunteer bias) alone. By itself, driver training status was a poor predictor of accidents, as the highest correlation with accidents was -0.06. Variables such as citizenship grade and grade point average were much better predictors.

An evaluation of the results as to the causal effectiveness of driver training is more difficult. It is reasonable to conclude that part of the difference between the driving records of those with and without driver training was due to differences in biographical characteristics, since the alternative is much less plausible, namely, that despite the personal differences between the groups, their driving records would have been the same if it were not for taking driver training.

Various limitations such as missing data and the limitations of analysis of covariance preclude conclusive and precise results, but it is believed that the weight of the evidence permits the following conclusions:

(1) Driver training reduced fatal and injury, partially-at-fault, and single vehicle accidents for females. The reduction is estimated to be from 9 to 11 fatal and injury accidents per thousand drivers in the first year of driving. The evidence for this was fairly firm. It is theoretically possible, although it appears unlikely, that some unknown factor X, substantially uncorrelated with the biographical variables covered in this analysis, was really responsible for the differences found. The influence of measurement error is more difficult to assess (Cochran, 1968, 1970). In survey research, errors tend to be positively correlated with the values of the variables, and the errors tend to be correlated among themselves, so that the predicted value from Equation 2 may be more accurate and reliable that it first appears.

Given this, and given that the adjusted means were significant when all biographical variables were used as covariates, it appears unlikely that the adjustment was an underadjustment due to measurement error. In summary, it may be that the adjustment under Method 1 was an overadjustment, but it appears unlikely that it was an underadjustment.

(2) Due to the limitations of the present report no definite conclusion can be reached as to whether or not driver training reduced accidents among males. There was some evidence for differential effectiveness for different types of persons. However, given the unadjusted means, and given the moderate volunteer bias, it may be concluded that any overall accident reduction caused by driver training was slight.

(3) Driver training may have reduced convictions among males. The findings for the adjusted means using different methods were not consistent. The findings for the two dates used were also not consistent. The difference between the adjusted conviction means for females were not statistically significant, but the difference for convictions 1-3 years approached significance. Due to the limitations of the method, no definite conclusion can be reached as to whether or not driver training reduced convictions for females.

One reason for the sex difference in the effectiveness of driver training in reducing accidents may be that females had less prior experience with driving, and consequently profited from the course more. Male accidents may be due more to poor attitudes than are females' accidents, which may be due more to lack of skill or knowledge.

Cost benefit analysis. The cost benefit analysis for driver training is presented in Table 123. The marginal cost of behind-the-wheel driver

TABLE 123
Cost/Benefit Analysis of Driver Training by Sex
(Cost = $55,000 per thousand trained)

| Variable | Benefits (in dollars saved through accident reduction) | |
|---|---|---|
| | Male | Female |
| Accidents 1 DT | 52,000* | 39,000* |
| Accidents 1 DT adjusted for volunteer bias | -8,000 | 6,000 |
| Fatal and injury accidents 1 DT | 78,000* | 102,000* |
| Fatal and injury accidents 1 DT adjusted for volunteer bias | -12,000 | 66,000* |
| Fatal and injury accidents 1 DT adjusted for volunteer bias and overadjusted for response bias | -- | 54,000(a) |

*$p < .05$.

(a)No probability calculated.

training in 1970 was estimated at $55.00 to $60.00.* The figure of $55.00 is used in the table. The probabilities referred to are those associated with difference in mean accidents (Method 1), and do not refer to the costs. The findings for males were that the benefits in accident reduction were insufficient to cover the cost of the training, but the cost of driver training for females is approximately repaid by the savings from reduced fatal and injury accidents, assuming that the effects are causal.

## Evaluation of Driver Education

It was not originally planned to evaluate classroom driver education, since it was anticipated that almost everyone would have taken it. Although 91 percent of each sex did take the course, the number of those without the course was sufficient to permit detection of a statistically significant difference between the driver records of the two groups. As can be seen in Appendices B and C, males with driver education had fewer convictions 1 OL, and females with driver education had fewer fatal and injury accidents 1 OL than those without the course. Consequently, an analysis similar to the preceding analysis for driver training was done.

A limitation of this analysis was that driver education status was only available for questionnaire respondents. The correlation matrix used for the analyses of covariance was the same as that used for prediction of driver record from biographical data. Some of the correlations on tape were based on subsets of subjects other than those whose driver education status was known. It is believed that this did not introduce any serious error. The driver record was analyzed relative to the date of licensing, since most students completed classroom driver education prior to licensing.

The longitudinal differences between the driver education and no driver education groups may be found by examining the correlations in the Appendices with accidents and convictions. Most of the significant differences in favor of those with driver education were in the first year of driving or were for the full four year driver record. An exception was the significant difference for convictions for males in the second year of driving.

A comparison of the biographical characteristics of the driver education groups revealed considerable differences, as presented in Table 124. The driver training taken was versus not taken and not offered. Note the higher seat belt usage for females with driver education. Of course, the fact that there were biographical differences between the groups would be of no significance unless these differences were related to driver record.

For males, the correlations of these biographical variables with convictions 1 OL were examined for volunteer bias. Twenty-four of the differences were favorable to the driver education group, two were unfavorable, and ten of the variables were uncorrelated with convictions 1 OL. Consequently, on the basis of biographical data alone, the males with driver

*Department of Education estimate.

TABLE 124

Means of Biographical Variables Which Significantly Differentiate Between Those Taking and Not Taking Driver Education by Sex

| Variable | Male means | | | Female means | | |
|---|---|---|---|---|---|---|
| | Driver education taken | Driver education not taken | r | Driver education taken | Driver education not taken | r |
| Fresno county | 0.174 | 0.300 | -0.09 | 0.165 | 0.278 | -0.09 |
| Sacramento county | 0.214 | 0.281 | -0.05 | -- | -- | -- |
| Los Angeles county | 0.437 | 0.265 | 0.10 | 0.399 | 0.268 | 0.08 |
| Single orig license | -- | -- | -- | 1.982 | 1.942 | 0.08 |
| Age licensed | 19.437 | 23.927 | -0.06 | -- | -- | -- |
| Length instr permit | 14.988 | 12.162 | 0.08 | 16.431 | 15.108 | 0.04 |
| Traffic density | 130.474 | 107.490 | 0.10 | 126.694 | 107.376 | 0.08 |
| Year left school | 11.823 | 11.235 | 0.22 | 11.891 | 11.612 | 0.14 |
| Transfer | 0.057 | 0.118 | -0.06 | 0.041 | 0.090 | -0.06 |
| Dropout | 0.057 | 0.213 | -0.15 | 0.029 | 0.106 | -0.10 |
| College transcript | 0.720 | 0.493 | 0.12 | 0.692 | 0.543 | 0.08 |
| Grade point average | 24.275 | 21.482 | 0.10 | 26.818 | 25.394 | 0.06 |
| Citizenship grade | 51.523 | 49.198 | 0.05 | -- | -- | -- |
| Absences | 89.698 | 131.503 | -0.10 | -- | -- | -- |
| Non-language IQ | 105.710 | 101.346 | 0.07 | -- | -- | -- |
| Achievement test | 51.825 | 49.100 | 0.07 | -- | -- | -- |
| Achievement index | 23.190 | 22.058 | 0.05 | -- | -- | -- |
| Rural school | 0.215 | 0.318 | -0.06 | 0.204 | 0.342 | -0.08 |
| Quest response date | 1.608 | 1.767 | -0.03 | -- | -- | -- |
| Attitude | 5.148 | 5.350 | -0.03 | -- | -- | -- |
| Total mileage | 59.440 | 66.318 | -0.03 | -- | -- | -- |
| Prior mileage | 15.483 | 18.585 | -0.04 | -- | -- | -- |
| Rear seat belts | -- | -- | -- | 2.006 | 1.785 | 0.05 |
| Married | 0.197 | 0.263 | -0.05 | -- | -- | -- |
| Divorced/separated | 0.009 | 0.030 | -0.06 | -- | -- | -- |
| Number of children | 0.114 | 0.178 | -0.05 | 0.247 | 0.367 | -0.06 |
| Number of brothers | 2.196 | 2.877 | -0.11 | 2.052 | 2.341 | -0.05 |
| Number of older sibs | 0.927 | 1.317 | -0.08 | 0.868 | 1.043 | -0.04 |
| Student | 0.440 | 0.367 | 0.04 | -- | -- | -- |
| Housewife | -- | -- | -- | 0.182 | 0.221 | -0.03 |
| Grade completed | 13.131 | 12.516 | 0.13 | 13.173 | 12.897 | 0.06 |
| Occupational goal | 64.501 | 60.558 | 0.05 | 61.618 | 58.857 | 0.05 |
| Unemployed | 0.043 | 0.081 | -0.05 | -- | -- | -- |
| Social activities | 0.319 | 0.250 | 0.04 | -- | -- | -- |
| Intramural activities | -- | -- | -- | 0.341 | 0.401 | -0.04 |
| Number of cigarettes | 6.915 | 9.517 | -0.07 | 4.731 | 5.751 | -0.04 |
| Hours driving | -- | -- | -- | 7.386 | 6.450 | 0.04 |
| Driver training taken | 0.604 | 0.178 | 0.28 | 0.596 | 0.252 | 0.20 |
| Parents occupation | 45.387 | 39.154 | 0.07 | -- | -- | -- |
| School data missing | 0.247 | 0.490 | -0.16 | 0.260 | 0.524 | -0.17 |
| Length license gap 1-4 yr | 25.603 | 42.011 | -0.04 | -- | -- | -- |
| Single lic renewal | 0.917 | 0.856 | 0.06 | -- | -- | -- |

education would be expected to have better conviction records than those without the course.

For females, a similar analysis was done for fatal and injury accidents 1 OL. There was less volunteer bias, with 9 of the differences favorable to the driver education group, 5 unfavorable, and 9 variables not significantly correlated with fatal and injury accidents 1 OL.

An analysis of covariance was done using Method A (Method 1 of the preceding section). The covariates were chosen by predicting driver education status from all the other biographical variables, with an F-level of 1 for the covariates to be selected. The results are presented in Tables 125 and 126. Driver training taken (versus driver training not taken or not offered) was the best predictor of driver education status. The multiple R's were 0.39 for males and 0 32 for females. Many variables not significantly correlated with driver education status entered the equations, which tended to indicate rather complex interactions among the variables.

The means and the adjusted means from the analysis of covariance are presented in Table 127. Included in this table are all driver record variables shown in Appendices B and C which were statistically significant, as well as accidents and convictions in the first year of driving, irrespective of significance. The violation types were for 1-4 years, since the data for the first year was not on the tape used for the analysis of covariance. A comparison of the violation types for the first year of driving is presented later.

For males, there were significant differences between the means for convictions and some violation types. The r's are the correlations between the variable and driver education status. The F's are those for the adjusted means. Only the adjusted mean for passing violations 1-4 remained significant after the analysis of covariance. The ANCOVA may be over-adjusting, as the direction of the difference changed for convictions 1 OL.

For females, there were statistically significant differences on fatal and injury accidents 1, partially-at-fault accidents 1, and some violation types. The analysis of covariance had little effect on the means, only changing fatal and injury accidents 1-4 from significant to non-significant. The beta coefficient for driver education status in Equation 3 for fatal and injury accidents for females was -0.039. An ANCOVA for fatal and injury accidents 1 for females was also done using Method B, which was the same as Method 1 of the previous section, with the result that the adjusted means were not statistically significant (F = 3.26, Beta = -0.032). This rather surprising result led to an examination of the covariance equations. The first variable to enter Equations 2 and 3 was wear seat belts, or the frequency of wearing seat belts. This variable was not used as a covariate in Method A. Since the frequency of wearing seat belts could have been affected by taking driver education, and since using such a variable as a covariate could result in an overadjustment, the covariance analysis was

TABLE 125

Stepwise Regression Equation (Discriminant Function) for Predicting Those Taking Driver Education for Males

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Driver training taken.... | Add | 0.283 | 365.38 | 0.254 | 0.28 |
| Year left school..... | Add | 0.333 | 144.23 | 0.159 | 0.22 |
| Traffic density..... | Add | 0.347 | 48.55 | - | 0.10 |
| Achievement index..... | Add | 0.352 | 14.70 | -0.685 | 0.05 |
| Length instr permit..... | Add | 0.354 | 7.99 | - | 0.08 |
| Unemployed..... | Add | 0.356 | 7.03 | -0.029 | -0.05 |
| Home status..... | Add | 0.358 | 6.41 | 0.042 | 0.01 |
| Number of brothers..... | Add | 0.360 | 5.51 | -0.043 | -0.11 |
| Sacramento county..... | Add | 0.361 | 5.00 | -0.050 | -0.05 |
| Number of jobs..... | Add | 0.362 | 3.95 | 0.027 | -0.01 |
| Rural school..... | Add | 0.363 | 3.83 | -0.028 | -0.06 |
| Fresno county..... | Add | 0.365 | 5.38 | -0.095 | -0.09 |
| Number of cigarettes..... | Add | 0.366 | 3.73 | -0.039 | -0.07 |
| Citizenship grade..... | Add | 0.367 | 3.67 | -0.046 | 0.05 |
| Grade point average..... | Add | 0.368 | 3.18 | 0.854 | 0.10 |
| Non-language IQ..... | Add | 0.373 | 20.14 | -0.310 | 0.07 |
| Achievement test..... | Add | 0.376 | 10.47 | -0.099 | 0.07 |
| Academic activities..... | Add | 0.378 | 7.51 | -0.053 | 0.01 |
| Occupational goal..... | Add | 0.380 | 4.60 | -0.066 | 0.05 |
| Vehicle mileage..... | Add | 0.381 | 4.50 | 0.036 | -0.01 |
| IQ discrepancy..... | Add | 0.382 | 3.40 | 0.048 | -0.01 |
| Height..... | Add | 0.383 | 4.14 | -0.053 | 0.01 |
| Number of children..... | Add | 0.384 | 3.31 | 0.049 | -0.05 |
| Single lic renewal..... | Add | 0.385 | 4.22 | 0.034 | 0.06 |
| Instruction permit..... | Add | 0.386 | 3.44 | 0.041 | 0.05 |
| Length instr permit..... | Drop | 0.386 | -0.67 | - | 0.08 |
| Divorced/separated..... | Add | 0.386 | 3.26 | -0.026 | -0.06 |
| Sonoma county..... | Add | 0.387 | 2.50 | -0.041 | 0.01 |
| Traffic density..... | Drop | 0.387 | -0.02 | - | 0.10 |
| Stanislaus county..... | Add | 0.388 | 2.66 | -0.028 | 0.01 |
| Vehicle weight..... | Add | 0.388 | 2.53 | 0.020 | -0.01 |
| Social mobility..... | Add | 0.389 | 2.32 | 0.058 | -0.02 |
| Parents occupation..... | Add | 0.390 | 3.45 | 0.047 | 0.07 |
| Annual mileage..... | Add | 0.390 | 2.00 | 0.024 | 0.02 |
| Weight..... | Add | 0.391 | 1.65 | 0.025 | -0.00 |
| Vehicle year..... | Add | 0.391 | 1.38 | -0.018 | 0.01 |
| Prior mileage..... | Add | 0.391 | 1.25 | -0.017 | -0.04 |
| Student..... | Add | 0.392 | 1.28 | -0.029 | 0.04 |
| Single orig license..... | Add | 0.392 | 1.31 | -0.017 | 0.01 |
| Age licensed..... | Add | 0.392 | 1.24 | -0.019 | -0.06 |
| Grade completed..... | Add | 0.393 | 1.19 | 0.025 | 0.13 |

TABLE 126

Stepwise Regression Equation (Discriminant Function) for Predicting Those Taking Driver Education for Females

| Variable | Action | R | F | Beta | r |
|---|---|---|---|---|---|
| Driver training taken.... | Add | 0.201 | 152.01 | 0.207 | 0.20 |
| Year left school..... | Add | 0.237 | 59.34 | 0.066 | 0.14 |
| Rural school..... | Add | 0.260 | 44.50 | -0.085 | -0.08 |
| Los Angeles county..... | Add | 0.268 | 15.68 | 0.153 | 0.08 |
| Citizenship grade..... | Add | 0.271 | 7.50 | -0.128 | -0.01 |
| Grade point average..... | Add | 0.277 | 12.42 | 0.775 | 0.06 |
| Single orig license..... | Add | 0.280 | 6.04 | 0.048 | 0.02 |
| Fresno county..... | Add | 0.283 | 6.00 | -0.100 | -0.09 |
| Student activities..... | Add | 0.285 | 5.51 | -0.035 | -0.02 |
| Hours driving..... | Add | 0.288 | 5.76 | 0.038 | 0.04 |
| Achievement test..... | Add | 0.289 | 4.31 | -0.125 | 0.01 |
| Achievement index..... | Add | 0.295 | 12.65 | -0.514 | 0.03 |
| Non-language IQ..... | Add | 0.302 | 15.52 | -0.247 | 0.02 |
| IQ discrepancy..... | Add | 0.305 | 8.58 | 0.063 | 0.01 |
| Student..... | Add | 0.307 | 4.96 | -0.040 | -0.00 |
| Length instr permit..... | Add | 0.309 | 5.08 | 0.032 | 0.04 |
| Drinking..... | Add | 0.310 | 3.13 | -0.029 | -0.02 |
| Traffic density..... | Add | 0.312 | 2.73 | -0.167 | -0.08 |
| College transcript..... | Add | 0.313 | 2.77 | 0.035 | 0.08 |
| Academic activities..... | Add | 0.314 | 2.12 | -0.021 | -0.01 |
| Stanislaus county..... | Add | 0.314 | 1.72 | -0.033 | 0.01 |
| Parents occupation..... | Add | 0.315 | 1.92 | -0.027 | 0.02 |
| Number of older sibs..... | Add | 0.316 | 1.81 | -0.020 | -0.04 |
| Age licensed..... | Add | 0.316 | 1.62 | -0.023 | -0.02 |
| Housewife..... | Add | 0.317 | 1.66 | 0.022 | -0.03 |
| Intramural activities.... | Add | 0.318 | 1.41 | -0.020 | -0.04 |
| Vehicle year..... | Add | 0.318 | 1.41 | -0.025 | -0.01 |
| Mileage errands..... | Add | 0.319 | 1.40 | 0.019 | 0.02 |
| Equipped seat belts..... | Add | 0.319 | 1.28 | 0.019 | 0.00 |

rerun with wear seat belts deleted from the pool of possible covariates, with the result that the adjusted means were not statistically significant ($F = 3.39$). This discrepancy between the methods limits the findings, although Method B was close to significance.

For females the correlations of fatal and injury accidents 1 with equipped seat belts and wear seat belts were -0.03 and -0.05 respectively. For females the correlations of driver education status with equipped seat belts and wear seat belts were 0.00 and 0.05 respectively, indicating no

TABLE 127
Means and Adjusted Means of Accident Types and Conviction Types by Driver Education Status and Sex

| Variable | Driver education status | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | r | Adjusted mean | F | Mean | r | Adjusted mean | F |
| Passing violation 1-4 yrs... | No DE | 0.057 | -0 03* | 0.053 | 4.15* | -- | -- | -- | -- |
| | DE | 0.036 | | 0.036 | | | | | |
| Drunk driv viol 1-4 yrs..... | No DE | 0.018 | -0.03* | 0.015 | 2.44 | 0.005 | -0.05* | 0.005 | 9.74* |
| | DE | 0.008 | | 0.008 | | 0.000 | | 0.000 | |
| FTA/FTP viol 1-4 yrs..... | No DE | 0.300 | -0.07* | 0.096 | 0.15 | 0.075 | -0.06* | 0.058 | 8.56* |
| | DE | 0.133 | | 0.147 | | 0.019 | | 0.020 | |
| Equipment viol 1-4 yrs..... | No DE | 0.892 | -0.03* | 0.598 | 0.00 | 0.145 | -0.05* | 0.134 | 7.29* |
| | DE | 0.710 | | 0.732 | | 0.072 | | 0.073 | |
| Misc non-mov viol 1-4 yrs... | No DE | 0.542 | -0.03* | 0.270 | 2.66 | 0.120 | -0.05* | 0.115 | 9.15* |
| | DE | 0.432 | | 0.453 | | 0.060 | | 0.061 | |
| Convictions 1 yr..... | No DE | 0.703 | -0.05* | 0.481 | 0.76 | 0.158 | -0.01 | -- | 0.23 |
| | DE | 0.533 | | 0.548 | | 0.147 | | -- | |
| Convictions 1-4 yrs..... | No DE | 3.238 | -0.04* | 2.558 | 0.57 | -- | -- | -- | -- |
| | DE | 2.855 | | 2.900 | | | | | |
| Accidents 1 yr..... | No DE | 0.169 | -0.02 | 0.152 | 0.34 | 0.098 | -0.01 | 0.093 | 1.16 |
| | DE | 0.143 | | 0.144 | | 0.089 | | 0.092 | |
| Fatal/injury acc 1 yr..... | No DE | -- | -- | -- | -- | 0.043 | -0.04* | 0.036 | 5.13* |
| | DE | | | | | 0.022 | | 0.022 | |
| Fatal/injury acc 1-4 yrs.... | No DE | -- | -- | -- | -- | 0.115 | -0.03* | 0.114 | 3.16 |
| | DE | | | | | 0.089 | | 0.089 | |
| Part fault acc 1 yr..... | No DE | -- | -- | -- | -- | 0.028 | -0.04* | 0.023 | 5.14* |
| | DE | | | | | 0.012 | | 0.012 | |

*p < .05.

difference between the groups on having seat belts, but with those with driver education wearing seat belts more frequently. The preceding results tend to suggest that one means by which driver education may have reduced fatal and injury accidents for females was by encouraging the usage of seat belts, although the possibility cannot be excluded that this finding reflects personal differences. As may be seen in Appendix C, there was a correlation of 0.01 between driver education status and Property Damage Accidents 1 OL, indicating that females with driver education had slightly more property damage accidents than those without the course, although the difference was not statistically significant. This suggests the possibility that driver education encouraged usage of seat belts, with the result that some potentially injurious accidents resulted in property damage accidents v.

There were 1,586 females (24 percent) for whom we did not have data on driver education status. These subjects averaged 0.038 fatal and injury accidents in their first year of driving. To adjust for response bias these subjects were lumped in with those with driver education. The weighted mean for the combined group was 0.027 which reduced the difference between groups from 0.014 to 0.009 or 9 accidents per thousand drivers in the first year of driving.

The results for violation types in the first year of driving is presented in Table 128. Two of the differences favored each group.

The results for female fatal and injury accidents in the first year of driving by driver education and training statuses are presented in Table 129. The driver training not taken group included those not offered driver

TABLE 128

Means and Standard Deviations of Violation Types in the First Year of Driving for Which There Were Statistically Significant Differences Between Those Taking and Not Taking Classroom Driver Education by Sex

| Sex and type of violation | Driver Education Status - | | | | t |
|---|---|---|---|---|---|
| | Driver education taken | | Driver education not taken | | |
| | $\bar{X}$ | SD | $\bar{X}$ | SD | |
| Male | | | | | |
| Turning violations | 0.029 | 0.176 | 0.064 | 0.288 | 2.49 |
| Female | | | | | |
| Sign violations... | 0.037 | 0.200 | 0.013 | 0.111 | -2.89 |
| Lane violations... | 0.006 | 0.076 | 0.000 | 0.000 | -4.65 |
| FTA/FTP violations | 0.001 | 0.028 | 0.008 | 0.150 | 2.86 |

TABLE 129

Mean Fatal and Injury Accidents in the First Year of Driving by Driver Education Status and Driver Training Status for Females

(Figures in parentheses are sample sizes)

| Status | Driver training taken | Driver training not taken |
|---|---|---|
| Driver education taken..... | 0.015 (2,262) | 0.031 (1,535) |
| Driver education not taken..... | 0.051 (98) | 0.034 (291) |

training. Those with both driver education and driver training had the lowest accident records. The comparable results for accidents and convictions for both sexes are presented in Table 130, with somewhat less clearcut results.

The cost/benefit analysis is presented in Table 131, using the results from Method A. For males the cost/benefit analysis was highly favorable for Accidents 1, but approximately at the break even point when adjusted for volunteer bias. The results for females were highly favorable. The minimum

TABLE 130

Mean Accidents and Convictions in the First Year of Driving by Driver Training Status, Driver Education Status and Sex

(Figures in parentheses are sample sizes)

| Sex and driver training status | Accidents | | Convictions | |
|---|---|---|---|---|
| | Driver education status | | Driver education status | |
| | Taken | Not taken | Taken | Not taken |
| Male | | | | |
| Driver training taken..... | 0.134 (2,878) | 0.095 (74) | 0.466 (2,878) | 0.459 (74) |
| Driver training not taken or not offered..... | 0.158 (1,459) | 0.184 (342) | 0.627 (1,459) | 0.724 (342) |
| Female | | | | |
| Driver training taken..... | 0.079 (2,262) | 0.122 (98) | 0.128 (2,262) | 0.133 (98) |
| Driver training not taken or not offered..... | 0.104 (1,535) | 0.086 (291) | 0.175 (1,535) | 0.141 (291) |

TABLE 131

Cost/Benefit Analysis of Driver Education by Sex

(Cost = $20,000 per thousand trained)

| Variable | Benefits (in dollars saved through accident reduction) | |
|---|---|---|
| | Male | Female |
| Accidents 1 OL..... | 54,000* | 18,000 |
| Accidents 1 OL adjusted for volunteer bias... | 16,000 | 2,100 |
| Fatal and injury accidents 1 OL..... | -- | 126,000* |
| Fatal and injury accidents 1 OL adjusted for volunteer bias..... | -- | 78,000* |
| Fatal and injury accidents 1 OL adjusted for volunteer bias and overadjusted for response bias..... | -- | 54,000(a) |

*$p < .05$.

(a)No probability calculated.

estimate of benefits ($54,000) is two and one-half times the cost, and sufficed to pay the costs for both males and females.

In summary, driver education appeared to reduce fatal and injury accidents among females at a considerable savings in accident costs. Driver education had little or no effect on accidents for males. The other findings were less conclusive due to methodological limitations.

# CHAPTER 6

## INTERVIEW OF HIGH AND LOW ACCIDENT SUBJECTS

In this chapter will be presented the differences between high and low accident subjects on the interview data, the intercorrelations among variables which significantly differentiated between the groups, equations indicating how well the variables discriminated between the groups, and then results relating to drugs.

### Biographical Differences

Due to limitations of space, only those questions which discriminated between high and low accident subjects for either sex will be presented. The interview questionnaire, coding scheme, and a table of means and standard deviations for all variables are available upon request. Those interview questions and driver behavior sort items which significantly differentiated between the high and low accident groups for either sex, along with the codes used, are presented in Exhibit 6. It should be noted that many of the codes are opposite in direction to that of the name of the variable, so that care must be exercised in interpreting the tables in this chapter.

Over 300 variables were tested for statistical significance, but only a small proportion were found significant, and are presented here. Also, simple t-tests were made for each variable between high and low accident groups for each sex separately, and no protection level was used for the number of tests. This method tends to capitalize on chance, so that new findings presented here should be considered tentative until replicated.

The means and standard deviations for males by accident group are presented in Table 132. The r is the point-biserial correlation between group membership and the variable. The low accident group was coded 1, the high accident group 2. It should be interpreted as an index of how well the variable discriminated between the two groups (discriminant function), rather than as a correlation coefficient, since subjects with an intermediate number of accidents were not included in the interview phase. Most of the r's were quite low, indicating that the biographical differences between the groups on each variable were slight. The first three variables in the table were defined in Chapter 2. Length of license gap was included in the tables even though it was not quite statistically significant.

As compared to the low accident group, high accident males: (1) had more convictions; (2) less often thought that old people drove too slowly; (3) drove more miles; (4) smoked more cigarettes; (5) less frequently were college students; (6) more frequently wanted to be a race car driver; (7) began dating at an earlier age; (8) rated their driving skill at ages 16-17 lower; (9) completed less education; (10) played hooky in high school more often; (11) had their own car with speed and custom accessories more often

EXHIBIT 6

Interview Questions Which Significantly Differentiate Between High and Low Accident Subjects

Old people slow
Do you think most old people drive too slowly? 1. Yes 2. No

Has own motorcycle
Do you have one (motorcycle) now? 1. Yes 2. No

Honk horn
How often do you honk your horn when another car cuts right in front of you? 1. Very often 2. Often 3. Occasionally 4. Seldom 5. Never

Drives sports car
What make, model, and year of car (truck or motorcycle) do you drive most of the time? 0. Others 1. Sports cars and sporty cars such as the AMX, Camaro, Cougar, Mustang, Barracuda, Firebird and Charger

Miles driven 12 months
How many miles did you drive in the past 12 months on public streets and roads? _____ Miles (thousands)

Miles driven life
How many miles have you driven since you started driving?
_____ Miles (thousands)

Cigarettes
How many cigarettes do you smoke a day? _____ Cigarettes

Clubs
How many clubs or organizations do you belong to? _____ Number

Felt like smashing
During the past three months, have you ever gotten so mad you felt like smashing something? 1. Yes 2. No

Student
Are you a student? 1. Full time 2. Part time 3. No

Race car driver
How much would you like to be a race car driver? 1. Very much 2. Much 3. A little 4. Not at all

Took driver training
Did you take on the road training in high school? 1. No 2. Yes

Age began dating
At what age did you begin dating? _____Age

Driving skill 16-17
How would you rate your driving skill when you were 16 to 17 years old? 1. Poor 2. Average 3. Good 4. Very good 5. Excellent

Education
What is the highest grade you completed in school? Code number of years after grade school.

Relations teachers
How well did you get along with your teachers in high school?
1. Very well 2. Quite well 3. Fairly well 4. Not well at all

Play hooky
Did you play hooky in high school? 1. Quite often 2. Only a few times 3. Not at all

EXHIBIT 6 (Continued)

Race car driver 16-17
When you were 16 to 17 years old, how much would you have liked to be a race car driver? 1. Very much 2. Much 3. A little 4. Not at all

Own car 16
When you were 16 or 17 did you have your own car or motorcycle? 1. Yes 2. No

Speed accessories 16-17
Did any of the cars or motorcycles you had when you were 16 or 17 have any speed accessories? 1. Yes 2. No (includes not having a car)

Custom accessories 16-17
Did any of them have any other custom accessories? 1. Yes 2. No (includes not having a car)

Relations parents
When you were 16 to 17 years old, how well did you get along with your parents? 1. Very well 2. Quite well 3. Fairly well 4. Not well at all

Parental approval
Did your parents approve of the group you hung around with when you were a teenager? 1. Yes 2. No

Mothers temper
Did your mother tend to lose her temper easily when you were a child? 1. Yes 2. No

Mother babied
When you were growing up, did your mother tend to baby you more than most other children, about the same as other children, or less than other children? 1. More 2. About the same 3. Less

Time drinking
Over how long a period of time did you have these drinks?
_____ Minutes (Question refers to the last time during the past three months subject drove after drinking. If he had not driven after drinking code 0)

Known marijuana smoker
Have you ever known anyone who smoked marijuana? 1. Yes 2. No

Trouble police after 20
Has any of this trouble (with the police) been since you were 20 years of age or older? 1. Yes 2. No (including never having been in trouble)

Other accidents
Apart from traffic accidents in which you were driving, have you had any other accidents of any kind in which you were injured, not counting minor cuts, burns or bruises? 1. Yes 2. No

Number other accidents
Code number of other accidents, code 0 if no accidents.

Parents restrict
When you were 16 to 17 years old, did your parents ever restrict your driving behavior in any way because you got a ticket, had an accident or for any other reason? 1. Yes 2. No

Parents suspended driving
If subject indicated parents restricted driving, he was asked how.
0. Didn't suspend 1. Suspended driving

EXHIBIT 6 (Continued)

Number traffic accidents
How many traffic accidents have you had? ____ Number

Quasi-reportable accidents
In how many of these ____ accidents was either someone injured or total property damage exceeded one hundred dollars? ___ Number

Cost
What was the total cost to all parties of all ____ accident(s) including property damage, medical expenses, settlements of law suites, etc.? _____ Dollars (hundreds)

At fault accidents
Of these ____ accidents, how many were mostly your fault? ___ Number

Improved
Has having been in an accident affected your driving in any way?
X. No accidents 1. Yes 2. No

Frankness
Did the respondent seem: 1. Frank and honest 2. Evasive or guarded at least occasionally 3. Untruthful (Rated by the interviewer)

DMV problems
Did respondent indicate he thought he might be being interviewed because of poor driving record or other problems with DMV? 1. Yes 2. No (Rated by the interviewer)

Missed stop sign
I have completely missed seeing a stop sign or traffic signal until it was too late to stop. 0. Not me 1. Me

Drove worried
During the past 3 months, I have driven when I was worried.
0. Not me 1. Me

Attended races 16-17
When I was 16-17 years old, I attended a car or motorcycle racing event. 0. Not me 1. Me

Drove think problems 16-17
When I was 16-17 years old, I sometimes would go for a drive alone so I could think about some problem. 0. Not me 1. Me

Drove get away 16-17
When I was 16-17 years old, I sometimes would go for a drive by myself just to get away from other people. 0. Not me 1. Me

Drove cool down 16-17
When I was 16-17 years old, I sometimes went for a drive alone to blow off steam after an argument with someone. 0. Not me 1. Me

Enjoy winding roads 16-17
When I was 16-17 years old, I enjoyed driving on winding roads.
0. Not me 1. Me

Like drive 16-17
When I was 16-17 years old, I liked to drive. 0. Not me 1. Me

Drove recklessly 16-17
When I was 16-17 years old, I drove more recklessly than I should have. 0. Not me 1. Me

TABLE 132

Means and Standard Deviation of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Group | Mean | Standard deviation | r | p |
|---|---|---|---|---|---|
| Convictions 1-4 years..... | L | 2.53 | 2.12 | 0.36 | .00001 |
| | H | 4.35 | 2.59 | | |
| Accidents 1-4 years..... | L | 0.00 | 0.00 | 0.96 | .00000 |
| | H | 3.38 | 0.70 | | |
| License gap 1-4 years..... | L | 39.16 | 124.09 | -0.14 | .05893 |
| | H | 12.08 | 66.67 | | |
| Old people slow..... | L | 1.25 | 0.44 | 0.17 | .01725 |
| | H | 1.41 | 0.49 | | |
| Miles driven 12 months..... | L | 13.95 | 10.85 | 0.19 | .00802 |
| | H | 19.82 | 18.52 | | |
| Miles driven life..... | L | 85.53 | 53.48 | 0.15 | .03162 |
| | H | 109.81 | 97.35 | | |
| Cigarettes..... | L | 6.58 | 10.13 | 0.18 | .01128 |
| | H | 10.87 | 12.99 | | |
| Student..... | L | 2.14 | 0.88 | 0.23 | .00178 |
| | H | 2.53 | 0.78 | | |
| Race car driver..... | L | 2.92 | 1.10 | -0.18 | .01118 |
| | H | 2.49 | 1.18 | | |
| Age began dating..... | L | 15.66 | 1.55 | -0.23 | .00181 |
| | H | 14.96 | 1.43 | | |
| Driving skill 16-17..... | L | 2.75 | 0.94 | -0.18 | .01249 |
| | H | 2.39 | 1.04 | | |
| Education..... | L | 5.65 | 1.86 | -0.21 | .00426 |
| | H | 4.87 | 1.80 | | |
| Play hooky..... | L | 2.25 | 0.73 | -0.17 | .02069 |
| | H | 2.01 | 0.71 | | |
| Race car driver 16-17..... | L | 2.64 | 1.12 | -0.22 | .00311 |
| | H | 2.14 | 1.15 | | |
| Own car 16-17..... | L | 1.40 | 0.49 | -0.16 | .02133 |
| | H | 1.24 | 0.43 | | |
| Speed accessories 16-17.... | L | 1.83 | 0.37 | -0.21 | .00437 |
| | H | 1.65 | 0.48 | | |
| Custom accessories 16-17... | L | 1.71 | 0.46 | -0.18 | .01371 |
| | H | 1.54 | 0.50 | | |
| Relations parents..... | L | 2.15 | 0.96 | 0.16 | .02639 |
| | H | 2.45 | 0.95 | | |
| Parental approval..... | L | 1.21 | 0.41 | 0.20 | .00618 |
| | H | 1.39 | 0.49 | | |
| Mothers temper..... | L | 1.77 | 0.42 | -0.18 | .01051 |
| | H | 1.60 | 0.49 | | |
| Mother babied..... | L | 2.12 | 0.62 | -0.17 | .01670 |
| | H | 1.89 | 0.71 | | |
| Time drinking..... | L | 110.28 | 117.68 | 0.15 | .03587 |
| | H | 149.74 | 142.53 | | |
| Known marijuana smoker..... | L | 1.11 | 0.32 | -0.16 | .02608 |
| | H | 1.03 | 0.18 | | |
| Trouble police after 20.... | L | 1.92 | 0.28 | -0.14 | .04754 |
| | H | 1.82 | 0.39 | | |
| Other accidents..... | L | 1.88 | 0.33 | -0.21 | .00409 |
| | H | 1.71 | 0.46 | | |
| Number other accidents..... | L | 0.23 | 0.76 | 0.17 | .01939 |
| | H | 0.54 | 1.04 | | |
| Parents restrict..... | L | 1.70 | 0.46 | -0.14 | .04283 |
| | H | 1.56 | 0.50 | | |

TABLE 132 (Continued)

Means and Standard Deviation of Variables which Significantly Differentiate Between High and Low Accident Males

| Variable | Group | Mean | Standard deviation | r | p |
|---|---|---|---|---|---|
| Parents suspended driving.. | L | 0.30 | 0.46 | | |
| | H | 0.44 | 0.50 | 0.14 | .04283 |
| Number traffic accidents... | L | 0.88 | 0.93 | | |
| | H | 4.12 | 1.52 | 0.78 | .00000 |
| Quasi-reportable accidents. | L | 0.49 | 0.62 | | |
| | H | 3.07 | 1.40 | 0.77 | .00000 |
| Cost..... | L | 10.55 | 54.59 | | |
| | H | 47.46 | 77.32 | 0.27 | .00041 |
| At fault accidents..... | L | 0.45 | 0.77 | | |
| | H | 1.77 | 1.49 | 0.49 | .00000 |
| Improved..... | L | 1.54 | 0.50 | | |
| | H | 1.19 | 0.39 | -0.36 | .00005 |
| DMV problems..... | L | 1.97 | 0.17 | | |
| | H | 1.87 | 0.33 | -0.18 | .01383 |
| Drove worried..... | L | 0.59 | 0.49 | | |
| | H | 0.80 | 0.40 | 0.22 | .00221 |
| Attended races 16-17..... | L | 0.55 | 0.50 | | |
| | H | 0.69 | 0.46 | 0.15 | .03962 |
| Drove think problems 16-17. | L | 0.38 | 0.49 | | |
| | H | 0.55 | 0.50 | 0.17 | .01591 |
| Drove get away 16-17..... | L | 0.42 | 0.50 | | |
| | H | 0.61 | 0.49 | 0.19 | .00771 |
| Drove winding roads 16-17.. | L | 0.54 | 0.50 | | |
| | H | 0.68 | 0.47 | 0.15 | .04082 |
| Drove recklessly 16-17..... | L | 0.54 | 0.50 | | |
| | H | 0.73 | 0.45 | 0.19 | .00758 |
| Enterprising..... | L | 0.56 | 0.50 | | |
| | H | 0.75 | 0.44 | 0.19 | .00709 |
| Aggressive..... | L | 0.50 | 0.50 | | |
| | H | 0.69 | 0.46 | 0.20 | .00605 |
| Self dissatisfied..... | L | 0.22 | 0.42 | | |
| | H | 0.36 | 0.48 | 0.15 | .03174 |
| Generous..... | L | 0.68 | 0.47 | | |
| | H | 0.83 | 0.38 | 0.18 | .01253 |
| Affectionate..... | L | 0.74 | 0.44 | | |
| | H | 0.86 | 0.35 | 0.15 | .03051 |
| Lively..... | L | 0.71 | 0.46 | | |
| | H | 0.83 | 0.38 | 0.15 | .04075 |
| Adventurous..... | L | 0.71 | 0.46 | | |
| | H | 0.87 | 0.33 | 0.20 | .00504 |
| Sensitive..... | L | 0.70 | 0.46 | | |
| | H | 0.88 | 0.32 | 0.23 | .00184 |
| Emotional..... | L | 0.44 | 0.50 | | |
| | H | 0.58 | 0.50 | 0.14 | .04798 |
| Modest..... | L | 0.49 | 0.50 | | |
| | H | 0.63 | 0.48 | 0.14 | .04554 |
| Sophisticated..... | L | 0.20 | 0.40 | | |
| | H | 0.38 | 0.49 | 0.20 | .00573 |
| Assertive..... | L | 0.54 | 0.50 | | |
| | H | 0.69 | 0.46 | 0.16 | .02773 |
| Tough..... | L | 0.22 | 0.42 | | |
| | H | 0.36 | 0.48 | 0.15 | .03174 |

at ages 16-17; (12) got along less well with their parents at ages 16-17; (13) received less parental approval of the group they hung around with at ages 16-17; (14) had mothers who lost her temper more easily and who babied him more; (15) the last time they drank before driving, they spent more time drinking; (16) more frequently had known someone who smoked marijuana; (17) were more frequently in trouble with the police after age 20; (18) had more injury accidents, not counting auto accidents in which they were driving; (19) more frequently had their parents restrict their driving in some way including suspension; (20) more frequently indicated that having been in an accident had improved their driving; (21) more frequently thought they might be being interviewed because of poor driving record; (22) more frequently drove when worried, attended car races when 16-17, drove to get away from other people when 16-17, enjoyed driving on winding roads when 16-17, and drove recklessly when 16-17; (23) rated themselves (adjective sort) as more enterprising, aggressive, self-dissatisfied, generous, affectionate, lively, adventurous, sensitive, emotional, modest, sophisticated, assertive and tough.

High accident males were characterized by greater social deviancy, higher exposure, greater involvement with cars when a teenager, and more reckless, more emotionally involved driving when a teenager.

Questions about driving recklessly were also asked with reference to the subjects' present driving. The only such items to significantly differentiate between the groups was that the high accident subjects had driven when they were worried more often than the low accident subjects. Several of the items referring to their driving at ages 16-17 differentiated between the groups, such as the high accident subjects rating themselves as having driven more recklessly. Thus, the high and low accident males described their present driving behavior as similar, although the high accident males admitted to worse driving in the past. Although the high accident males reported twice as many accidents in the year previous to the interview (this year was not in the first four years of driving), the difference was not quite statistically significant.

An attempt was made to interpret the adjectives as defining personality types of high accident males. At first examination of the correlation matrix (Table 134) it appeared that there might be two types: (1) those checking self-dissatisfied, sensitive, and emotional; and (2) those checking aggressive, adventurous, and tough. A cross-tabulation of the number of adjectives checked in each of these two sets of adjectives is presented in Table 133. As can be seen, the results were quite contrary to the hypothesis of two personality types. Forty-three subjects checked two or more adjectives from both sets. Smaller numbers of subjects checked items mostly in one or the other set, while the smallest group checked few in either set. The group checking two or more items from each set reminds one of the findings of Brown & Berdie (1960) and Beamish & Malfetti

TABLE 133
Number of Adjectives Checked in the Two Sets for Males

| Number checked from aggressive, adventurous, and tough | Number checked from self-dissatisfied, sensitive and emotional | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | All |
| 0 | [illegible] | 1 | 0 | 3 | 4 |
| 1 | 2 | 5 | 13 | 5 | 25 |
| 2 | 4 | 12 | 14 | 10 | 40 |
| 3 | 1 | 6 | 16 | 3 | 26 |
| All | 7 | 24 | 43 | 21 | 95 |

(1962) that male accident and conviction involvement was correlated with higher scores on the Psychopathic Deviate and Mania scales of the MMPI. The adjectives, as well as the other differences, suggested that high accident males reacted to their problems and difficulties in life by "acting out," and used the auto for that purpose.

The correlation matrix for those variables which significantly differentiated between high and low accident males is presented in Table 134. Most of the correlations among the independent variables were quite low. Accidents 1-4 years and accident group correlated 0.96, so that it mattered little which was used as a criterion measure. Approximately 40 high accident subjects (both sexes) reported fewer accidents (variable: number of traffic accidents) than were on DMV records. For these subjects, the value coded for number of traffic accidents was the number from DMV records. The intercorrelations among the accident variables were fairly high, but accident cost correlated only 0.27 with accident group, indicating they were largely different measures.

The multiple regression equation (discriminant function) predicting accident group from the interview data is presented in Table 135. All regression equations in this chapter selected the variables to enter the equations from the pool of those variables which significantly differentiated between the accident groups for that sex. The multiple R was 0.61, which was probably spuriously high due to screening a large number of variables on a small number of subjects, and would probably shrink considerably upon cross-validation. The equations predicting accident group from the non-driving related variables is presented in Table 136. The R was 0.58, almost identical to the R for all significant variables.

The means and standard deviations for females are presented in Table 137. Compared to low accident females, high accident females: (1) had more convictions; (2) had their own motorcycles more frequently; (3) honked their horns less frequently when someone cut in front of them; (4) drove sport

TABLE 134
Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Convictions 1-4 years | Accidents 1-4 years | License gap 1-4 years | Accident group | Old people slow | Miles driven 12 months | Miles driven life | Cigarettes | Student | Race car driver | Age began dating | Driving skill 16-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 years..... | 100 | | | | | | | | | | | |
| Accidents 1-4 years..... | 37 | 100 | | | | | | | | | | |
| License gap 1-4 years..... | -00 | -12 | 100 | | | | | | | | | |
| Accident group..... | 36 | 96 | -14 | 100 | | | | | | | | |
| Old people slow..... | 09 | 17 | -12 | 17 | 100 | | | | | | | |
| Miles driven 12 months..... | 13 | 20 | -10 | 19 | 13 | 100 | | | | | | |
| Miles driven life..... | 10 | 16 | -07 | 15 | 09 | 55 | 100 | | | | | |
| Cigarettes..... | 07 | 19 | 12 | 18 | -04 | 02 | 07 | 100 | | | | |
| Student..... | 14 | 20 | 05 | 23 | -14 | 10 | 12 | 09 | 100 | | | |
| Race car driver..... | -11 | -20 | 05 | -18 | 07 | -08 | -05 | -15 | -10 | 100 | | |
| Age began dating..... | -19 | -21 | 00 | -23 | -00 | -10 | -07 | -06 | -09 | -01 | 100 | |
| Driving skill 16-17..... | -17 | -19 | -03 | -18 | -14 | 02 | 10 | -10 | -10 | -05 | 04 | 100 |
| Education..... | -34 | -21 | -22 | -21 | -00 | -07 | -04 | -21 | -38 | 19 | 14 | 21 |
| Play hooky..... | -19 | -16 | -11 | -17 | -03 | -10 | -02 | -09 | -04 | 20 | 15 | 07 |
| Race car driver 16-17..... | -18 | -20 | -05 | -22 | -03 | -10 | 03 | -13 | -12 | 63 | 08 | -02 |
| Own car 16-17..... | -06 | -17 | -10 | -16 | -05 | 14 | -11 | -02 | -04 | 10 | 16 | -10 |
| Speed accessories 16-17.... | -16 | -17 | -03 | -21 | -02 | -13 | -20 | 02 | -11 | 11 | 10 | -05 |
| Custom accessories 16-17... | -09 | -16 | 02 | -18 | -07 | -01 | -12 | -06 | -09 | 12 | 13 | -05 |
| Relations parents..... | 19 | 19 | 14 | 16 | 15 | 08 | -08 | -00 | -03 | -00 | -11 | -18 |
| Parental approval..... | 23 | 22 | 05 | 20 | 05 | 09 | -03 | 12 | 07 | -11 | -09 | -13 |
| Mothers temper..... | -23 | -23 | -00 | -18 | -00 | -04 | 07 | -09 | -03 | 07 | 16 | -01 |
| Mother babied..... | -05 | -17 | 01 | -17 | 02 | 16 | 04 | 12 | 00 | 07 | -00 | 02 |
| Time drinking..... | 10 | 16 | 10 | 15 | 00 | -01 | 02 | 19 | -04 | -11 | -04 | -06 |
| Known marijuana smoker..... | -07 | -13 | -03 | -16 | -03 | -06 | -05 | -17 | 10 | 16 | 09 | 12 |
| Trouble police after 20.... | -12 | -11 | -12 | -14 | -02 | -02 | -01 | -13 | -05 | 12 | 08 | 10 |

Note.--Correlations of ± .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 134 (Continued)

Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Education | Play hooky | Race car driver 16-17 | Own car 16-17 | Speed accessories 16-17 | Custom accessories 16-17 | Relations parents | Parental approval | Mothers temper | Mother babied | Time drinking | Known marijuana smoker | Trouble police after 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 years..... | | | | | | | | | | | | | |
| Accidents 1-4 years..... | | | | | | | | | | | | | |
| License gap 1-4 years..... | | | | | | | | | | | | | |
| Accident group..... | | | | | | | | | | | | | |
| Old people slow..... | | | | | | | | | | | | | |
| Miles driven 12 months..... | | | | | | | | | | | | | |
| Miles driven life..... | | | | | | | | | | | | | |
| Cigarettes..... | | | | | | | | | | | | | |
| Student..... | | | | | | | | | | | | | |
| Race car driver..... | | | | | | | | | | | | | |
| Age began dating..... | | | | | | | | | | | | | |
| Driving skill 16-17..... | | | | | | | | | | | | | |
| Education..... | 100 | | | | | | | | | | | | |
| Play hooky..... | 32 | 100 | | | | | | | | | | | |
| Race car driver 16-17..... | 24 | 32 | 100 | | | | | | | | | | |
| Own car 16-17..... | 12 | 17 | 23 | 100 | | | | | | | | | |
| Speed accessories 16-17.... | 04 | 26 | 27 | 40 | 100 | | | | | | | | |
| Custom accessories 16-17... | 05 | 13 | 24 | 53 | 48 | 100 | | | | | | | |
| Relations parents..... | -15 | -16 | -07 | -14 | -12 | -11 | 100 | | | | | | |
| Parental approval..... | -19 | -26 | -13 | -05 | -11 | -08 | 40 | 100 | | | | | |
| Mothers temper..... | 13 | 14 | 04 | 00 | -01 | -04 | -30 | -27 | 100 | | | | |
| Mother babied..... | -10 | 06 | 12 | -03 | 03 | 04 | 03 | -03 | 01 | 100 | | | |
| Time drinking..... | -09 | -11 | -09 | -06 | 03 | -02 | 03 | 08 | -01 | -02 | 100 | | |
| Known marijuana smoker..... | -07 | 14 | 22 | 07 | 12 | 05 | -05 | -14 | 06 | -00 | -19 | 100 | |
| Trouble police after 20.... | 11 | 22 | 08 | -03 | 09 | 02 | -07 | -12 | 04 | 01 | -11 | 11 | 100 |

Note.--Correlations of $\pm$ .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 134 (Continued)

Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Convictions 1-4 years | Accidents 1-4 years | License gap 1-4 years | Accident group | Old people slow | Miles driven 12 months | Miles driven life | Cigarettes | Student | Race car driver | Age began dating | Driving skill 16-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other accidents..... | -00 | -20 | 09 | -21 | -05 | -13 | -01 | -02 | 03 | 04 | 05 | -00 |
| Number other accidents..... | -04 | 15 | -09 | 17 | 01 | 10 | -00 | 09 | -07 | -06 | -08 | 06 |
| Number traffic accidents... | 32 | 81 | -11 | 78 | 12 | 23 | 19 | 24 | 20 | -21 | -15 | -21 |
| Quasi-reportable accidents. | 28 | 82 | -15 | 77 | 14 | 27 | 16 | 20 | 17 | -17 | -15 | -23 |
| Cost..... | 14 | 25 | 07 | 27 | -04 | 07 | -02 | 24 | 12 | -21 | -05 | -18 |
| At fault accidents..... | 35 | 51 | -06 | 49 | 01 | 14 | 03 | 29 | 23 | -16 | -16 | -21 |
| Drove worried..... | 17 | 24 | -06 | 22 | 00 | 15 | 06 | 13 | 06 | -03 | 01 | 02 |
| Attended races 16-17..... | 07 | 10 | 03 | 15 | 04 | 11 | 08 | 07 | -04 | -25 | -12 | 00 |
| Drove think problems 16-17. | 07 | 18 | 01 | 17 | -13 | 04 | -02 | 18 | 15 | -25 | -05 | -09 |
| Drove get away 16-17..... | -01 | 19 | 09 | 19 | -03 | 03 | -06 | 20 | 12 | -33 | -06 | -05 |
| Drove winding roads 16-17.. | 15 | 11 | 07 | 15 | 03 | -01 | -07 | 03 | -17 | -18 | -04 | 00 |
| Drove recklessly 16-17..... | 22 | 17 | 01 | 19 | 09 | 11 | 05 | 12 | 12 | -13 | -09 | -14 |
| Enterprising..... | 08 | 20 | -05 | 19 | -03 | 03 | -08 | -02 | -11 | -01 | -11 | -00 |
| Aggressive..... | 17 | 19 | -05 | 20 | -04 | 01 | 02 | 14 | 09 | -15 | -17 | 08 |
| Self dissatisfied..... | 09 | 17 | -03 | 15 | 12 | -03 | -03 | 11 | 05 | -01 | -02 | -14 |
| Generous..... | 00 | 17 | -02 | 18 | -01 | 01 | 08 | 06 | 12 | -05 | -10 | 01 |
| Affectionate..... | 19 | 17 | -06 | 15 | 04 | 01 | 08 | 09 | 16 | 02 | -11 | -03 |
| Lively..... | 19 | 16 | -08 | 15 | -01 | 02 | 06 | 09 | 02 | -10 | -04 | -12 |
| Adventurous..... | 14 | 17 | -03 | 20 | -05 | 03 | 07 | 08 | -06 | -22 | -14 | -10 |
| Sensitive..... | 05 | 19 | -04 | 23 | 06 | -00 | -17 | -02 | -07 | -02 | -05 | -00 |
| Emotional..... | 07 | 13 | -06 | 14 | -02 | -01 | -02 | 09 | 16 | -08 | -10 | -05 |
| Modest..... | 04 | 15 | -06 | 14 | 02 | 04 | 07 | 00 | 11 | -09 | -07 | -11 |
| Sophisticated..... | 04 | 21 | -03 | 20 | 02 | 08 | 18 | 06 | 13 | -14 | 03 | 05 |
| Assertive..... | 22 | 18 | 05 | 16 | 07 | -03 | -04 | 10 | 05 | -08 | -22 | -01 |
| Tough..... | 16 | 13 | -07 | 15 | -03 | -09 | -04 | 01 | 13 | 02 | -08 | -11 |

Note.--Correlations of $\pm$ .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 134 (Continued)
Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Variable | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Education | Play hooky | Race car driver 16-17 | Own car 16-17 | Speed accessories 16-17 | Custom accessories 16-17 | Relations parents | Parental approval | Mothers temper | Mother babied | Time drinking | Known marijuana smoker | Trouble police after 20 |
| Other accidents..... | -07 | 20 | 08 | 05 | 14 | 13 | -07 | -06 | 12 | -05 | -02 | 05 | 14 |
| Number other accidents..... | 10 | -10 | -12 | -10 | -16 | -15 | 06 | 09 | -12 | 05 | 04 | -07 | -08 |
| Number traffic accidents... | -17 | -13 | -23 | -10 | -18 | -16 | 09 | 24 | -17 | -12 | 20 | -16 | -18 |
| Quasi-reportable accidents. | -13 | -17 | -17 | -11 | -16 | -10 | 12 | 20 | -17 | -08 | 13 | -15 | -17 |
| Cost..... | -22 | -20 | -21 | 05 | -11 | -02 | 04 | 18 | -04 | -01 | 12 | -06 | -15 |
| At fault accidents..... | -16 | -12 | -16 | -05 | -19 | -08 | 04 | 16 | -09 | -02 | 24 | -11 | -19 |
| Drove worried..... | -03 | -10 | 01 | -04 | -15 | -09 | 13 | 03 | -05 | -01 | -01 | 01 | -09 |
| Attended races 16-17..... | -09 | -26 | -39 | -16 | -26 | -32 | 06 | 11 | 08 | 04 | 15 | -15 | -08 |
| Drove think problems 16-17. | -11 | -11 | -21 | -16 | -15 | -17 | 05 | 09 | -10 | -09 | -03 | -10 | -05 |
| Drove get away 16-17..... | -13 | -13 | -33 | -16 | -12 | -24 | 13 | 13 | -12 | -17 | 07 | -13 | -13 |
| Drove winding roads 16-17.. | 07 | -08 | -36 | -05 | -15 | -09 | -04 | 10 | 04 | -15 | 17 | -23 | -09 |
| Drove recklessly 16-17..... | -13 | -18 | -25 | -22 | -20 | -28 | 22 | 19 | -02 | -09 | 11 | -08 | -07 |
| Enterprising..... | 09 | 09 | -10 | -05 | -02 | -07 | -09 | -01 | -04 | -09 | -05 | -01 | 04 |
| Aggressive..... | -07 | -01 | -23 | -12 | -12 | -11 | 04 | 02 | -00 | -07 | 06 | -14 | 03 |
| Self dissatisfied..... | -05 | -00 | -01 | -01 | 03 | -10 | 21 | 09 | -14 | 08 | 02 | -00 | -1[illegible] |
| Generous..... | -04 | 00 | 04 | -10 | 05 | 01 | -06 | 08 | -10 | -05 | -00 | 07 | -08 |
| Affectionate..... | -10 | -04 | -00 | 00 | 04 | 02 | 00 | 12 | -05 | -09 | 10 | -11 | 04 |
| Lively..... | -04 | -00 | -12 | 00 | 05 | -01 | -06 | 03 | -02 | -07 | 11 | -08 | -06 |
| Adventurous..... | -03 | -16 | -25 | -17 | -18 | -21 | -07 | -03 | 01 | -15 | 14 | -20 | -1[illegible] |
| Sensitive..... | 11 | -05 | -11 | -06 | 05 | -00 | 05 | 03 | -10 | -03 | 11 | -25 | -12 |
| Emotional..... | -06 | -11 | -10 | -09 | -03 | -03 | 08 | 09 | -03 | -06 | 03 | -04 | -16 |
| Modest..... | -15 | -00 | 10 | 06 | 03 | 07 | -08 | 09 | -10 | -02 | -07 | 01 | -06 |
| Sophisticated..... | 10 | 12 | 01 | -09 | 03 | -05 | -11 | 09 | 08 | -01 | -02 | -09 | 08 |
| Assertive..... | -15 | -05 | -13 | -02 | 03 | -06 | 02 | 11 | -04 | 04 | 16 | -11 | 11 |
| Tough..... | -08 | 01 | -02 | -04 | -08 | -15 | -03 | 09 | -07 | -06 | 11 | 04 | -13 |

Note.--Correlations of ± .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 134 (Continued)
Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Other accidents | Number other accidents | Number traffic accidents | Quasi-reportable accidents | Cost | At fault accidents | Drove worried | Attended races 16-17 | Drove think problems 16-17 | Drove get away 16-17 | Drove winding roads 16-17 | Drove recklessly 16-17 | Enterprising |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other accidents | 100 | | | | | | | | | | | | |
| Number other accidents | -81 | 100 | | | | | | | | | | | |
| Number traffic accidents | -16 | 12 | 100 | | | | | | | | | | |
| Quasi-reportable accidents | -22 | 16 | 88 | 100 | | | | | | | | | |
| Cost | -12 | 09 | 32 | 33 | 100 | | | | | | | | |
| At fault accidents | -10 | 04 | 68 | 62 | 33 | 100 | | | | | | | |
| Drove worried | -14 | 11 | 24 | 26 | 17 | 17 | 100 | | | | | | |
| Attended races 16-17 | -13 | 14 | 18 | 14 | 07 | 07 | 07 | 100 | | | | | |
| Drove think problems 16-17 | -09 | 07 | 24 | 22 | 24 | 23 | 20 | 16 | 100 | | | | |
| Drove get away 16-17 | -14 | 12 | 26 | 20 | 18 | 19 | 06 | 19 | 63 | 100 | | | |
| Drove winding roads 16-17 | -04 | 12 | 16 | 10 | 13 | 05 | 08 | 31 | 20 | 26 | 100 | | |
| Drove recklessly 16-17 | -10 | 13 | 23 | 20 | 18 | 24 | 14 | 15 | 29 | 30 | 33 | 100 | |
| Enterprising | -16 | 17 | 23 | 22 | -02 | 10 | -07 | 05 | 01 | 06 | 17 | -03 | 100 |
| Aggressive | -06 | 09 | 17 | 15 | 07 | 15 | -08 | 11 | 22 | 16 | 11 | 15 | 13 |
| Self dissatisfied | -07 | -00 | 15 | 14 | 08 | 06 | 19 | -15 | 08 | 13 | -02 | 10 | -17 |
| Generous | 00 | 04 | 18 | 13 | -10 | 08 | 02 | 01 | 14 | 08 | -06 | -06 | 17 |
| Affectionate | 00 | -04 | 11 | 06 | -04 | 03 | 07 | -04 | 09 | -04 | 03 | 08 | -03 |
| Lively | 05 | -06 | 16 | 13 | 03 | 10 | -06 | 06 | 08 | 01 | 08 | 05 | 20 |
| Adventurous | -08 | 09 | 14 | 11 | 04 | 13 | 02 | 26 | 17 | 12 | 20 | 01 | 19 |
| Sensitive | -01 | -04 | 14 | 14 | 09 | 12 | 14 | -00 | 04 | -01 | 07 | 09 | 03 |
| Emotional | -02 | -07 | 19 | 17 | 12 | 13 | 12 | 01 | 22 | 19 | -07 | 10 | -12 |
| Modest | -04 | -04 | 16 | 16 | 10 | 09 | 29 | -01 | 10 | 02 | -03 | -17 | -02 |
| Sophisticated | -04 | -00 | 23 | 25 | 04 | 11 | 17 | -01 | 08 | 04 | -02 | -07 | 17 |
| Assertive | -17 | 19 | 14 | 11 | 04 | 10 | 02 | 01 | 10 | 10 | 13 | 03 | 22 |
| Tough | -13 | 13 | 12 | 12 | 06 | 06 | 04 | 18 | 06 | 09 | 03 | 03 | 17 |

Note.--Correlations of ± .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 134 (Continued)

Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Males

| Variable | Variable | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aggressive | Self dissatisfied | Generous | Affectionate | Lively | Adventurous | Sensitive | Emotional | Modest | Sophisticated | Assertive | Tough |
| Other accidents..... | | | | | | | | | | | | |
| Number other accidents..... | | | | | | | | | | | | |
| Number traffic accidents... | | | | | | | | | | | | |
| Quasi-reportable accidents. | | | | | | | | | | | | |
| Cost..... | | | | | | | | | | | | |
| At fault accidents..... | | | | | | | | | | | | |
| Drove worried..... | | | | | | | | | | | | |
| Attended races 16-17..... | | | | | | | | | | | | |
| Drove think problems 16-17. | | | | | | | | | | | | |
| Drove get away 16-17..... | | | | | | | | | | | | |
| Drove winding roads 16-17.. | | | | | | | | | | | | |
| Drove recklessly 16-17..... | | | | | | | | | | | | |
| Enterprising..... | | | | | | | | | | | | |
| Aggressive..... | 100 | | | | | | | | | | | |
| Self dissatisfied..... | -07 | 100 | | | | | | | | | | |
| Generous..... | 05 | -01 | 100 | | | | | | | | | |
| Affectionate..... | 10 | 06 | 20 | 100 | | | | | | | | |
| Lively..... | 29 | -06 | 18 | 26 | 100 | | | | | | | |
| Adventurous..... | 29 | -07 | 27 | 10 | 27 | 100 | | | | | | |
| Sensitive..... | -11 | 19 | 06 | 19 | 02 | 05 | 100 | | | | | |
| Emotional..... | 04 | 21 | -00 | 17 | -02 | -04 | 07 | 100 | | | | |
| Modest..... | -19 | 05 | 16 | 17 | -11 | 04 | 06 | 08 | 100 | | | |
| Sophisticated..... | 07 | -02 | 23 | 11 | 02 | 04 | 04 | 02 | 19 | 100 | | |
| Assertive..... | 21 | -02 | 10 | 17 | 08 | 12 | 02 | -06 | 02 | 14 | 100 | |
| Tough..... | 24 | -02 | 01 | -06 | 16 | 19 | -10 | 07 | 03 | -02 | 02 | 100 |

Note.--Correlations of $\pm$ .14 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 135

Regression Equations (Beta Coefficients) for Predicting Accident Group From Interview Data for Males

| Sex | Equation |
|---|---|
| Male | |
| | Accident group = 0.24 Student +0.22 Sensitive +0.19 Enterprising +0.18 Old people slow +0.14 Drove worried +0.12 Parental approval -0.14 Age began dating -0.18 Mother babied -0.14 Other accidents +0.14 Cigarettes +0.14 Miles driven life |

TABLE 136

Regression Equations (Beta Coefficients) for Predicting Accident Group from Non-Driving Interview Data for Males

| Sex | Equation |
|---|---|
| Male | |
| | Accident group = 0.14 Cigarettes +0.17 Student -0.14 Age began dating -0.16 Education +0.14 Relations parents -0.20 Mother babied -0.18 Other accidents +0.15 Enterprising +0.23 Sensitive +0.16 Sophisticated |

cars more frequently; (5) drove more miles in their lifetime; (6) belonged to more clubs; (7) felt like smashing things less frequently; (8) took behind-the-wheel driver training less frequently; (9) had poorer relations with their teachers in high school; (10) played hooky more often in high school; (11) received less parental approval of their friends; (12) had their parents restrict and suspend their driving more frequently; (13) improved their driving more because they had been in an accident; (14) appeared to the interviewer to be less frank and honest; (15) more frequently reported missing seeing a stop sign until it was too late; (16) when 16-17 years of age more frequently attended car races , drove to think about problems, drove to get away from other people; drove to cool down after an argument with someone, enjoyed driving on winding roads, liked to drive, and admitted driving recklessly; and (17) described themselves as more conventional, persevering, polished, self-controlled, friendly, decisive, orderly, sophisticated, and less frank.

TABLE 137

Means and Standard Deviation of Variables Which Significantly Differentiate Between High and Low Accident Females

| Variable | Group | Mean | Standard deviation | r | p |
|---|---|---|---|---|---|
| Convictions 1-4 years..... | L | 0.73 | 1.00 | | |
| | H | 1.63 | 1.56 | 0.32 | .00001 |
| Accidents 1-4 years..... | L | 0.00 | 0.00 | | |
| | H | 2.19 | 0.51 | 0.94 | .00000 |
| Has own motorcycle..... | L | 1.99 | 0.09 | | |
| | H | 1.94 | 0.23 | -0.13 | .04026 |
| Honk horn..... | L | 3.36 | 1.23 | | |
| | H | 3.74 | 1.05 | 0.16 | .00906 |
| Drives sports car..... | L | 0.13 | 0.33 | | |
| | H | 0.25 | 0.43 | 0.15 | .01426 |
| Miles driven life..... | L | 38.34 | 30.50 | | |
| | H | 49.85 | 38.12 | 0.16 | .00982 |
| Clubs..... | L | 0.53 | 0.92 | | |
| | H | 0.84 | 1.34 | 0.13 | .03459 |
| Felt like smashing..... | L | 1.43 | 0.50 | | |
| | H | 1.57 | 0.50 | 0.13 | .03140 |
| Took driver training..... | L | 1.65 | 0.48 | | |
| | H | 1.52 | 0.50 | -0.12 | .04545 |
| Relations teachers..... | L | 1.57 | 0.76 | | |
| | H | 1.84 | 0.79 | 0.18 | .00548 |
| Play booky..... | L | 2.57 | 0.58 | | |
| | H | 2.37 | 0.67 | -0.15 | .01335 |
| Parental approval..... | L | 1.06 | 0.24 | | |
| | H | 1.21 | 0.41 | 0.20 | .00164 |
| Parents restrict..... | L | 1.90 | 0.30 | | |
| | H | 1.72 | 0.45 | -0.22 | .00071 |
| Suspended driving..... | L | 0.10 | 0.30 | | |
| | H | 0.28 | 0.45 | 0.22 | .00071 |
| Number traffic accidents... | L | 0.42 | 0.68 | | |
| | H | 2.51 | 0.92 | 0.78 | .00000 |
| Quasi-reportable accidents. | L | 0.14 | 0.35 | | |
| | H | 1.74 | 0.87 | 0.76 | .00000 |
| Cost..... | L | 1.26 | 3.48 | | |
| | H | 26.62 | 87.16 | 0.19 | .00283 |
| At fault accidents..... | L | 0.20 | 0.42 | | |
| | H | 0.97 | 0.84 | 0.49 | .00000 |
| Improved..... | L | 1.53 | 0.51 | | |
| | H | 1.27 | 0.45 | -0.22 | .00343 |

TABLE 137 (Continued)

Means and Standard Deviation of Variables Which Significantly Differentiate Between High and Low Accident Females

| Variable | Group | Mean | Standard deviation | r | p |
|---|---|---|---|---|---|
| Frankness | L | 1.06 | 0.24 | | |
| | H | 1.15 | 0.38 | 0.13 | .03605 |
| Missed stop sign | L | 0.27 | 0.45 | | |
| | H | 0.40 | 0.49 | 0.14 | .02476 |
| Attended races 16-17 | L | 0.30 | 0.46 | | |
| | H | 0.48 | 0.50 | 0.19 | .00319 |
| Driven think problem 16-17 | L | 0.19 | 0.39 | | |
| | H | 0.42 | 0.50 | 0.24 | .00025 |
| Drove get away 16-17 | L | 0.30 | 0.46 | | |
| | H | 0.45 | 0.50 | 0.16 | .01074 |
| Drove cool down 16-17 | L | 0.12 | 0.32 | | |
| | H | 0.23 | 0.42 | 0.15 | .01611 |
| Enjoy winding roads 16-17 | L | 0.14 | 0.35 | | |
| | H | 0.32 | 0.47 | 0.20 | .00160 |
| Like drive 16-17 | L | 0.91 | 0.29 | | |
| | H | 0.97 | 0.17 | 0.13 | .03169 |
| Drove recklessly 16-17 | L | 0.28 | 0.45 | | |
| | H | 0.52 | 0.50 | 0.24 | .00030 |
| Conventional | L | 0.42 | 0.50 | | |
| | H | 0.55 | 0.50 | 0.13 | .03847 |
| Persevering | L | 0.48 | 0.50 | | |
| | H | 0.62 | 0.49 | 0.15 | .01876 |
| Polished | L | 0.14 | 0.34 | | |
| | H | 0.28 | 0.45 | 0.18 | .00473 |
| Frank | L | 0.84 | 0.37 | | |
| | H | 0.72 | 0.45 | -0.14 | .02923 |
| Self controlled | L | 0.70 | 0.46 | | |
| | H | 0.82 | 0.39 | 0.13 | .03351 |
| Friendly | L | 0.90 | 0.30 | | |
| | H | 0.96 | 0.19 | 0.13 | .03741 |
| Decisive | L | 0.49 | 0.50 | | |
| | H | 0.67 | 0.47 | 0.19 | .00295 |
| Orderly | L | 0.62 | 0.49 | | |
| | H | 0.74 | 0.44 | 0.12 | .04619 |
| Sophisticated | L | 0.14 | 0.35 | | |
| | H | 0.27 | 0.45 | 0.15 | .01519 |
| License gap 1-4 years | L | 31.96 | 113.41 | | |
| | H | 14.91 | 59.95 | -0.10 | .12222 |

With the exception of the adjective self-description, the results were similar to those for males, although there were fewer significant differences for females. The only adjective both sexes used to describe themselves was "sophisticated." High accident females described themselves rather favorably. It is interesting that both the subjects themselves, as well as the interviewers, rated the high accident females as being less frank than the low accident females.

The correlation matrix is presented in Table 138. The results were similar to those for males.

The multiple regression equation predicting accident group is presented in Table 139. The R was 0.54. The equation using only non-driving predictors is presented in Table 140. The R was 0.41 which is considerably lower than that for the preceding equation.

In summary, the results provide some support for the stereotype of the reckless teen age driver, whose driving improves after a few years experience.

## Drugs

In this section will be presented data on the responses to items dealing with marijuana and alcohol.

The question was asked, "Have you ever known anyone who smoked marijuana?" Eighty-six percent responded that they had. The 86 percent were further asked, "Did they ever describe any effect or lack of effect of smoking marijuana on their driving?" Forty-two percent (160 subjects) reported an effect. The responses of these 160 subjects were classified according to the type of effect. The percentage of these 160 subjects who mentioned each type of effect is presented in Table 141. Subjects could be counted in more than one category, so the total percent does not add to 100. Slowed reactions, spatial distortions, and time and speed distortions were the most common reported effects of smoking marijuana on driving.

The question was asked, "During the past three months have you ever driven after you had been drinking?" Seventy-one percent of the males and 32 percent of the females answered yes. The question was then asked of those who had drunk before driving, "The last time you did, how many drinks did you have?" The average number was 4.93 for males and 2.57 for females. The last question was "Over how long a period did you have these drinks?" The averages were 199 minutes for males and 184 minutes for females. These results indicated that males averaged a higher blood alcohol concentration when driving than females.

TABLE 138

Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Females

| Variable | Convictions 1-4 years | Accidents 1-4 years | License gap 1-4 years | Accident group | Has own motorcycle | Honk horn | Drives hot car | Miles driven life | Clubs | Felt like smashing | Took driver training | Relations teachers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 years..... | 100 | | | | | | | | | | | |
| Accidents 1-4 years..... | 30 | 100 | | | | | | | | | | |
| License gap 1-4 years..... | -03 | -10 | 100 | | | | | | | | | |
| Accident group..... | 32 | 24 | -10 | 100 | | | | | | | | |
| Has own motorcycle..... | -04 | -15 | 01 | -13 | 100 | | | | | | | |
| Honk horn..... | 03 | 16 | -06 | 16 | -07 | 100 | | | | | | |
| Drives hot car..... | 00 | 21 | -01 | 15 | -07 | 00 | 100 | | | | | |
| Miles driven life..... | 31 | 18 | 01 | 16 | -01 | -03 | 07 | 100 | | | | |
| Clubs..... | 11 | 10 | -06 | 13 | -03 | -05 | 02 | 11 | 100 | | | |
| Felt like smashing..... | -03 | 12 | 04 | 13 | -06 | 08 | -04 | -03 | 02 | 100 | | |
| Took driver training..... | -10 | -11 | -08 | -12 | -12 | -01 | 01 | -05 | -06 | 08 | 100 | |
| Relations teachers..... | 11 | 17 | 04 | 18 | -01 | 07 | -06 | 09 | -05 | -14 | -13 | 100 |
| Play hooky..... | -26 | -16 | -10 | -15 | -03 | 13 | 03 | -15 | 07 | 14 | 11 | -32 |
| Parental approval..... | 17 | 22 | 03 | 20 | 02 | -02 | 00 | 22 | -13 | -05 | -07 | 30 |
| Number traffic accidents... | 25 | 83 | -12 | 78 | -12 | 10 | 11 | 16 | 08 | 12 | -12 | 15 |
| Quasi-reportable accidents. | 26 | 79 | -10 | 76 | -22 | 11 | 19 | 13 | 06 | 09 | -02 | 11 |
| Cost..... | 09 | 17 | -04 | 19 | -01 | -14 | 01 | 07 | -05 | -06 | 04 | 05 |
| At fault accidents..... | 24 | 57 | -08 | 49 | -06 | 09 | 06 | 04 | 06 | 00 | -05 | 08 |
| Missed stop sign..... | 10 | 14 | -03 | 14 | 05 | 02 | 02 | 09 | 03 | 03 | -04 | 18 |
| Attended races 16-17..... | 14 | 16 | 10 | 19 | -02 | -01 | 07 | 18 | 03 | -07 | -11 | 15 |
| Driven think problem 16-17. | 18 | 25 | -03 | 24 | -01 | 00 | 03 | 10 | 03 | -08 | -04 | 08 |
| Drove get away 16-17..... | 22 | 18 | 05 | 16 | -02 | 07 | 05 | 13 | -05 | -17 | -07 | 13 |
| Drove cool down 16-17..... | 06 | 16 | -01 | 15 | 09 | -05 | 00 | 03 | 08 | -07 | -06 | 04 |
| Enjoy winding roads 16-17.. | 16 | 23 | 00 | 20 | -19 | 09 | 05 | 18 | -05 | -15 | -01 | 13 |
| Like drive 16-17..... | 06 | 14 | -06 | 13 | -05 | -03 | 08 | 08 | -00 | -20 | 04 | 07 |
| Drove recklessly 16-17..... | 18 | 26 | -02 | 24 | -06 | 04 | 08 | 09 | 00 | -06 | -04 | 20 |
| Conventional..... | 00 | 13 | -04 | 13 | -07 | -00 | 05 | -03 | 02 | 09 | 06 | -04 |
| Persevering..... | 06 | 15 | -02 | 15 | -13 | 05 | -01 | 06 | 01 | 07 | 05 | 03 |
| Polished..... | 04 | 15 | -03 | 18 | 10 | -05 | 10 | 01 | 16 | 04 | -17 | -12 |
| Frank..... | -11 | -11 | 12 | -14 | -05 | 01 | 03 | -08 | 05 | -06 | 00 | 07 |
| Self controlled..... | 03 | 14 | -01 | 13 | 05 | 09 | -04 | 07 | 04 | 15 | -03 | -14 |
| Friendly..... | 07 | 12 | -00 | 13 | 04 | 03 | 05 | 02 | -12 | 13 | 01 | 01 |
| Decisive..... | 10 | 19 | -03 | 19 | -07 | -01 | 04 | 08 | 16 | -04 | 01 | 03 |
| Orderly..... | -02 | 11 | 03 | 12 | 01 | 09 | 03 | -03 | -07 | 12 | -09 | 04 |
| Sophisticated..... | 06 | 17 | 00 | 15 | 10 | 02 | 11 | 02 | 05 | -01 | -12 | -06 |

Note.--Correlations of $\pm$ .12 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 138 (Continued)

Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Females

| Variable | Play hooky | Parental approval | Number traffic accidents | Quasi-reportable accidents | Cost | At fault accidents | Missed stop sign | Attended races 16-17 | Driven think problem 16-17 | Drove get away 16-17 | Drove cool down 16-17 | Enjoy winding roads 16-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Convictions 1-4 years | | | | | | | | | | | | |
| Accidents 1-4 years | | | | | | | | | | | | |
| License gap 1-4 years | | | | | | | | | | | | |
| Accident group | | | | | | | | | | | | |
| Has own motorcycle | | | | | | | | | | | | |
| Honk horn | | | | | | | | | | | | |
| Drives hot car | | | | | | | | | | | | |
| Miles driven life | | | | | | | | | | | | |
| Clubs | | | | | | | | | | | | |
| Felt like smashing | | | | | | | | | | | | |
| Took driver training | | | | | | | | | | | | |
| Relations teachers | | | | | | | | | | | | |
| Play hooky | 100 | | | | | | | | | | | |
| Parental approval | -40 | 100 | | | | | | | | | | |
| Number traffic accidents | -07 | 19 | 100 | | | | | | | | | |
| Quasi-reportable accidents | -07 | 25 | 77 | 100 | | | | | | | | |
| Cost | -09 | 05 | 14 | 21 | 100 | | | | | | | |
| At fault accidents | -02 | 09 | 66 | 51 | 14 | 100 | | | | | | |
| Missed stop sign | -01 | 06 | 11 | 05 | -02 | 09 | 100 | | | | | |
| Attended races 16-17 | -27 | 18 | 13 | 14 | 00 | 10 | 05 | 100 | | | | |
| Driven think problem 16-17 | -10 | 04 | 18 | 29 | -00 | 10 | 02 | 09 | 100 | | | |
| Drove get away 16-17 | -14 | 03 | 11 | 17 | -03 | 11 | 03 | 17 | 60 | 100 | | |
| Drove cool down 16-17 | -13 | 10 | 11 | 12 | -01 | 13 | 00 | 14 | 45 | 37 | 100 | |
| Enjoy winding roads 16-17 | -16 | 14 | 17 | 20 | -03 | 12 | 08 | 12 | 27 | 26 | 14 | 100 |
| Like drive 16-17 | -15 | 10 | 16 | 16 | 05 | 08 | 03 | 13 | 13 | 16 | 07 | 10 |
| Drove recklessly 16-17 | -30 | 21 | 20 | 26 | 08 | 16 | 04 | 30 | 19 | 23 | 27 | 22 |
| Conventional | -05 | -04 | 08 | 07 | 05 | 07 | 03 | 11 | 04 | -00 | -02 | -10 |
| Persevering | -00 | 02 | 11 | 11 | 06 | 11 | 01 | -12 | -01 | -05 | -02 | -00 |
| Polished | -05 | 00 | 16 | 13 | 02 | 06 | -04 | 02 | 09 | -00 | 07 | 06 |
| Frank | -03 | -05 | -13 | -11 | -02 | -02 | -03 | -02 | -04 | 02 | 01 | 08 |
| Self controlled | 13 | 04 | 08 | 03 | 03 | 05 | 01 | -06 | -01 | -02 | -05 | 01 |
| Friendly | -02 | 06 | 12 | 07 | 03 | 11 | -02 | 11 | -03 | 01 | -00 | -00 |
| Decisive | -10 | 11 | 17 | 18 | 05 | 14 | 04 | 05 | 12 | 08 | 04 | 09 |
| Orderly | -04 | 10 | 14 | 10 | 07 | 04 | -07 | 08 | -05 | -08 | -10 | -04 |
| Sophisticated | -09 | 04 | 17 | 10 | -03 | 08 | +03 | 01 | 14 | 12 | 00 | -00 |

Note.--Correlations of $\pm$ .12 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 138 (Continued)
Correlation Matrix of Variables Which Significantly Differentiate Between High and Low Accident Females

| Variable | Variable | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Like drive 16-17 | Drove recklessly 16-17 | Conventional | Persevering | Polished | Frank | Self controlled | Friendly | Decisive | Orderly | Sophisticated |
| Convictions 1-4 years | | | | | | | | | | | |
| Accidents 1-4 years | | | | | | | | | | | |
| License gap 1-4 years | | | | | | | | | | | |
| Accident group | | | | | | | | | | | |
| Has own motorcycle | | | | | | | | | | | |
| Honk horn | | | | | | | | | | | |
| Drives hot car | | | | | | | | | | | |
| Miles driven life | | | | | | | | | | | |
| Clubs | | | | | | | | | | | |
| Felt like smashing | | | | | | | | | | | |
| Took driver training | | | | | | | | | | | |
| Relations teachers | | | | | | | | | | | |
| Play hooky | | | | | | | | | | | |
| Parental approval | | | | | | | | | | | |
| Number traffic accidents | | | | | | | | | | | |
| Quasi-reportable accidents | | | | | | | | | | | |
| Cost | | | | | | | | | | | |
| At fault accidents | | | | | | | | | | | |
| Missed stop sign | | | | | | | | | | | |
| Attended races 16-17 | | | | | | | | | | | |
| Driven think problem 16-17 | | | | | | | | | | | |
| Drove get away 16-17 | | | | | | | | | | | |
| Drove cool down 16-17 | | | | | | | | | | | |
| Enjoy winding roads 16-17 | | | | | | | | | | | |
| Like drive 16-17 | 100 | | | | | | | | | | |
| Drove recklessly 16-17 | 13 | 100 | | | | | | | | | |
| Conventional | 07 | 04 | 100 | | | | | | | | |
| Persevering | -18 | -07 | 14 | 100 | | | | | | | |
| Polished | 04 | -05 | 09 | 02 | 100 | | | | | | |
| Frank | -05 | -09 | -11 | -02 | 01 | 100 | | | | | |
| Self controlled | -09 | -01 | 08 | 04 | 07 | -05 | 100 | | | | |
| Friendly | 08 | 02 | 06 | 03 | -06 | 01 | 01 | 100 | | | |
| Decisive | 08 | 09 | 11 | 25 | 07 | 13 | 15 | 11 | 100 | | |
| Orderly | -01 | 01 | 19 | 04 | 07 | 00 | 13 | 03 | 05 | 100 | |
| Sophisticated | 04 | -03 | 16 | 03 | 45 | 05 | 11 | -18 | 12 | 06 | 100 |

Note.--Correlations of ± .12 are statistically significant at the .05 level. Decimal points are omitted.

TABLE 139

Regression Equations (Beta Coefficients) for Predicting Accident Group From Interview Data for Females

| Sex | Equation |
|---|---|
| Female | |
| | Accident group = 0.18 Drove think problems (16-17) +0.14 Drove recklessly (16-17) +0.14 Polished +0.15 Honk horn +0.13 Parental approval +0.17 Felt like smashing +0.15 Persevering +0 13 Clubs +0.12 Like drive (16-17) +0.13 Drives hot car +0.13 Relations teachers -0.11 Frank |

TABLE 140

Regression Equations (Beta Coefficients) for Predicting Accident Group from Non-Driving Interview Data for Females

| Sex | Equation |
|---|---|
| Female | |
| | Accident group = 0.16 Felt like smashing +0.19 Relations teachers +0.13 Parental approval +0.18 Polished -0.15 Frank +0.18 Decisive |

TABLE 141

Percentage of Subjects Mentioning an Effect of Smoking Marijuana on Driving

(Based only on subjects mentioning an effect)

| Effect | Percent |
|---|---|
| Slowed reactions | 30.0 |
| Spatial distortions | 20.0 |
| Time and speed distortions | 19.4 |
| Warped judgment | 14.4 |
| Illusions and hallucinations | 13.8 |
| Decreased attention and concentration | 12.5 |
| Decreased anxiety | 10.0 |
| Diffuse mental confusion and disorientation | 9.4 |
| Decreased psychomotor control and coordination | 8.8 |
| Increased aggression and hostility | 5.6 |
| Kinesthetic distortion | 3.8 |
| Indecisiveness and passivity | 3.1 |
| Increased anxiety | 2.5 |
| Drowsiness | 2.5 |

# CHAPTER 7

## SUMMARY AND CONCLUSIONS

In this chapter we shall review the major findings, compare them with past research, indicate further research needed, and consider possible applications of the findings.

Some previous research will not be considered here for various reasons. In some of the research previously reviewed, no correlation was found between certain variables and driver record, although these variables had statistically significant correlations in the present study. In many of these studies the sample sizes were too small to detect low correlations as being statistically significant. The results of the present, more statistically powerful research are therefore more definitive. In other studies the research was limited to various subgroups, such as traffic-violators or college students. No comment will be made on any differences in the findings between such studies and the present study, because such differences may reflect real differences between the population and sub-populations involved, and are thus not necessarily in conflict.

The findings regarding driver record were in general agreement with previous California research on drivers of all ages (California Department of Motor Vehicles, 1964-1967). The results with respect to the longitudinal year to year trends in driver record were also consistent with a previous California cross-sectional study (Ferdun, Peck, & Coppin, 1967).

There were few accidents or convictions prior to licensing. The conviction rate adjusted for mileage either increased or remained constant during the first three years of driving, then decreased during the fourth year of driving. This finding is in general agreement with Brezina (1969) and Pelz & Schuman (1970a, 1970b). The average number of accidents showed little change in the first four years of driving. The present results support the findings of the Teen-aged Driver Study (Ferdun, Peck, & Coppin, 1967) in that the differences between the accident means of 16-17 year olds and 18-19 year olds do not support increasing the licensing age. The accident rate adjusted for mileage decreased with increasing experience. The result for accidents is in agreement with Brezina (1969), but in conflict with the the results of Schuman, Pelz, Ehrlich, & Selzer (1967), and Pelz & Schuman, (1968, 1970a, 1970b), who found that the accident rate increased until 19 years of age then decreased. It is difficult to determine whether or not this difference represented a real difference in the populations, or was a reflection of methodological differences between the studies. It would be interesting to see the results of a replication of the present longitudinal study in Michigan. The main practical application of this finding relates to the retraining of young drivers. Pelz and Schuman have developed a retraining course which they are administering in the senior year of high school, on the basis of the peak in accidents at age 19. The practically flat mean accident curves and the decreasing accidents per mile over

years found in the present study would indicate that any additional training for California young drivers should be given either in the initial driver training course, or, for a retraining course, as soon after licensing as the person could be expected to have gained a reasonable amount of experience, say six months to a year.

The discrepancy between the accident and conviction trends, and the increase in mileage across years without a corresponding increase in accidents, provide evidence that young drivers learn a great deal about accident avoidance with increasing practice, but seem to show little change in attitudes toward the traffic laws until their fourth year of driving.

In this study, no changes were found in the severity of accidents with increasing experience, contrary to the findings of Pelz and Schuman referenced above. Again, it is not possible to determine whether this reflects methodological differences in the studies or real differences in the populations. The year-to-year trends for accident types generally paralleled those for total accidents. The trends for most violation types paralleled that for convictions. Speed was the most common type of violation, and also the violation most frequently involved in fatal and injury accidents. These two facts do not necessarily imply that speeding is the most dangerous violation, since the fact that speeding is the most frequent violation would tend to result in its occurring in conjunction with an accident (Harrington & McBride, 1970).

The main finding for violation types was that females appeared to have particular difficulty with right-of-way violations in their first year of driving, suggesting that this might be an area for further investigation and work by driver educators. On a per mile basis, females of all ages had a higher rate of right-of-way violations, and a higher rate of fatal and injury accidents involving right-of-way violations, than males (Harrington & McBride, 1970). In the present study, right-of-way violations accounted for 6-7 percent of all moving violations, but accounted for 20 percent of the violations connected with fatal and injury accidents, suggesting that the courts, the police, and driver educators might attempt to place more emphasis on this area. Traffic engineering has contributed to a reduction of right-of-way accidents by separate turn signal phases, freeways, etc.

Sex differences in the characteristics of fatal and injury accidents reflected: (1) differences in exposure, (2) males' greater risk taking and reckless driving, and (3) males' driving older vehicles.

There were marked changes in the characteristics of fatal and injury accidents during the first four years of driving. Some changes reflected changes in exposure, such as (1) increased percentages over the years on freeways and highways, (2) increased percentages at night, (3) decreased percentages in the afternoon, and (4) an increased percentage in higher speed zones. Other changes indicated an improvement in driving: (1) a decreasing percentage of single vehicle accidents, and (2) a decreasing percentage involving traffic violations.

The most dramatic differences were found between single vehicle and

multiple vehicle accidents. Some of the differences which appeared to be causal in nature were that a greater percentage of single vehicle accidents were at night, on other than straight-level roads, involved speeding, involved defective physical conditions, involved drinking, and involved defective vehicles. Various combinations of these factors encompassed the most typical single vehicle accidents.

These findings for accident characteristics were generally consistent with the research reviewed in Chapter 3, as well as with California Highway Patrol (annual), New York Department of Motor Vehicles (1964a), and Washington State Patrol (1967).

The number of DMV suspensions, revocations and probations increased with increasing driving experience and the consequent accumulation of accidents and convictions. Court suspensions decreased across years as the subjects moved from juvenile to adult court. License gaps increased in the third year when most original licenses expired.

During the period of DMV Suspensions and Revocations, 32 percent of males had accidents or received traffic convictions. This indicated that the majority of males with such suspensions and revocations probably continued to drive. Means should be developed to make such actions more effective in removing drivers from the road.

Those with court suspensions and DMV Suspensions/Revocations had slightly higher conviction rates and lower accident rates during the term of the suspension/revocation, than did the total population of drivers. The lower accident rate may have reflected failure to report accidents by those suspended or revoked in order to prevent detection of their illegal driving. Most (63 percent) of those receiving traffic convictions during the period of suspension or revocation were not convicted for driving without a valid license. This suggests the need for improvement in DMV, court, and police procedures in these matters.

The results for DMV suspension/revocation were generally consistent with previous California research (California Department of Motor Vehicles, 1966; Coppin & van Oldenbeek, 1962, 1965).

The results for predicting accidents from other driver record data were consistent with those for drivers of all ages (California Department of Motor Vehicles, 1964-1967). Convictions 1-4 years was the best concurrent predictor of accidents 1-4 years, being 0.29 for males and 0.26 for females. Adding types of violations and original license data to the regression equations increased the multiple R only slightly. Convictions 1-2 years and Length of License Gap 1-4 years were the best driver record predictors of Accidents 3-4 years, but the correlations were quite low, all being less than 0.12. The multiple correlations for predicting Accidents 3-4 from prior driver record were 0.16 for males and 0.14 for females which were double the correlations with Convictions 1-2 years. Predicting Accidents 3-4 years from Types of Violations 1-2 years yielded multiple correlations significantly higher than the simple correlation with Convictions 1-2 years indicating that an optimal point system was superior to a simple

counting of convictions. Both this study and Part 8 of the California Driver Record Study found that a simple counting of convictions sufficed for concurrent "prediction." The present results are the more valid, inasmuch as they involve true (future) prediction. In summary, future accidents can be predicted to only a slight degree from previous driver record. Convictions could be predicted to a moderate degree from previous driver record data.

The correlations of biographical variables with Accidents 1-4 years were uniformly low. The highest correlations were with citizenship grade, -0.153 for males and -0.123 for females, indicating that those with good grades had fewer accidents. Poor school adjustment, poor academic achievement, high mileage, and number of cigarettes smoked were among the best predictors of accidents. In most instances, less socially desirable biographical characteristics were associated with higher accident frequencies. A man drives as he lives. The preceding results are in general agreement with the findings of the previous research presented in Chapter 1.

The multiple correlations of biographical variables with accidents 1-4 years were 0.25 for males and 0.23 for females. When the biographical variables were restricted to non-driving variables that could have been measured prior to driving began, the multiple R's shrank to 0.19 for males and 0.21 for females. These correlations were considered too low for most practical individual prediction, such as licensing drivers or determining those in need of additional or special driver training. Predicting Accidents 3-4 years from biographical data, Convictions 1-2 years, and other driver record data also yielded disappointing results, with R's of 0.22 for males and 0.19 for females. The poor predictability of accidents is consistent with previous research. A higher degree of predictability had been hoped for on the basis of the high accident rate of teen-agers, and the hypothesized relation of this high rate to poor attitudes, thrill-seeking and reckless driving. One possible explanation for the present results was that any greater degree of predictability due to the factors just mentioned was counterbalanced by the role of inexperience, which was obviously a factor for all beginning drivers. Another limiting factor was the unreliability of the criterion measure.

Although the degree to which accidents could be predicted from biographical data was too low for most practical purposes, actuarial prediction, or the prediction of group means would be feasible, for example, in the setting of insurance rates. The present results support the practice of giving discounts to those with good grades, rather than to those with driver education or training, since grade point average was found to be a far better predictor.

The results were similar for prediction of Convictions 1-4 years, but the correlations were much higher. Citizenship grade was also the best predictor of convictions, with correlations of -0.436 for males and -0.264

for females. The multiple correlations using all biographical variables as predictors were 0.60 for males and 0.42 for females. The correlations between Convictions 3-4 years and Convictions 1-2 years were 0.40 for males and 0.25 for females. Thus, convictions are predictable to a moderately high degree, considering the limited reliability of the criterion measure.

Citizenship Grade, a rating by teachers, was the best predictor of driver record. Several other studies reviewed in the Introduction also found evidence that teachers were able to predict driving behavior (Brazell, 1962; Kenel, 1967; Harrington, 1970). Since "a man drives as he lives," it would seem one way to predict driving behavior would be to ask the person himself, and those who know him best, such as his teachers, parents and friends, what kind of a person he is. These considerations suggest the desirability of more research with ratings such as Citizenship Grade.

For those with fatal and injury accidents, the characteristics surrounding their first such accident were of no practical value in predicting future accidents and convictions. This is believed to be a new finding. There was also little correlation between biographical variables and accident characteristics. There were low intercorrelations among the accident characteristics, except that single vehicle accidents happened under fairly specific circumstances, described previously.

Miscellaneous driving variables such as mileage, seat belt usage, and year own car were only predictable from biographical data to a low or moderate degree. These findings suggest the possibility that driving behavior is a fairly independent dimension of human behavior.

As in most of previous research cited in Chapter 1, those taking behind-the-wheel driver training were found to have moderately better accident and conviction records during their first year of driving than those without such training. After the first year of driving there were no differences in accident history between the two groups, with the exception of the fourth year for females. Also, as in previous research, there were found to be differences between the groups on a number of biographical variables, indicating significant selection and volunteer biases. Those taking driver training, compared to those without formal training, had taken classroom driver education more often, dropped out of high school less often, and had more socially desirable biographical characteristics, to a moderate degree. The relationship between these biases was such that the driver training group would be expected to have fewer accidents and convictions solely on the basis of their superior personal characteristics. An attempt was made to statistically adjust (analysis of covariance) the accident and conviction means to remove the effects of the differences in personal characteristics. The main result was that for females driver training appeared to reduce fatal and injury accidents, partially-at-fault

accidents, and single vehicle accidents. This result cannot be considered totally conclusive due to the inherent limitations of the method employed. The remaining results were even less positive and indicated that driver training had little or no effect on accident frequency for males, but possibly reduced the conviction rate for both sexes. The apparent sex differences in the effectiveness of driver training perhaps reflected the fact that females had less driving experience and knowledge at the time of taking driver training, and consequently profited more from the course. Perhaps one reason no effect was found for males was that their accidents were more due to poor attitudes, risk taking and thrill seeking, than to the driving skills and knowledge taught in the behind-the-wheel course.

The ex post facto method of research has certain limitations as indicated previously, and does not have the degree of conclusiveness of a randomized experiment. However, it is believed that the present research has provided the most valid evaluation to date of the effectiveness of driver training. A cost/benefit analysis was favorable for driver training for females, but not for males.

An analysis similar to the preceding found some evidence that classroom driver education reduced fatal and injury accidents among females, possibly by encouraging the use of seat belts. The cost/benefit analysis was favorable to driver education for females, but not for males.

It is recommended that any future driver training research along the lines of this report use a randomized groups experimental design. This could be done most easily at high schools which can not handle all the students who apply. The researcher could randomly determine who would take driver education and who would not. Even this approach has certain limitations in determining the pure effects of driver training. In most instances the students probably receive some instruction or practice from their parents, whether or not they took driver training. Some parents, for example, may give their children no training because they think the driver training course is sufficient. Perhaps a more fundamental question research should attempt to answer is "What is the best method to teach youngsters to drive safely?" Such research should include both the parents' efforts as well as formal driver education and training. Clearly, the cost/benefit ratio for driver education and training should be improved. Because some possible improvements have been accomplished in California driver training in recent years, the results herein are not necessarily relevant to present program effectiveness. Various areas of driver education and training might be researched in an attempt to develop more effective courses, such as amount of course content relating to accident prevention, degree of professionalization of the instructors, integration of driver education and training into one course, and the value of simulators and driving ranges.

Interview of high and low accident subjects revealed that the high accident subjects, compared to the low accident subjects, were more socially deviant, had less desirable personal characteristics, were more involved with cars, and drove recklessly for emotional reasons. Most of the differences in driving behavior referred to past, rather than present, behavior. The results were in general agreement with that of the work of Pelz and Schuman, previously cited, as well as with the research reviewed in Chapter 1.

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APPENDIX A

Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Fresno county | 8,121 | 0.198 | 0.398 | 5,794 | 0.184 | 0.387 |
| Sonoma county | 8,121 | 0.084 | 0.277 | 5,794 | 0.096 | 0.294 |
| Sacramento county | 8,121 | 0.235 | 0.424 | 5,794 | 0.251 | 0.434 |
| Stanislaus county | 8,121 | 0.094 | 0.291 | 5,794 | 0.102 | 0.303 |
| Los Angeles county | 8,121 | 0.390 | 0.488 | 5,794 | 0.367 | 0.482 |
| Height | 8,076 | 68.794 | 2.943 | 5,767 | 64.213 | 2.376 |
| Weight | 8,121 | 146.922 | 25.370 | 5,768 | 121.781 | 15.926 |
| Single orig license | 8,076 | 1.996 | 0.059 | 5,768 | 1.966 | 0.182 |
| Drive test score | 8,015 | 82.930 | 7.805 | 5,757 | 82.321 | 7.752 |
| Age licensed | 8,121 | 22.673 | 26.909 | 5,794 | 27.492 | 28.574 |
| Length instr permit | 8,121 | 13.772 | 10.130 | 5,794 | 15.744 | 10.095 |
| Instruction permit | 8,121 | 0.861 | 0.346 | 5,794 | 0.902 | 0.297 |
| Traffic density | 8,121 | 124.573 | 67.622 | 5,794 | 122.565 | 66.478 |
| Birth location | 5,675 | 1.858 | 0.872 | 3,951 | 1.822 | 0.867 |
| Home status | 5,696 | 1.270 | 0.601 | 3,972 | 1.216 | 0.551 |
| Year left school | 5,728 | 11.638 | 0.854 | 3,994 | 11.813 | 0.593 |
| Transfer | 5,691 | 0.090 | 0.286 | 3,982 | 0.056 | 0.231 |
| Dropout | 5,691 | 0.105 | 0.306 | 3,982 | 0.054 | 0.226 |
| College transcript | 5,691 | 0.614 | 0.487 | 3,982 | 0.639 | 0.480 |
| Driver training grade | 622 | 2.910 | 0.677 | 525 | 2.730 | 0.668 |
| Grade point average | 5,723 | 22.655 | 6.677 | 3,989 | 26.037 | 6.122 |
| GPA trend | 4,824 | 1.133 | 0.657 | 3,618 | 1.199 | 0.632 |
| Citizenship grade | 3,454 | 49.992 | 9.917 | 2,499 | 49.991 | 9.867 |
| Absences | 5,073 | 106.960 | 107.477 | 3,649 | 110.747 | 95.723 |
| Non-language IQ | 5,247 | 103.598 | 14.853 | 3,719 | 103.997 | 14.043 |
| Achievement test | 5,246 | 50.236 | 9.684 | 3,719 | 52.315 | 8.483 |
| IQ discrepancy | 5,246 | 0.136 | 0.343 | 3,719 | 0.084 | 0.277 |
| Achievement index | 5,235 | 22.347 | 5.286 | 3,719 | 25.066 | 4.891 |
| Rural school | 5,761 | 0.240 | 0.427 | 4,000 | 0.222 | 0.416 |
| Quest response date | 5,066 | 1.643 | 1.400 | 4,406 | 1.462 | 1.346 |
| Attitude | 5,057 | 5.193 | 1.778 | 4,403 | 5.157 | 1.596 |
| Driver training safety | 2,940 | 0.887 | 0.761 | 2,355 | 0.735 | 0.776 |
| Driver train quality | 2,899 | 2.200 | 0.916 | 2,316 | 2.093 | 0.872 |
| Driver education | 4,788 | 0.909 | 0.288 | 4,208 | 0.905 | 0.293 |
| Driver ed quality | 4,351 | 2.519 | 1.034 | 3,809 | 2.541 | 1.027 |
| Mileage work | 4,717 | 40.060 | 60.346 | 4,199 | 20.908 | 29.693 |
| Mileage errands | 4,717 | 12.360 | 17.383 | 4,199 | 9.625 | 13.063 |
| Mileage other | 4,717 | 34.884 | 41.917 | 4,199 | 14.998 | 22.028 |
| Mileage total | 4,863 | 86.681 | 83.985 | 4,271 | 44.490 | 45.916 |
| Annual mileage | 4,863 | 109.158 | 99.143 | 4,271 | 56.678 | 56.084 |
| Total mileage | 4,622 | 60.615 | 62.323 | 3,715 | 27.883 | 32.091 |
| Prior mileage | 4,359 | 16.064 | 25.192 | 3,575 | 8.636 | 16.607 |

APPENDIX A (Continued)
Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Mileage T score..... | 5,039 | 49.773 | 9.982 | 4,382 | 49.919 | 10.218 |
| Vehicle weight..... | 4,961 | 2.918 | 1.229 | 4,353 | 2.734 | 1.040 |
| Vehicle year..... | 4,919 | 60.130 | 4.707 | 4,327 | 61.244 | 3.870 |
| Vehicle mileage..... | 4,523 | 25.604 | 20.494 | 3,638 | 14.139 | 14.456 |
| Equipped seat belts..... | 5,026 | 0.694 | 0.461 | 4,388 | 0.725 | 0.447 |
| Wear seat belts..... | 3,490 | 2.367 | 1.367 | 3,180 | 1.984 | 1.369 |
| Married..... | 5,018 | 0.213 | 0.409 | 4,378 | 0.412 | 0.492 |
| Divorced/separated..... | 5,018 | 0.012 | 0.110 | 4,378 | 0.032 | 0.177 |
| Number of children..... | 5,015 | 0.131 | 0.408 | 4,378 | 0.270 | 0.582 |
| Number of brothers..... | 5,009 | 2.314 | 1.852 | 4,374 | 2.090 | 1.631 |
| Number of older sibs..... | 4,986 | 0.996 | 1.390 | 4,356 | 0.990 | 1.225 |
| Parents alive..... | 5,029 | 0.901 | 0.299 | 4,383 | 0.907 | 0.290 |
| Parents married..... | 5,029 | 0.759 | 0.428 | 4,383 | 0.780 | 0.415 |
| Student..... | 4,928 | 0.424 | 0.494 | 4,329 | 0.349 | 0.477 |
| Housewife..... | 0 | 0.000 | 0.000 | 4,329 | 0.188 | 0.391 |
| Grade completed..... | 5,046 | 13.005 | 1.399 | 4,388 | 13.116 | 1.364 |
| Occupational goal..... | 4,111 | 63.504 | 22.546 | 2,901 | 61.260 | 17.031 |
| Social mobility..... | 3,941 | 21.114 | 19.995 | 2,843 | 19.652 | 18.892 |
| Unemployed..... | 5,010 | 0.048 | 0.213 | 4,375 | 0.055 | 0.228 |
| Social activities..... | 5,053 | 0.304 | 0.460 | 4,400 | 0.446 | 0.497 |
| Academic activities..... | 5,050 | 0.294 | 0.456 | 4,399 | 0.464 | 0.499 |
| Student activities..... | 5,052 | 0.429 | 0.495 | 4,401 | 0.626 | 0.484 |
| Intramural activities.... | 5,054 | 0.616 | 0.486 | 4,398 | 0.346 | 0.476 |
| Varsity letters..... | 5,048 | 0.924 | 1.594 | 0 | 0.000 | 0.000 |
| Non-varsity letters..... | 5,051 | 0.679 | 1.269 | 0 | 0.000 | 0.000 |
| Safety self-rating..... | 5,034 | 2.326 | 0.760 | 4,383 | 2.371 | 0.706 |
| Drinking..... | 5,015 | 1.553 | 1.316 | 4,376 | 1.092 | 1.059 |
| Number of cigarettes..... | 5,021 | 7.311 | 10.619 | 4,385 | 4.960 | 8.542 |
| Number of jobs..... | 4,981 | 1.065 | 0.792 | 4,349 | 0.797 | 0.722 |
| Year own car..... | 4,981 | 2.862 | 1.069 | 4,354 | 3.297 | 0.923 |
| Hours driving..... | 4,269 | 11.418 | 11.919 | 3,677 | 7.319 | 7.692 |
| Percent motorcycle..... | 5,011 | 4.680 | 13.792 | 4,369 | 0.586 | 4.654 |
| Armed forces service..... | 5,721 | 0.381 | 0.486 | 0 | 0.000 | 0.000 |
| Response bias..... | 5,761 | 0.366 | 0.482 | 4,000 | 0.222 | 0.415 |
| Driver train not offer... | 6,876 | 0.066 | 0.248 | 5,206 | 0.085 | 0.278 |
| Driver train not taken... | 6,876 | 0.356 | 0.479 | 5,206 | 0.366 | 0.482 |
| Driver training taken.... | 6,876 | 0.578 | 0.494 | 5,206 | 0.549 | 0.498 |
| Driver train taken w off. | 6,423 | 1.619 | 0.486 | 4,765 | 1.600 | 0.490 |
| Parents occupation..... | 6,018 | 42.358 | 24.690 | 4,832 | 44.667 | 24.485 |
| Conv instruct permit..... | 6,990 | 0.039 | 0.225 | 5,228 | 0.005 | 0.073 |
| Acc instruct permit..... | 6,997 | 0.004 | 0.061 | 5,229 | 0.002 | 0.048 |
| Sign violation 6 mo pr... | 8,121 | 0.007 | 0.088 | 5,794 | 0.001 | 0.037 |

APPENDIX A (Continued)
Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Sign violation 1 yr..... | 8,121 | 0.108 | 0.351 | 5,794 | 0.037 | 0.199 |
| Sign violation 2 yr..... | 8,121 | 0.128 | 0.382 | 5,794 | 0.047 | 0.222 |
| Sign violation 3 yr..... | 8,121 | 0.143 | 0.404 | 5,794 | 0.051 | 0.229 |
| Sign violation 4 yr..... | 8,121 | 0.110 | 0.353 | 5,794 | 0.047 | 0.230 |
| Sign violation 1-4 yrs... | 8,121 | 0.489 | 0.809 | 5,794 | 0.182 | 0.464 |
| Lane violation 6 mo pr... | 8,121 | 0.002 | 0.047 | 5,794 | 0.000 | 0.013 |
| Lane violation 1 yr..... | 8,121 | 0.037 | 0.202 | 5,794 | 0.008 | 0.089 |
| Lane violation 2 yr..... | 8,121 | 0.042 | 0.210 | 5,794 | 0.010 | 0.097 |
| Lane violation 3 yr..... | 8,121 | 0.042 | 0.212 | 5,794 | 0.012 | 0.109 |
| Lane violation 4 yr..... | 8,121 | 0.033 | 0.188 | 5,794 | 0.008 | 0.094 |
| Lane violation 1-4 yrs... | 8,121 | 0.154 | 0.419 | 5,794 | 0.037 | 0.197 |
| Following viol 6 mo pr... | 8,121 | 0.000 | 0.016 | 5,794 | 0.000 | 0.000 |
| Following viol 1 yr..... | 8,121 | 0.007 | 0.084 | 5,794 | 0.004 | 0.060 |
| Following viol 2 yr..... | 8,121 | 0.012 | 0.113 | 5,794 | 0.003 | 0.057 |
| Following viol 3 yr..... | 8,121 | 0.015 | 0.123 | 5,794 | 0.006 | 0.076 |
| Following viol 4 yr..... | 8,121 | 0.017 | 0.132 | 5,794 | 0.009 | 0.092 |
| Following viol 1-4 yrs... | 8,121 | 0.052 | 0.233 | 5,794 | 0.021 | 0.146 |
| Passing viol 6 mo pr..... | 8,121 | 0.000 | 0.022 | 5,794 | 0.000 | 0.000 |
| Passing viol 1 yr..... | 8,121 | 0.010 | 0.104 | 5,794 | 0.002 | 0.042 |
| Passing viol 2 yr..... | 8,121 | 0.011 | 0.106 | 5,794 | 0.003 | 0.052 |
| Passing viol 3 yr..... | 8,121 | 0.012 | 0.109 | 5,794 | 0.002 | 0.046 |
| Passing viol 4 yr..... | 8,121 | 0.008 | 0.090 | 5,794 | 0.002 | 0.044 |
| Passing viol 1-4 yrs..... | 8,121 | 0.040 | 0.205 | 5,794 | 0.008 | 0.092 |
| Right-of-way viol 6 mo pr | 8,121 | 0.001 | 0.035 | 5,794 | 0.001 | 0.026 |
| Right-of-way viol 1 yr... | 8,121 | 0.034 | 0.187 | 5,794 | 0.020 | 0.147 |
| Right-of-way viol 2 yr... | 8,121 | 0.035 | 0.189 | 5,794 | 0.014 | 0.122 |
| Right-of-way viol 3 yr... | 8,121 | 0.029 | 0.172 | 5,794 | 0.014 | 0.124 |
| Right-of-way viol 4 yr... | 8,121 | 0.018 | 0.139 | 5,794 | 0.014 | 0.117 |
| Right-of-way viol 1-4 yrs | 8,121 | 0.117 | 0.349 | 5,794 | 0.062 | 0.260 |
| Turning viol 6 mo pr..... | 8,121 | 0.002 | 0.046 | 5,794 | 0.001 | 0.026 |
| Turning viol 1 yr..... | 8,121 | 0.039 | 0.212 | 5,794 | 0.013 | 0.114 |
| Turning viol 2 yr..... | 8,121 | 0.047 | 0.225 | 5,794 | 0.013 | 0.114 |
| Turning viol 3 yr..... | 8,121 | 0.053 | 0.236 | 5,794 | 0.013 | 0.115 |
| Turning viol 4 yr..... | 8,121 | 0.043 | 0.218 | 5,794 | 0.012 | 0.115 |
| Turn. violation 1-4 yrs... | 8,121 | 0.182 | 0.460 | 5,794 | 0.051 | 0.235 |
| Speed violation 6 mo pr.. | 8,121 | 0.009 | 0.098 | 5,794 | 0.001 | 0.032 |
| Speed violation 1 yr..... | 8,121 | 0.250 | 0.585 | 5,794 | 0.058 | 0.255 |
| Speed violation 2 yr..... | 8,121 | 0.348 | 0.692 | 5,794 | 0.088 | 0.323 |
| Speed violation 3 yr..... | 8,121 | 0.403 | 0.748 | 5,794 | 0.118 | 0.379 |
| Speed violation 4 yr..... | 8,121 | 0.301 | 0.629 | 5,794 | 0.098 | 0.343 |
| Speed violation 1-4 yrs.. | 8,121 | 1.302 | 1.584 | 5,794 | 0.363 | 0.728 |
| Drunk driv viol 6 mo pr.. | 8,121 | 0.000 | 0.000 | 5,794 | 0.000 | 0.000 |

APPENDIX A (Continued)

Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Drunk driv viol 1 yr.... | 8,121 | 0.001 | 0.033 | 5,794 | 0.000 | 0.000 |
| Drunk driv viol 2 yr.... | 8,121 | 0.002 | 0.048 | 5,794 | 0.000 | 0.000 |
| Drunk driv viol 3 yr.... | 8,121 | 0.003 | 0.061 | 5,794 | 0.000 | 0.000 |
| Drunk driv viol 4 yr.... | 8,121 | 0.005 | 0.077 | 5,794 | 0.001 | 0.029 |
| Drunk driv viol 1-4 yrs. | 8,121 | 0.012 | 0.118 | 5,794 | 0.001 | 0.029 |
| Reckless dr viol 6 mo pr | 8,121 | 0.000 | 0.011 | 5,794 | 0.000 | 0.000 |
| Reckless dr viol 1 yr... | 8,121 | 0.005 | 0.072 | 5,794 | 0.000 | 0.019 |
| Reckless dr viol 2 yr... | 8,121 | 0.005 | 0.072 | 5,794 | 0.000 | 0.000 |
| Reckless dr viol 3 yr... | 8,121 | 0.008 | 0.088 | 5,794 | 0.001 | 0.023 |
| Reckless dr viol 4 yr... | 8,121 | 0.004 | 0.064 | 5,794 | 0.000 | 0.000 |
| Reckless dr viol 1-4 yrs | 8,121 | 0.021 | 0.155 | 5,794 | 0.001 | 0.029 |
| Drug violation 6 mo pr.. | 8,121 | 0.000 | 0.000 | 5,794 | 0.000 | 0.000 |
| Drug violation 1 yr..... | 8,121 | 0.000 | 0.011 | 5,794 | 0.000 | 0.000 |
| Drug violation 2 yr..... | 8,121 | 0.001 | 0.025 | 5,794 | 0.000 | 0.000 |
| Drug violation 3 yr..... | 8,121 | 0.000 | 0.000 | 5,794 | 0.000 | 0.000 |
| Drug violation 4 yr..... | 8,121 | 0.000 | 0.011 | 5,794 | 0.000 | 0.000 |
| Drug violation 1-4 yrs.. | 8,121 | 0.001 | 0.029 | 5,794 | 0.000 | 0.000 |
| Driv w susp viol 6 mo pr | 8,121 | 0.000 | 0.016 | 5,794 | 0.000 | 0.000 |
| Driv w susp viol 1 yr... | 8,121 | 0.006 | 0.097 | 5,794 | 0.000 | 0.013 |
| Driv w susp viol 2 yr... | 8,121 | 0.009 | 0.162 | 5,794 | 0.000 | 0.013 |
| Driv w susp viol 3 yr... | 8,121 | 0.010 | 0.163 | 5,794 | 0.000 | 0.019 |
| Driv w susp viol 4 yr... | 8,121 | 0.016 | 0.207 | 5,794 | 0.000 | 0.019 |
| Driv w susp viol 1-4 yrs | 8,121 | 0.041 | 0.437 | 5,794 | 0.001 | 0.032 |
| Hit and run viol 6 mo pr | 8,121 | 0.000 | 0.016 | 5,794 | 0.000 | 0.000 |
| Hit and run viol 1 yr... | 8,121 | 0.003 | 0.051 | 5,794 | 0.001 | 0.035 |
| Hit and run viol 2 yr... | 8,121 | 0.003 | 0.056 | 5,794 | 0.000 | 0.019 |
| Hit and run viol 3 yr... | 8,121 | 0.002 | 0.044 | 5,794 | 0.000 | 0.000 |
| Hit and run viol 4 yr... | 8,121 | 0.002 | 0.038 | 5,794 | 0.000 | 0.000 |
| Hit and run viol 1-4 yrs | 8,121 | 0.009 | 0.097 | 5,794 | 0.002 | 0.039 |
| FTA/FTP viol 6 mo pr.... | 8,121 | 0.002 | 0.048 | 5,794 | 0.000 | 0.000 |
| FTA/FTP viol 1 yr..... | 8,121 | 0.030 | 0.308 | 5,794 | 0.003 | 0.062 |
| FTA/FTP viol 2 yr..... | 8,121 | 0.057 | 0.357 | 5,794 | 0.008 | 0.117 |
| FTA/FTP viol 3 yr..... | 8,121 | 0.100 | 0.520 | 5,794 | 0.013 | 0.129 |
| FTA/FTP viol 4 yr..... | 8,121 | 0.088 | 0.476 | 5,794 | 0.015 | 0.160 |
| FTA/FTP viol 1-4 yrs.... | 8,121 | 0.276 | 1.076 | 5,794 | 0.038 | 0.300 |
| Equipment viol 6 mo pr.. | 8,121 | 0.017 | 0.190 | 5,794 | 0.003 | 0.063 |
| Equipment viol 1 yr..... | 8,121 | 0.210 | 0.769 | 5,794 | 0.021 | 0.179 |
| Equipment viol 2 yr..... | 8,121 | 0.249 | 0.832 | 5,794 | 0.024 | 0.218 |
| Equipment viol 3 yr..... | 8,121 | 0.276 | 0.864 | 5,794 | 0.028 | 0.217 |
| Equipment viol 4 yr..... | 8,121 | 0.177 | 0.727 | 5,794 | 0.020 | 0.172 |
| Equipment viol 1-4 yrs.. | 8,121 | 0.912 | 1.930 | 5,794 | 0.093 | 0.446 |
| Misc moving viol 6 mo pr | 8,121 | 0.011 | 0 108 | 5,794 | 0.000 | 0.013 |

APPENDIX A (Continued)
Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Misc moving viol 1 yr.... | 8,121 | 0.007 | 0.084 | 5,794 | 0.003 | 0.056 |
| Misc moving viol 2 yr.... | 8,121 | 0.010 | 0.102 | 5,794 | 0.002 | 0.042 |
| Misc moving viol 3 yr.... | 8,121 | 0.008 | 0.095 | 5,794 | 0.001 | 0.032 |
| Misc moving viol 4 yr.... | 8,121 | 0.007 | 0.091 | 5,794 | 0.002 | 0.047 |
| Misc moving viol 1-4 yrs. | 8,121 | 0.032 | 0.195 | 5,794 | 0.007 | 0.092 |
| Misc non-mov viol 6 mo pr | 8,121 | 0.035 | 0.228 | 5,794 | 0.008 | 0.103 |
| Misc non-mov viol 1 yr... | 8,121 | 0.112 | 0.435 | 5,794 | 0.017 | 0.149 |
| Misc non-mov viol 2 yr... | 8,121 | 0.149 | 0.546 | 5,794 | 0.021 | 0.180 |
| Misc non-mov viol 3 yr... | 8,121 | 0.201 | 0.701 | 5,794 | 0.028 | 0.205 |
| Misc non-mov viol 4 yr... | 8,121 | 0.141 | 0.587 | 5,794 | 0.021 | 0.186 |
| Misc non-mov viol 1-4 yrs | 8,121 | 0.603 | 1.446 | 5,794 | 0.087 | 0.433 |
| Convictions 6 mo pr..... | 8,121 | 0.058 | 0.273 | 5,794 | 0.010 | 0.105 |
| Convictions 1 yr..... | 8,121 | 0.649 | 1.141 | 5,794 | 0.164 | 0.450 |
| Convictions 2 yr..... | 8,121 | 0.835 | 1.273 | 5,794 | 0.204 | 0.514 |
| Convictions 3 yr..... | 8,121 | 0.961 | 1.406 | 5,794 | 0.247 | 0.593 |
| Convictions 4 yr..... | 8,121 | 0.728 | 1.204 | 5,794 | 0.215 | 0.543 |
| Convictions 1-2 yrs..... | 8,121 | 1.484 | 1.959 | 5,794 | 0.368 | 0.733 |
| Convictions 1-4 yrs..... | 8,121 | 3.173 | 3.398 | 5,794 | 0.830 | 1.282 |
| Convictions 3-4 yrs..... | 8,121 | 1.689 | 2.107 | 5,794 | 0.462 | 0.884 |
| Accidents 6 mo pr..... | 8,121 | 0.005 | 0.073 | 5,794 | 0.003 | 0.054 |
| Accidents 1 yr..... | 8,121 | 0.159 | 0.407 | 5,794 | 0.096 | 0.316 |
| Accidents 2 yr..... | 8,121 | 0.182 | 0.433 | 5,794 | 0.094 | 0.309 |
| Accidents 3 yr..... | 8,121 | 0.172 | 0.426 | 5,794 | 0.084 | 0.300 |
| Accidents 4 yr..... | 8,121 | 0.127 | 0.372 | 5,794 | 0.070 | 0.275 |
| Accidents 1-2 yrs..... | 8,121 | 0.341 | 0.604 | 5,794 | 0.190 | 0.441 |
| Accidents 1-4 yrs..... | 8,121 | 0.640 | 0.853 | 5,794 | 0.345 | 0.617 |
| Accidents 3-4 yrs..... | 8,121 | 0.299 | 0.577 | 5,794 | 0.155 | 0.414 |
| Fatal/injury acc 6 mo pr. | 8,121 | 0.001 | 0.027 | 5,794 | 0.000 | 0.013 |
| Fatal/injury acc 1 yr.... | 8,121 | 0.050 | 0.227 | 5,794 | 0.028 | 0.168 |
| Fatal/injury acc 2 yr.... | 8,121 | 0.057 | 0.236 | 5,794 | 0.026 | 0.164 |
| Fatal/injury acc 3 yr.... | 8,121 | 0.056 | 0.240 | 5,794 | 0.022 | 0.145 |
| Fatal/injury acc 4 yr.... | 8,121 | 0.041 | 0.207 | 5,794 | 0.023 | 0.152 |
| Fatal/injury acc 1-4 yrs. | 8,121 | 0.204 | 0.456 | 5,794 | 0.098 | 0.323 |
| Property acc 6 mo pr..... | 8,121 | 0.005 | 0.068 | 5,794 | 0.003 | 0.052 |
| Property acc 1 yr..... | 8,121 | 0.109 | 0.337 | 5,794 | 0.069 | 0.265 |
| Property acc 2 yr..... | 8,121 | 0.125 | 0.358 | 5,794 | 0.068 | 0.260 |
| Property acc 3 yr..... | 8,121 | 0.116 | 0.348 | 5,794 | 0.06 | 0.258 |
| Property acc 4 yr..... | 8,121 | 0.086 | 0.301 | 5,794 | 0.048 | 0.226 |
| Property acc 1-4 yrs..... | 8,121 | 0.436 | 0.698 | 5,794 | 0.246 | 0.515 |
| Single veh acc 6 mo pr... | 8,121 | 0.000 | 0.011 | 5,794 | 0.000 | 0.013 |
| Single veh acc 1 yr..... | 8,121 | 0.013 | 0.112 | 5,794 | 0.007 | 0.085 |
| Single veh acc 2 yr..... | 8,121 | 0.016 | 0.124 | 5,794 | 0.004 | 0.062 |

APPENDIX A (Continued)
Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Single veh acc 3 yr..... | 8,121 | 0.014 | 0.116 | 5,794 | 0.002 | 0.047 |
| Single veh acc 4 yr..... | 8,121 | 0.010 | 0.098 | 5,794 | 0.004 | 0.064 |
| Single veh acc 1-4 yrs... | 8,121 | 0.052 | 0.228 | 5,794 | 0.017 | 0.133 |
| Drunk driv acc 6 mo pr... | 8,121 | 0.000 | 0.000 | 5,794 | 0.000 | 0.000 |
| Drunk driv acc 1 yr..... | 8,121 | 0.001 | 0.031 | 5,794 | 0.000 | 0.000 |
| Drunk driv acc 2 yr..... | 8,121 | 0.001 | 0.029 | 5,794 | 0.000 | 0.000 |
| Drunk driv acc 3 yr..... | 8,121 | 0.001 | 0.029 | 5,794 | 0.000 | 0.000 |
| Drunk driv acc 4 yr..... | 8,121 | 0.001 | 0.027 | 5,794 | 0.000 | 0.019 |
| Drunk driv acc 1-4 yrs... | 8,121 | 0.003 | 0.059 | 5,794 | 0.000 | 0.019 |
| Part fault acc 6 mo pr... | 8,121 | 0.000 | 0.019 | 5,794 | 0.000 | 0.013 |
| Part fault acc 1 yr..... | 8,121 | 0.030 | 0.173 | 5,794 | 0.015 | 0.122 |
| Part fault acc 2 yr..... | 8,121 | 0.032 | 0.178 | 5,794 | 0.011 | 0.109 |
| Part fault acc 3 yr..... | 8,121 | 0.031 | 0.179 | 5,794 | 0.009 | 0.096 |
| Part fault acc 4 yr..... | 8,121 | 0.020 | 0.142 | 5,794 | 0.010 | 0.099 |
| Part fault acc 1-4 yrs... | 8,121 | 0.114 | 0.342 | 5,794 | 0.046 | 0.220 |
| Accident cost 6 mo pr.... | 8,121 | 0.035 | 0.657 | 5,794 | 0.027 | 1.201 |
| Accident cost 1 yr..... | 8,121 | 1.637 | 6.064 | 5,794 | 0.918 | 4.339 |
| Accident cost 2 yr..... | 8,121 | 1.823 | 6.172 | 5,794 | 0.882 | 4.249 |
| Accident cost 3 yr..... | 8,121 | 1.806 | 6.414 | 5,794 | 0.737 | 3.578 |
| Accident cost 4 yr..... | 8,121 | 1.298 | 5.424 | 5,794 | 0.695 | 3.482 |
| Accident cost 1-4 yrs.... | 8,121 | 6.564 | 12.280 | 5,794 | 3.232 | 8.092 |
| School data missing..... | 8,121 | 0.291 | 0.454 | 5,794 | 0.310 | 0.462 |
| Length license gap 1 yr.. | 8,121 | 0.608 | 10.634 | 5,794 | 0.146 | 4.577 |
| Length license gap 2 yr.. | 8,121 | 2.099 | 20.311 | 5,794 | 2.648 | 20.361 |
| Length license gap 3 yr.. | 8,121 | 24.007 | 74.920 | 5,794 | 21.394 | 72.164 |
| Length license gap 4 yr.. | 8,121 | 28.846 | 94.151 | 5,794 | 20.830 | 81.127 |
| Length license gap 1-4 yr | 8,120 | 55.263 | 161.764 | 5,794 | 44.878 | 151.266 |
| Accident rate 6 mo pr.... | 5,039 | 2.976 | 13.906 | 4,382 | 2.667 | 12.411 |
| Accident rate 1 yr..... | 5,039 | 31.754 | 78.606 | 4,382 | 19.773 | 61.586 |
| Accident rate 2 yr..... | 5,039 | 37.890 | 87.600 | 4,382 | 19.867 | 60.734 |
| Accident rate 3 yr..... | 5,039 | 36.841 | 85.868 | 4,382 | 18.660 | 59.868 |
| Accident rate 4 yr..... | 5,039 | 30.120 | 78.400 | 4,382 | 16.590 | 55.675 |
| Accident rate 1-4 yrs.... | 5,039 | 130.859 | 170.441 | 4,382 | 69.068 | 123.551 |
| Convictions DT 6 mo pr... | 6,876 | 0.187 | 0.617 | 5,206 | 0.030 | 0.192 |
| Convictions DT 6 mo sub.. | 6,876 | 0.309 | 0.658 | 5,206 | 0.075 | 0.285 |
| Convictions DT 1 yr..... | 6,876 | 0.652 | 1.062 | 5,206 | 0.160 | 0.432 |
| Convictions DT 2 yr..... | 6,834 | 0.826 | 1.251 | 5,199 | 0.205 | 0.514 |
| Convictions DT 3 yr..... | 6,446 | 0.856 | 1.300 | 5,083 | 0.234 | 0.578 |
| Convictions DT 4 yr..... | 5,135 | 0.671 | 1.097 | 4,540 | 0.209 | 0.544 |
| Convictions DT 1-2 yrs... | 6,834 | 1.476 | 1.862 | 5,199 | 0.365 | 0.716 |
| Convictions DT 1-3 yrs... | 6,446 | 2.317 | 2.586 | 5,083 | 0.598 | 1.012 |
| Convictions DT 1-4 yrs... | 5,135 | 2.941 | 3.096 | 4,540 | 0.798 | 1.252 |

APPENDIX A (Continued)
Means and Standard Deviations by Sex

| Variable | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Number of subjects | Mean | Standard deviation | Number of subjects | Mean | Standard deviation |
| Accidents DT 6 mo pr..... | 6,876 | 0.037 | 0.199 | 5,206 | 0.014 | 0.124 |
| Accidents DT 6 mo sub.... | 6,876 | 0.079 | 0.281 | 5,206 | 0.047 | 0.219 |
| Accidents DT 1 yr..... | 6,876 | 0.161 | 0.408 | 5,206 | 0.093 | 0.307 |
| Accidents DT 2 yr..... | 6,834 | 0.180 | 0.428 | 5,199 | 0.089 | 0.305 |
| Accidents DT 3 yr..... | 6,446 | 0.161 | 0.413 | 5,083 | 0.084 | 0.296 |
| Accidents DT 4 yr..... | 5,135 | 0.121 | 0.359 | 4,540 | 0.067 | 0.265 |
| Accidents DT 1-2 yrs..... | 6,834 | 0.341 | 0.603 | 5,199 | 0.182 | 0.437 |
| Accidents DT 1-3 yrs..... | 6,446 | 0.499 | 0.740 | 5,083 | 0.266 | 0.539 |
| Accidents DT 1-4 yrs..... | 5,135 | 0.621 | 0.838 | 4,540 | 0.333 | 0.607 |
| Quest data missing..... | 8,121 | 0.376 | 0.484 | 5,794 | 0.240 | 0.427 |
| Single lic renewal..... | 8,121 | 0.900 | 0.300 | 5,794 | 0.558 | 0.497 |
| Rural..... | 1,437 | 0.422 | 0.494 | 514 | 0.376 | 0.485 |
| Highway..... | 1,442 | 0.424 | 0.494 | 515 | 0.379 | 0.486 |
| Freeway..... | 1,378 | 0.080 | 0.271 | 493 | 0.070 | 0.256 |
| Four or more lanes..... | 1,399 | 0.434 | 0.496 | 495 | 0.473 | 0.500 |
| Motorcycle..... | 1,444 | 0.138 | 0.346 | 516 | 0.035 | 0.184 |
| Car..... | 1,444 | 0.922 | 0.269 | 516 | 0.981 | 0.138 |
| Truck or bus..... | 1,444 | 0.164 | 0.370 | 516 | 0.105 | 0.306 |
| Weekend..... | 1,445 | 0.529 | 0.499 | 516 | 0.477 | 0.500 |
| Injury accident..... | 1,489 | 0.978 | 0.145 | 525 | 0.987 | 0.115 |
| Clear weather..... | 1,424 | 0.784 | 0.411 | 512 | 0.809 | 0.394 |
| Daylight..... | 1,442 | 0.585 | 0.493 | 513 | 0.690 | 0.463 |
| Straight-level road..... | 1,415 | 0.789 | 0.408 | 508 | 0.862 | 0.345 |
| Pedestrian..... | 1,191 | 0.037 | 0.189 | 429 | 0.035 | 0.184 |
| Intersection..... | 1,191 | 0.329 | 0.470 | 429 | 0.403 | 0.491 |
| Non-intersection..... | 1,191 | 0.391 | 0.488 | 429 | 0.408 | 0.492 |
| Single vehicle..... | 1,191 | 0.243 | 0.429 | 429 | 0.154 | 0.361 |
| Speed zone 36+..... | 1,388 | 0.352 | 0.478 | 498 | 0.265 | 0.442 |
| Vehicle < 5 years old.... | 1,433 | 0.383 | 0.436 | 512 | 0.465 | 0.499 |
| Driver violation..... | 1,442 | 0.576 | 0.494 | 516 | 0.469 | 0.500 |
| Physical defect..... | 1,489 | 0.020 | 0.138 | 525 | 0.010 | 0.097 |
| Driver drunk..... | 1,442 | 0.017 | 0.128 | 516 | 0.004 | 0.062 |
| Vehicle defect..... | 1,489 | 0.044 | 0.204 | 525 | 0.029 | 0.167 |
| Speed over 20 MPH..... | 1,273 | 0.724 | 0.447 | 413 | 0.608 | 0.489 |
| Speeding..... | 1,251 | 0.134 | 0.340 | 404 | 0.062 | 0.241 |
| Speed violation CHP..... | 1,442 | 0.272 | 0.445 | 516 | 0.180 | 0.385 |
| Right-way viol CHP..... | 1,442 | 0.105 | 0.307 | 516 | 0.128 | 0.334 |
| Following viol CHP..... | 1,442 | 0.042 | 0.201 | 516 | 0.046 | 0.211 |
| Passing viol CHP..... | 1,442 | 0.017 | 0.128 | 516 | 0.004 | 0.062 |
| Turning viol CHP..... | 1,442 | 0.033 | 0.178 | 516 | 0.023 | 0.151 |
| Sign violation CHP..... | 1,442 | 0.035 | 0.185 | 516 | 0.037 | 0.189 |
| Misc violation CHP..... | 1,442 | 0.072 | 0.259 | 516 | 0.050 | 0.219 |

APPENDIX B
Correlation Matrix for Males

| Variable | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fresno county | 100 | | | | | | | | | | | | | | | | | | | |
| Sonoma county | -15 | 100 | | | | | | | | | | | | | | | | | | |
| Sacramento county | -28 | -17 | 100 | | | | | | | | | | | | | | | | | |
| Stanislaus county | -16 | -17 | -18 | 100 | | | | | | | | | | | | | | | | |
| Los Angeles county | -40 | -24 | -44 | -26 | 100 | | | | | | | | | | | | | | | |
| Height | -3 | 0 | 2 | -2 | 2 | 100 | | | | | | | | | | | | | | |
| Weight | -1 | 1 | 1 | 2 | -4 | 59 | 100 | | | | | | | | | | | | | |
| Single orig license | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 100 | | | | | | | | | | | | |
| Drive test score | -7 | 5 | 3 | 4 | -2 | -17 | -1 | -1 | 100 | | | | | | | | | | | |
| Age licensed | -2 | -1 | 2 | -1 | 1 | 9 | 7 | -4 | -8 | 100 | | | | | | | | | | |
| Length instr permit | -9 | 4 | 5 | 0 | 0 | -8 | -12 | 3 | 5 | -32 | 100 | | | | | | | | | |
| Traffic density | -63 | -29 | -5 | -32 | 92 | 0 | -2 | 0 | -2 | 1 | 3 | 100 | | | | | | | | |
| Birth location | -6 | -2 | 9 | -3 | 0 | 0 | -2 | -1 | -3 | 12 | -6 | 4 | 100 | | | | | | | |
| Home status | -4 | 1 | -1 | 3 | 3 | 2 | 3 | 0 | -1 | 9 | -4 | 3 | 5 | 100 | | | | | | |
| Year left school | -6 | 3 | 5 | -10 | 7 | 3 | -1 | 6 | 5 | -9 | 16 | 10 | -9 | -12 | 100 | | | | | |
| Transfer | -1 | 0 | -3 | 3 | 3 | -1 | 2 | -1 | -3 | 3 | -9 | 1 | 10 | 9 | -52 | 100 | | | | |
| Dropout | 8 | 0 | -4 | 5 | -8 | -2 | -1 | -8 | -6 | 10 | -12 | -10 | 3 | 0 | -61 | -11 | 100 | | | |
| College transcript | -4 | -3 | 2 | -3 | 5 | 4 | 0 | 3 | 7 | -14 | 17 | 7 | -6 | -11 | 53 | -39 | -43 | 100 | | |
| Grade point average | -3 | 1 | 1 | -1 | 3 | 4 | -2 | 4 | 11 | -13 | 19 | 4 | 0 | -11 | 43 | -21 | -42 | -7 | 100 | |
| GPA trend | 1 | 0 | 0 | -1 | 0 | -1 | 1 | 0 | 2 | 1 | 1 | 0 | -2 | -3 | 7 | -4 | -7 | 2 | 0 | 100 |
| Citizenship grade | 0 | 1 | 0 | 0 | 0 | 4 | -1 | 2 | 8 | 2 | 15 | 0 | 1 | -7 | 31 | -20 | -28 | 33 | 73 | 6 |
| Absences | 0 | 0 | -1 | 3 | 0 | -5 | -1 | -6 | -9 | 4 | -12 | -1 | 3 | 11 | -43 | 18 | 42 | -30 | -51 | -6 |
| Non-language IQ | -9 | -2 | 5 | 6 | -1 | -2 | 1 | 2 | 6 | -16 | 18 | 2 | 2 | -7 | 23 | -10 | -21 | 29 | 52 | -6 |
| Achievement test | -3 | -3 | 11 | -1 | -5 | 7 | 0 | 2 | 6 | -16 | 17 | -1 | 5 | -7 | 25 | -11 | -25 | 36 | 43 | -6 |
| IQ discrepancy | -6 | 5 | 1 | 10 | -6 | -6 | -2 | -2 | 3 | 0 | 0 | -5 | -3 | -1 | 2 | 0 | 0 | -3 | -2 | 0 |
| Achievement index | 7 | 1 | 2 | -3 | -1 | -2 | -3 | 2 | 9 | -6 | 12 | 0 | -2 | -8 | 38 | -22 | -35 | 36 | 66 | 3 |
| Rural school | 26 | 25 | -19 | 20 | -36 | -4 | 3 | -1 | 3 | 1 | -8 | -47 | -1 | -1 | -11 | 1 | 8 | -13 | -4 | 1 |
| Quest response date | 0 | 0 | -2 | -1 | 2 | -3 | -1 | -3 | -2 | 7 | -9 | 1 | 3 | 7 | -12 | 8 | 9 | -13 | -20 | -1 |
| Attitude | 0 | 1 | -7 | 0 | 6 | -7 | -3 | -2 | -5 | -2 | -3 | 4 | -3 | 0 | -6 | 1 | 6 | -9 | -12 | -3 |
| Driver training safety | 0 | 3 | -1 | 6 | -5 | 0 | 0 | 2 | -2 | -7 | 4 | -9 | -2 | 0 | 0 | 1 | 1 | 4 | 0 | -1 |
| Driver education | -9 | 1 | -5 | 1 | 10 | 1 | 0 | 1 | 1 | -6 | 8 | 10 | -1 | 1 | 22 | -6 | -15 | 12 | 10 | 3 |
| Driver ed quality | 1 | 2 | 5 | 1 | -6 | 1 | 1 | 1 | -3 | -6 | 5 | -5 | 0 | -2 | 4 | -2 | -3 | 6 | 11 | -4 |
| Mileage work | -1 | 3 | -4 | 1 | 2 | 1 | 1 | 1 | 1 | -1 | -2 | 1 | 2 | 2 | -8 | 5 | 7 | -7 | -10 | 3 |
| Mileage other | 0 | 1 | 1 | 1 | -2 | 3 | 0 | 3 | 3 | -4 | 1 | -1 | -1 | -1 | 0 | 0 | 1 | 2 | -6 | -1 |
| Annual mileage | -1 | 1 | -2 | 1 | 1 | 2 | 2 | 3 | 1 | -3 | -1 | 0 | 2 | 1 | -5 | 4 | 4 | -3 | -10 | 1 |
| Total mileage | 7 | 5 | 3 | 5 | -13 | 3 | 3 | 1 | 2 | 0 | -7 | -14 | 0 | 4 | -15 | 5 | 14 | -19 | -23 | -2 |
| Prior mileage | 5 | 5 | 1 | 5 | -10 | 2 | 4 | -1 | 2 | -1 | -5 | -11 | 0 | 4 | -12 | 4 | 11 | -12 | -15 | 1 |
| Vehicle weight | 3 | 2 | 1 | 5 | -8 | -2 | 2 | -1 | -4 | 3 | -5 | -8 | -5 | 2 | -9 | 4 | 8 | -12 | -15 | 2 |
| Vehicle year | 0 | 0 | 2 | -1 | -1 | -7 | -2 | 2 | 0 | -6 | 8 | -1 | -1 | -3 | 8 | -3 | -9 | 9 | 13 | -1 |
| Vehicle mileage | 6 | 2 | -1 | 5 | -8 | 6 | 4 | 2 | 3 | -3 | -4 | -10 | -1 | 1 | -7 | 3 | 5 | -4 | -11 | -1 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Citizenship grade..... | 100 | | | | | | | | | | | | | | | | | | | |
| Absences..... | -44 | 100 | | | | | | | | | | | | | | | | | | |
| Non-language IQ..... | 29 | -22 | 100 | | | | | | | | | | | | | | | | | |
| Achievement test..... | 37 | -25 | 69 | 100 | | | | | | | | | | | | | | | | |
| IQ discrepancy..... | 0 | 0 | 23 | -13 | 100 | | | | | | | | | | | | | | | |
| Achievement index..... | 69 | -47 | 8 | 26 | 0 | 100 | | | | | | | | | | | | | | |
| Rural school..... | 0 | -1 | -4 | -6 | 6 | 0 | 100 | | | | | | | | | | | | | |
| Quest response date..... | -15 | 15 | -14 | -16 | 0 | -13 | 1 | 100 | | | | | | | | | | | | |
| Attitude..... | -13 | 9 | -15 | -17 | 0 | -5 | 1 | 11 | 100 | | | | | | | | | | | |
| Driver training safety... | -9 | 4 | 6 | 9 | -2 | -4 | 6 | -3 | 1 | 100 | | | | | | | | | | |
| Driver education..... | 5 | -10 | 7 | 7 | -1 | 5 | -6 | -3 | -3 | 0 | 100 | | | | | | | | | |
| Driver ed quality..... | 3 | -4 | 10 | 16 | -5 | 6 | 3 | -2 | -4 | 30 | 0 | 100 | | | | | | | | |
| Mileage work..... | -6 | 5 | -2 | -5 | 2 | -8 | 4 | 0 | -4 | 4 | 1 | -2 | 100 | | | | | | | |
| Mileage other..... | -11 | 4 | 5 | 2 | 4 | -8 | 2 | 2 | 4 | 4 | 1 | 1 | 10 | 100 | | | | | | |
| Annual mileage..... | -11 | 7 | 1 | -2 | 3 | -10 | 3 | 1 | -1 | 6 | 2 | 0 | 75 | 65 | 100 | | | | | |
| Total mileage..... | -22 | 15 | -12 | -15 | 0 | -16 | 9 | 8 | 2 | 7 | -3 | -1 | 31 | 23 | 36 | 100 | | | | |
| Prior mileage..... | -12 | 11 | -8 | -11 | 2 | -12 | 12 | 3 | 0 | 5 | -4 | -4 | 11 | 11 | 16 | 27 | 100 | | | |
| Vehicle weight..... | -11 | 12 | -9 | -13 | 3 | -9 | 3 | 5 | 2 | -4 | -1 | -2 | 12 | -1 | 8 | 14 | 7 | 100 | | |
| Vehicle year..... | 10 | -9 | 7 | 11 | -3 | 8 | 0 | -4 | -5 | 3 | 1 | 4 | 5 | 8 | 9 | 0 | 0 | -18 | 100 | |
| Vehicle mileage..... | -12 | 9 | -6 | -8 | 2 | -5 | 11 | 6 | -2 | 4 | -1 | -1 | 24 | 23 | 32 | 62 | 21 | 9 | -3 | 100 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipped seat belts..... | 2 | 0 | 4 | -1 | -5 | 2 | -1 | 2 | 5 | -6 | 7 | -4 | -2 | -2 | 8 | -2 | -9 | 12 | 13 | 1 |
| Wear seat belts..... | 0 | -1 | 1 | -5 | 3 | 2 | -2 | 2 | 2 | -1 | 6 | 3 | 0 | -2 | 6 | -1 | -6 | 6 | 12 | 3 |
| Married..... | 5 | 7 | 3 | 9 | -15 | 1 | 4 | -8 | -1 | 9 | -11 | -15 | 2 | 6 | -23 | 9 | 20 | -24 | -25 | -2 |
| Divorced/separated..... | -2 | 3 | 2 | 3 | -4 | -1 | -1 | -3 | 1 | 1 | -3 | -3 | -1 | 1 | -13 | 7 | 9 | -9 | -9 | 0 |
| Number of children..... | 1 | 5 | 2 | 7 | -9 | -2 | 1 | -16 | -2 | 10 | -11 | -9 | 0 | 4 | -26 | 8 | 24 | -24 | -24 | 0 |
| Number of brothers..... | 9 | -1 | -2 | 6 | -9 | -10 | -7 | -3 | -7 | 16 | -17 | -11 | 6 | 3 | -21 | 6 | 17 | -19 | -17 | 0 |
| Number of older sibs..... | 0 | -1 | -4 | 8 | -5 | -7 | -1 | -5 | -3 | 9 | -12 | -7 | -3 | 4 | -16 | 5 | 14 | -16 | -16 | 2 |
| Parents married..... | 2 | 0 | 0 | -1 | -1 | 0 | -3 | -1 | 1 | -6 | 10 | -1 | -2 | -45 | 8 | -7 | -7 | 9 | 12 | 0 |
| Student..... | -4 | -5 | -3 | -4 | 11 | 3 | -1 | 2 | 3 | -13 | 14 | 11 | 0 | -9 | 21 | -11 | -20 | 33 | 49 | 0 |
| Housewife..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Grade completed..... | -2 | -2 | 9 | -5 | -3 | 9 | 3 | 7 | 6 | -7 | 19 | 1 | -3 | -10 | 91 | -21 | -47 | 53 | 62 | 4 |
| Occupational goal..... | -5 | -5 | 3 | -9 | 10 | 2 | -2 | 3 | 3 | -8 | 14 | 12 | 5 | -4 | 26 | -11 | -24 | 36 | 43 | -1 |
| Social mobility..... | 13 | 2 | -6 | 9 | -10 | -8 | -1 | 1 | -2 | 6 | -4 | -14 | 2 | 4 | -3 | -2 | 6 | -4 | 1 | 0 |
| Unemployed..... | 0 | 0 | -1 | -1 | 1 | 0 | 0 | 1 | -3 | 3 | -1 | 1 | 1 | -2 | -6 | 5 | 6 | -7 | -12 | -2 |
| Social activities..... | -1 | 0 | -5 | 0 | 5 | 3 | 2 | 1 | 3 | -8 | 4 | 4 | -1 | -2 | 10 | -3 | -12 | 14 | 16 | 2 |
| Academic activities..... | 4 | -4 | 2 | 2 | -4 | 0 | -1 | 3 | 3 | -4 | 6 | -4 | 0 | -3 | 12 | -4 | -13 | 17 | 40 | -2 |
| Student activities..... | 0 | -1 | 2 | 0 | -1 | 3 | 2 | 2 | 4 | -10 | 5 | 0 | 0 | -3 | 10 | -4 | -12 | 14 | 23 | 0 |
| Intramural activities ... | 2 | 0 | -4 | 3 | 0 | 8 | 8 | 1 | 6 | -6 | -3 | -2 | 1 | 3 | 4 | 2 | -7 | 3 | 10 | 0 |
| Varsity letters. ..... | 5 | 3 | -1 | 4 | -7 | 14 | 13 | 3 | 5 | -7 | -1 | -9 | -3 | 2 | 10 | -5 | -9 | 10 | 21 | 1 |
| Non-varsity letters..... | 8 | -1 | -2 | 2 | -5 | 0 | 0 | 3 | 3 | -8 | 0 | -7 | 0 | -1 | 8 | -4 | -9 | 9 | 21 | 0 |
| Drinking ..... | 0 | 3 | 3 | -1 | -4 | 1 | 1 | -2 | -2 | -3 | -1 | -3 | 0 | 3 | 0 | 0 | 1 | 0 | -4 | -4 |
| Number of cigarettes..... | 2 | 3 | 4 | 1 | -7 | 2 | 4 | -1 | -2 | 1 | -7 | -6 | 3 | 7 | -20 | 11 | 19 | -21 | -32 | -5 |
| Number of jobs..... | 2 | 2 | -3 | 3 | -1 | 3 | 2 | 0 | -1 | 1 | -5 | -2 | 2 | 6 | -13 | 7 | 13 | -17 | -26 | 0 |
| Year own car..... .... | -2 | -5 | 2 | -2 | 4 | 3 | 0 | -4 | 0 | 22 | -3 | 5 | 1 | -7 | 3 | -4 | -6 | 11 | 18 | 3 |
| Hours driving..... | 2 | 1 | 4 | -3 | -4 | 1 | 4 | -1 | 1 | -2 | -2 | -3 | 1 | -1 | -8 | 3 | 8 | -8 | -17 | 2 |
| Percent motorcycle ..... | -4 | 1 | 1 | -2 | 3 | 1 | 1 | 1 | -1 | -5 | 5 | 4 | 1 | 0 | 2 | 0 | -2 | 0 | 0 | -1 |
| Armed forces service..... | 4 | 4 | 11 | 3 | -17 | 0 | -2 | 2 | -1 | 6 | -5 | -14 | 2 | 5 | -3 | 4 | 2 | -13 | -22 | -2 |
| Response bias..... | 3 | 1 | 7 | 2 | -12 | -1 | -2 | -1 | -5 | 8 | -9 | -9 | 5 | 10 | -17 | 11 | 13 | -21 | -24 | -4 |
| Driver train not offer... | -2 | 4 | 1 | -7 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 4 | 1 | -1 | 1 | -2 | -1 | -7 | 0 | -3 |
| Driv train taken w off... | -3 | 11 | -8 | 12 | -4 | 0 | 0 | 2 | 8 | -5 | 5 | -7 | -2 | -4 | 17 | 2 | -19 | 15 | 21 | 3 |
| Parents occupation..... | -13 | -5 | 7 | -13 | 18 | 10 | 0 | 2 | 6 | -13 | 14 | 22 | 2 | -4 | 20 | -4 | -19 | 20 | 26 | 0 |
| Sign violation 1-4 yrs... | -5 | -5 | -10 | -3 | 18 | -2 | -1 | -3 | -4 | 2 | -5 | 16 | -2 | 5 | -10 | 6 | 9 | -8 | -17 | -5 |
| Lane viol 1-4 yrs..... | -1 | -1 | -6 | -3 | 9 | -1 | 0 | -1 | -1 | 0 | -4 | 7 | -1 | 3 | -8 | 5 | 6 | -7 | -10 | -1 |
| Following viol 1-4 yrs... | -5 | -3 | -5 | -2 | 11 | 2 | 0 | 1 | 0 | 2 | -1 | 10 | -2 | 2 | -2 | 2 | 0 | 0 | -5 | 0 |
| Passing violation 1-4 yrs | 3 | -1 | -3 | 2 | -1 | 0 | 2 | 1 | 1 | -2 | -1 | -2 | 0 | 1 | -2 | 1 | 3 | -2 | -5 | -2 |
| Right-of-way viol 1-4 yrs | -1 | -4 | -5 | -3 | 10 | -1 | -1 | -3 | -3 | 1 | -2 | 8 | 1 | 1 | -4 | 4 | 2 | -5 | -9 | -2 |
| Turning viol 1-4 yrs..... | -7 | -3 | -9 | -3 | 17 | -1 | 0 | -1 | -2 | 3 | -5 | 15 | -1 | 2 | -7 | 5 | 5 | -6 | -12 | -4 |
| Speed violation 1-4 yrs.. | 2 | 1 | -4 | -1 | 2 | -2 | 1 | -1 | -1 | -8 | 1 | 0 | -4 | 4 | -12 | 6 | 11 | -11 | -26 | -7 |
| Drunk driv viol 1-4 yrs.. | -1 | 0 | -1 | -1 | 3 | -1 | -1 | -1 | -2 | 2 | -2 | 2 | 0 | 0 | -7 | 6 | 5 | -0 | -8 | -2 |
| Reckless dr viol 1-4 yrs. | 2 | 0 | -1 | 5 | -4 | -2 | 1 | 1 | -2 | 2 | -4 | -5 | 0 | 3 | -10 | 3 | 7 | -4 | -10 | -4 |

NOTE: Decimal points and lead zeros omitted.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
| Equipped seat belts..... | 12 | -10 | 9 | 13 | -2 | 7 | -2 | -7 | -9 | -2 | 3 | 1 | 1 | 6 | 5 | -2 | 0 | -6 | 27 | 0 |
| Wear seat belts..... | 11 | -12 | 8 | 11 | -1 | 8 | -1 | -9 | -18 | -9 | 2 | -3 | 3 | 0 | 2 | -4 | -1 | -2 | -3 | -1 |
| Married..... | -18 | 27 | -15 | -18 | 3 | -18 | 13 | 14 | 2 | 1 | -3 | -2 | 8 | -7 | 3 | 19 | 13 | 8 | -3 | 12 |
| Divorced/separated..... | -8 | 10 | -4 | -6 | 1 | -6 | 2 | 4 | 5 | 1 | -6 | -2 | -1 | 4 | 2 | 7 | 4 | 3 | -2 | 3 |
| Number of children..... | -16 | 25 | -14 | -17 | 4 | -17 | 10 | 10 | 4 | 0 | -5 | -3 | 6 | -7 | 1 | 16 | 8 | 7 | -5 | 7 |
| Number of brothers..... | -10 | 18 | -16 | -20 | 5 | -8 | 13 | 9 | 7 | -4 | -11 | -4 | 1 | -4 | -1 | 5 | 5 | 6 | -10 | 1 |
| Number of older sibs..... | -10 | 16 | -15 | -19 | 6 | -7 | 9 | 4 | 4 | -2 | -8 | 0 | 1 | -2 | 0 | 4 | 4 | 3 | -4 | 3 |
| Parents married..... | 9 | -16 | 8 | 8 | 1 | 8 | -1 | -5 | -2 | 3 | 1 | 2 | -1 | 2 | 0 | -6 | -8 | -2 | 4 | -1 |
| Student..... | 33 | -25 | 27 | 40 | -8 | 37 | -10 | -20 | -6 | 7 | 4 | 13 | -12 | -10 | -15 | -22 | -16 | -16 | 9 | -14 |
| Housewife..... | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Grade completed..... | 44 | -49 | 33 | 45 | -6 | 49 | -10 | -21 | -14 | 3 | 13 | 10 | -7 | -3 | -7 | -17 | -16 | -14 | 14 | -6 |
| Occupational goal..... | 29 | -22 | 32 | 43 | -7 | 26 | -12 | -14 | -11 | 7 | 5 | 9 | -8 | -2 | -6 | -16 | -10 | -16 | 11 | -9 |
| Social mobility..... | 4 | 5 | -4 | -2 | 2 | 6 | 16 | 3 | -1 | 0 | -2 | -2 | -2 | -1 | -3 | -1 | 7 | 2 | -1 | 2 |
| Unemployed..... | -9 | 8 | -8 | -8 | 0 | -10 | -1 | 4 | 9 | 2 | -5 | 1 | -5 | 2 | -2 | -1 | 1 | 1 | -5 | -3 |
| Social activities ..... | 7 | -9 | 5 | 10 | -5 | 13 | -3 | -2 | -2 | -1 | 4 | -7 | -1 | 3 | 2 | 0 | -3 | -5 | 8 | 7 |
| Academic activities..... | 30 | -15 | 26 | 33 | -3 | 28 | 0 | -8 | -11 | -4 | 1 | 4 | -4 | 0 | -2 | -7 | -6 | -5 | 8 | -4 |
| Student activities..... | 17 | -11 | 12 | 17 | -2 | 19 | 4 | -4 | -8 | -7 | 1 | -2 | -2 | 1 | 0 | -2 | -1 | -3 | 10 | 1 |
| Intramural activities.... | 3 | -6 | 3 | 4 | -1 | 10 | 9 | 3 | -3 | -4 | 0 | -4 | 1 | 3 | 2 | 3 | 3 | -4 | 5 | 6 |
| Varsity letters... ..... | 9 | -11 | 10 | 11 | 2 | 20 | 17 | -1 | -2 | 1 | 1 | 2 | -1 | 2 | 1 | 2 | 1 | -1 | 5 | 6 |
| Non-varsity letters ..... | 10 | -12 | 11 | 14 | -1 | 18 | 17 | -2 | -3 | 1 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | -3 | 4 | 5 |
| Drinking..... | -14 | 6 | 5 | 5 | -4 | -9 | -2 | 3 | 6 | 14 | -1 | 10 | -1 | 9 | 4 | 7 | 1 | 2 | -1 | 4 |
| Number of cigarettes..... | -33 | 23 | -9 | -14 | -2 | -32 | 4 | 10 | 5 | 6 | -7 | 0 | 7 | 8 | 11 | 16 | 8 | 7 | -2 | 10 |
| Number of jobs..... ..... | -19 | 18 | -12 | -19 | 3 | -22 | 5 | 8 | 7 | 0 | -1 | -2 | 5 | 4 | 7 | 12 | 7 | 6 | -9 | 8 |
| Year own car..... | 21 | -22 | 12 | 14 | -1 | 14 | -5 | -5 | -7 | -7 | -1 | 4 | -8 | -8 | -11 | -19 | -13 | -9 | 6 | -18 |
| Hours driving..... | -12 | 8 | -8 | -11 | 1 | -13 | 0 | -4 | 1 | 2 | -2 | 1 | 36 | 23 | 41 | 26 | 9 | 9 | 6 | 20 |
| Percent motorcycle..... | -5 | 1 | 3 | 1 | -2 | -2 | 0 | -2 | 3 | 5 | 2 | 3 | -1 | 5 | 3 | 4 | 5 | -18 | 2 | -1 |
| Armed forces service..... | -17 | 4 | -9 | -16 | 4 | -19 | 4 | 12 | -2 | -5 | 0 | -11 | 1 | 10 | 7 | 8 | 7 | 4 | -3 | 4 |
| Response bias..... | -18 | 15 | -14 | -17 | 3 | -18 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Driver train not offer... | 0 | -1 | 1 | 2 | 1 | 1 | 28 | 0 | 0 | -1 | -27 | 11 | 1 | 1 | 2 | -2 | 1 | -1 | 3 | 1 |
| Driv train taken w off... | 16 | -23 | 14 | 15 | 2 | 16 | 16 | -10 | -5 | 0 | 23 | -5 | 0 | 1 | 1 | -6 | -1 | -6 | 3 | 0 |
| Parents occupation..... | 14 | -19 | 25 | 31 | -7 | 12 | -23 | -10 | -7 | 4 | 7 | 7 | -3 | 1 | -1 | -8 | -11 | -13 | 10 | -8 |
| Sign violation 1-4 yrs... | -25 | 13 | -8 | -13 | -1 | -16 | -9 | 8 | 14 | 3 | -1 | -3 | 1 | 7 | 6 | 7 | 3 | 2 | -5 | 5 |
| Lane viol 1-4 yrs..... | -13 | 13 | -6 | -4 | -2 | -8 | -3 | 5 | 7 | 3 | 0 | 1 | 4 | 4 | 5 | 7 | 1 | 1 | -5 | 5 |
| Following viol 1-4 yrs... | -5 | 4 | 0 | -1 | -3 | -6 | -5 | 2 | 4 | 0 | 0 | 2 | 9 | 5 | 9 | 5 | -2 | -1 | 1 | 6 |
| Passing violation 1-4 yrs | -8 | 4 | -3 | -4 | 3 | -4 | 0 | 0 | 4 | 5 | -3 | 0 | 2 | 3 | 4 | 5 | 4 | -1 | 2 | 4 |
| Right-of-way viol 1-4 yrs | -12 | 10 | -5 | -6 | -2 | -9 | -4 | 2 | 8 | 2 | 1 | -2 | 2 | 3 | 3 | 4 | -1 | 0 | -3 | 4 |
| Turning viol 1-4 yrs..... | -16 | 10 | -7 | -9 | -1 | -10 | -7 | 5 | 10 | 4 | -2 | 1 | 3 | 1 | 3 | 5 | -2 | 1 | -4 | 4 |
| Speed violation 1-4 yrs.. | -33 | 19 | -8 | -12 | 1 | -26 | -6 | 8 | 14 | 12 | -2 | 1 | 11 | 13 | 18 | 21 | 14 | 5 | 3 | |
| Drunk driv viol 1-4 yrs.. | -7 | 9 | -4 | -6 | 1 | -7 | 0 | 0 | 5 | 1 | -3 | 0 | -2 | 2 | 0 | 3 | 1 | 1 | -4 | |
| Reckless dr viol 1-4 yrs. | -9 | 4 | -4 | -4 | -1 | -9 | 3 | 1 | 4 | 4 | -2 | 1 | -1 | 0 | 0 | 4 | 5 | 4 | -1 | 3 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Equipped seat belts | Wear seat belts | Married | Divorced/separated | Number of children | Number of brothers | Number of older sibs | Parents married | Student | Housewife | Grade completed | Occupational goal | Social mobility | Unemployed | Social activities | Academic activities | Student activities | Intramural activities | Varsity letters | Non-varsity letters |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipped seat belts..... | 100 | | | | | | | | | | | | | | | | | | | |
| Wear seat belts..... | 0 | 100 | | | | | | | | | | | | | | | | | | |
| Married..... | -6 | -12 | 100 | | | | | | | | | | | | | | | | | |
| Divorced/separated..... | -1 | -3 | 8 | 100 | | | | | | | | | | | | | | | | |
| Number of children..... | -7 | -10 | 59 | 19 | 100 | | | | | | | | | | | | | | | |
| Number of brothers..... | -13 | -9 | 15 | 1 | 17 | 100 | | | | | | | | | | | | | | |
| Number of older sibs..... | -9 | -6 | 12 | 1 | 14 | 61 | 100 | | | | | | | | | | | | | |
| Parents married..... | 9 | 4 | -9 | -2 | -9 | -3 | -6 | 100 | | | | | | | | | | | | |
| Student..... | 8 | 10 | -35 | -8 | -25 | -17 | -12 | 13 | 100 | | | | | | | | | | | |
| Housewife..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | | | | | | | | | | |
| Grade completed..... | 15 | 13 | -33 | -12 | -31 | -27 | -20 | 14 | 55 | 0 | 100 | | | | | | | | | |
| Occupational goal..... | 14 | 9 | -28 | -7 | -20 | -15 | -12 | 7 | 42 | 0 | 49 | 100 | | | | | | | | |
| Social mobility..... | -4 | -4 | 1 | 2 | 2 | 15 | 10 | -3 | -2 | 0 | -2 | 21 | 100 | | | | | | | |
| Unemployed..... | -7 | -4 | -5 | 6 | -1 | 5 | 2 | -1 | -2 | 0 | -10 | -8 | -1 | 100 | | | | | | |
| Social activities..... | 7 | 5 | -11 | -2 | -7 | -5 | -5 | 2 | 10 | 0 | 19 | 14 | 0 | -3 | 100 | | | | | |
| Academic activities..... | 9 | 14 | -14 | -5 | -11 | -8 | -8 | 4 | 23 | 0 | 31 | 23 | 3 | -5 | 20 | 100 | | | | |
| Student activities..... | 10 | 8 | -10 | -2 | -9 | -3 | -5 | 2 | 15 | 0 | 23 | 17 | 0 | -6 | 33 | 28 | 100 | | | |
| Intramural activities.... | 5 | 0 | -1 | 0 | 0 | 0 | -3 | -3 | 5 | 0 | 13 | 9 | 2 | -5 | 22 | 11 | 20 | 100 | | |
| Varsity letters ..... | 5 | 1 | -5 | -2 | -4 | 0 | 0 | -1 | 11 | 0 | 17 | 6 | 4 | -4 | 21 | 12 | 20 | 38 | 100 | |
| Non-varsity letters..... | 4 | -5 | -3 | -3 | -4 | 0 | -3 | 2 | 9 | 0 | 14 | 9 | 5 | -3 | 17 | 12 | 18 | 35 | 43 | 100 |
| Drinking..... | -2 | -12 | -8 | 4 | -3 | -2 | -4 | -2 | -4 | 0 | -1 | 2 | -4 | -1 | 8 | -4 | 4 | 7 | 4 | 4 |
| Number of cigarettes..... | -6 | -13 | 13 | 6 | 11 | 3 | 3 | -8 | -28 | 0 | -26 | -15 | -2 | 4 | -3 | -13 | -7 | -4 | -8 | -8 |
| Number of jobs..... | -9 | -5 | 18 | 5 | 13 | 0 | 8 | -7 | -35 | 0 | -26 | -19 | -1 | 6 | -5 | -9 | -6 | 0 | -2 | -1 |
| Year own car..... | 1 | 7 | -8 | -3 | -5 | 1 | -1 | 8 | 14 | 0 | 13 | 14 | 0 | 1 | -3 | 7 | -1 | -4 | -2 | -1 |
| Hours driving..... | 1 | -4 | 7 | 5 | 7 | 2 | 5 | -1 | -14 | 0 | -10 | -14 | -5 | 0 | 1 | -7 | -3 | -1 | -3 | -3 |
| Percent motorcycle..... | -9 | 3 | -4 | 0 | -4 | -3 | -2 | -2 | 0 | 0 | 0 | -1 | 0 | 1 | -2 | -1 | -3 | -1 | 0 | -1 |
| Armed forces service..... | 2 | 5 | 2 | 1 | -6 | 1 | -2 | -3 | -44 | 0 | -23 | -15 | 1 | -2 | 0 | -9 | -3 | 3 | -2 | -2 |
| Response bias... ..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Driver train not offer... | 0 | 1 | -5 | 1 | -4 | 6 | 2 | 4 | 5 | 0 | 1 | 4 | 0 | 3 | 1 | 3 | 10 | 9 | 6 | 5 |
| Driv train taken w off.. | 0 | 8 | -8 | -3 | -8 | -8 | -8 | 7 | 11 | 0 | 19 | 11 | 1 | -2 | 6 | 14 | 7 | 3 | 4 | 4 |
| Parents occupation ..... | 14 | 11 | -18 | -5 | -15 | -24 | -22 | 6 | 29 | 0 | 32 | 33 | -63 | -4 | 10 | 12 | 12 | 6 | 3 | 2 |
| Sign violation 1-4 yrs... | -6 | -8 | 5 | 2 | 5 | 1 | 1 | -4 | -9 | 0 | -10 | -5 | -2 | 3 | 0 | -5 | -2 | 0 | -2 | -1 |
| Lane viol 1-4 yrs..... | -4 | -3 | 5 | 4 | 7 | 3 | 3 | -5 | -5 | 0 | -8 | -7 | -1 | 2 | -1 | -5 | -1 | 0 | -2 | -1 |
| Following viol 1-4 yrs... | 0 | -1 | 1 | -1 | 1 | -1 | -1 | -3 | -4 | 0 | -4 | -2 | 0 | -2 | -2 | -4 | -3 | -3 | -2 | -1 |
| Passing violation 1-4 yrs | -1 | -2 | 1 | 2 | 0 | 1 | 2 | -2 | -2 | 0 | -3 | -2 | 1 | -1 | 1 | -1 | -1 | 2 | 0 | 0 |
| Right-of-way viol 1-4 yrs | -3 | -4 | 2 | 2 | 3 | 4 | 2 | 0 | -5 | 0 | -6 | -2 | -2 | 2 | 1 | -3 | -2 | 0 | -2 | -1 |
| Turning viol 1-4 yrs..... | -4 | -4 | 5 | 3 | 6 | 2 | 2 | -5 | -7 | 0 | -8 | -9 | -2 | 4 | 0 | -4 | -5 | -2 | -4 | -4 |
| Speed violation 1-4 yrs.. | -1 | -11 | 13 | 6 | 9 | 0 | 3 | -6 | -20 | 0 | -20 | -14 | -3 | 5 | -4 | -11 | -7 | -2 | -4 | -4 |
| Drunk driv viol 1-4 yrs.. | -2 | 1 | 0 | -1 | 0 | 3 | 4 | -5 | -4 | 0 | -6 | -4 | 2 | 4 | 0 | -3 | -1 | 1 | 0 | 1 |
| Reckless dr viol 1-4 yrs. | -2 | -4 | 3 | 3 | 2 | 1 | 1 | -2 | -3 | 0 | -7 | -4 | -2 | 5 | 0 | -2 | -2 | -1 | -2 | -2 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Drinking | Number of cigarettes | Number of jobs | Year own car | Hours driving | Percent motorcycle | Armed forces service | Response bias | Driver train not offer | Driv train taken w offer | Parents occupation | Sign violation 1-4 yrs | Lane viol 1-4 yrs | Following viol 1-4 yrs | Passing violation 1-4 yrs | Right-of-way viol 1-4 yrs | Turning viol 1-4 yrs | Speed violation 1-4 yrs | Drunk driv viol 1-4 yrs | Reckless dr viol 1-4 yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drinking..... | 100 | | | | | | | | | | | | | | | | | | | |
| Number of cigarettes..... | 26 | 100 | | | | | | | | | | | | | | | | | | |
| Number of jobs..... | 4 | 14 | 100 | | | | | | | | | | | | | | | | | |
| Year own car.. ..... | -8 | -11 | -8 | 100 | | | | | | | | | | | | | | | | |
| Hours driving..... | 1 | 12 | 6 | -9 | 100 | | | | | | | | | | | | | | | |
| Percent motorcycle..... | 3 | 3 | 2 | -4 | -1 | 100 | | | | | | | | | | | | | | |
| Armed forces service..... | 10 | 21 | 8 | -8 | -3 | 2 | 100 | | | | | | | | | | | | | |
| Response bias..... | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 100 | | | | | | | | | | | | |
| Driver train not offer... | 3 | 3 | -1 | 4 | -1 | -2 | -5 | 1 | 100 | | | | | | | | | | | |
| Driv train taken w off... | -3 | -8 | -8 | 7 | -4 | 1 | -1 | -9 | 0 | 100 | | | | | | | | | | |
| Parents occupation..... | 6 | -6 | -11 | 9 | -5 | 3 | -11 | -16 | -3 | 7 | 130 | | | | | | | | | |
| Sign violation 1-4 yrs... | 2 | 5 | 11 | -7 | 5 | 3 | -5 | 2 | 1 | -5 | -1 | 100 | | | | | | | | |
| Lane viol 1-4 yrs..... | 1 | 6 | 6 | -6 | 1 | 5 | -4 | 1 | -1 | -2 | -2 | 14 | 100 | | | | | | | |
| Following viol 1-4 yrs... | -1 | 1 | 3 | -2 | 4 | 3 | -2 | 0 | -1 | 0 | 0 | 9 | 9 | 100 | | | | | | |
| Passing violation 1-4 yrs | 0 | 1 | 2 | -6 | 2 | 5 | 0 | 1 | -1 | -1 | -1 | 6 | 5 | 3 | 100 | | | | | |
| Right-of-way viol 1-4 yrs | 1 | 5 | 4 | -5 | 2 | 1 | -2 | 2 | 0 | -4 | -1 | 13 | 8 | 3 | 3 | 100 | | | | |
| Turning viol 1-4 yrs..... | 0 | 4 | 6 | -5 | 2 | 2 | -5 | 1 | -3 | -5 | -1 | 20 | 10 | 7 | 7 | 9 | 100 | | | |
| Speed violation 1-4 yrs.. | 6 | 18 | 17 | -17 | 13 | 10 | 1 | 2 | -2 | -7 | -9 | 26 | 17 | 12 | 12 | 10 | 15 | 100 | | |
| Drunk driv viol 1-4 yrs.. | 4 | 2 | 4 | -1 | -2 | 1 | -1 | 2 | 0 | -1 | -3 | 9 | 4 | 1 | 0 | 2 | 1 | 5 | 100 | |
| Reckless dr viol 1-4 yrs. | 2 | 4 | 5 | -2 | -1 | 2 | -2 | 3 | -1 | -1 | -3 | 8 | 6 | 2 | 2 | 5 | 3 | 13 | 4 | 100 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Driv w susp viol 1-4 yrs. | -1 | -1 | -2 | 1 | 3 | -1 | 0 | 1 | -1 | 0 | -4 | 2 | -2 | 3 | -16 | 8 | 9 | -9 | -12 | -3 |
| Hit and run viol 1-4 yrs. | -1 | -2 | -1 | 1 | 2 | -3 | 1 | 1 | -3 | 0 | -3 | 2 | 2 | 1 | -6 | 6 | 3 | -6 | -8 | -2 |
| FTA/FTP viol 1-4 yrs..... | -3 | -6 | -3 | -3 | 9 | -1 | -1 | -3 | -5 | 9 | -11 | 8 | 2 | 9 | -27 | 15 | 21 | -19 | -25 | -6 |
| Equipment viol 1-4 yrs .. | 2 | . | -15 | 1 | 11 | -6 | -4 | -1 | -5 | 2 | -9 | 5 | -1 | 10 | -25 | 13 | 21 | -23 | -30 | -6 |
| Misc moving viol 1-4 yrs. | -1 | -1 | -3 | -1 | 4 | -7 | -2 | 1 | -1 | -2 | -2 | 4 | 4 | 2 | -4 | 3 | 3 | -4 | -6 | -2 |
| Misc non-mov viol 1-4 yrs | 0 | 1 | -11 | -1 | 10 | -5 | -4 | -2 | -5 | 3 | -11 | 6 | -2 | 8 | -25 | 13 | 20 | -19 | -28 | -5 |
| Convictions 6 mos prior.. | 0 | 0 | -6 | 3 | 3 | -4 | -1 | 0 | -1 | 1 | -2 | 1 | 0 | 6 | -14 | 7 | 11 | -11 | -14 | -1 |
| Convictions 1 yr..... | 0 | 0 | -12 | -1 | 12 | -3 | -1 | -1 | -3 | 2 | -7 | 8 | -3 | 9 | -25 | 13 | 19 | -20 | -30 | -7 |
| Convictions 2 yr..... | 2 | -2 | -13 | -1 | 12 | -2 | 0 | 0 | -3 | 3 | -8 | 7 | -2 | 7 | -16 | 10 | 13 | -15 | -26 | -6 |
| Convictions 3 yr..... | 0 | -1 | -9 | -1 | 9 | -4 | -3 | -2 | -4 | -5 | -4 | 6 | -3 | 4 | -14 | 8 | 12 | -13 | -26 | -5 |
| Convictions 4 yr..... | -2 | -2 | -7 | -1 | 9 | -4 | -1 | -2 | -2 | -3 | -3 | 7 | -3 | 5 | -14 | 8 | 12 | -9 | -19 | -4 |
| Convictions 1-2 yrs..... | 1 | -2 | -15 | -1 | 14 | -3 | -1 | -1 | -4 | 4 | -9 | 9 | -3 | 9 | -25 | 14 | 20 | -21 | -35 | -8 |
| Convictions 1-4 yrs..... | 0 | -2 | -15 | -1 | 15 | -5 | -2 | -2 | -5 | -1 | -7 | 10 | -4 | 9 | -25 | 14 | 20 | -21 | -37 | -8 |
| Convictions 3-4 yrs..... | -1 | -2 | -10 | -1 | 11 | -5 | -2 | -2 | -4 | -5 | -4 | 8 | -4 | 6 | -17 | 10 | 14 | -14 | -28 | -6 |
| Accidents 6 mos prior.... | -1 | - | 0 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | -1 | 0 | 0 | -7 | 4 | 2 | -3 | -5 | -1 |
| Accidents 1 yr... ..... | -4 | 2 | 1 | 0 | 2 | -3 | 0 | 0 | -2 | -1 | 0 | 2 | 0 | 1 | -8 | 4 | 6 | -5 | -11 | -3 |
| Accidents 2 yr..... | -2 | 2 | -1 | 0 | 1 | 2 | 2 | 1 | -2 | -1 | 1 | 1 | -1 | 0 | -1 | 0 | 1 | -4 | -10 | -2 |
| Accidents 3 yr..... | -2 | -1 | 1 | -1 | 1 | -2 | -1 | 0 | -1 | -6 | 3 | 2 | -1 | -1 | 1 | -1 | -1 | 3 | -9 | -2 |
| Accidents 4 yr..... | -1 | 1 | 0 | -1 | 1 | 0 | 0 | 0 | -1 | -3 | 3 | 1 | 0 | -1 | -2 | -1 | 2 | -1 | -3 | -1 |
| Accidents 1-2 yrs..... | -4 | 2 | 0 | 0 | 2 | -1 | 1 | 1 | -2 | -2 | 1 | 2 | -1 | 1 | -6 | 3 | 5 | -6 | -14 | -3 |
| Accidents 1-4 yrs..... | -4 | 2 | 1 | -1 | 2 | -2 | 0 | 0 | -2 | -5 | 3 | 3 | -1 | -1 | -4 | 1 | 4 | -3 | -13 | -4 |
| Accidents 3-4 yrs..... | -2 | 1 | 1 | -1 | 1 | -2 | -1 | 0 | -1 | -6 | 4 | 2 | -1 | -1 | 0 | -2 | 1 | 2 | -4 | -2 |
| Fatal/injury acc 1 yr.... | -3 | -1 | 2 | -1 | 2 | -1 | 2 | -1 | -1 | -1 | 0 | 3 | 0 | 0 | -6 | 3 | 5 | -6 | -9 | -1 |
| Fatal/injury acc 1-4 yrs. | -3 | 0 | 1 | -1 | 2 | -1 | 0 | -1 | -2 | -2 | 0 | 3 | 0 | 1 | -6 | 3 | 5 | -7 | -12 | -3 |
| Property acc 1 yr..... | -3 | 2 | 0 | 1 | 1 | -3 | -1 | 1 | -1 | -1 | 0 | 1 | 0 | 1 | -6 | 3 | 3 | -2 | -7 | -1 |
| Property acc 1-4 yrs..... | -3 | 2 | 0 | -1 | 1 | -1 | 1 | 1 | -2 | -6 | 4 | 2 | -1 | -1 | -1 | -1 | 1 | 1 | -8 | -3 |
| Single veh acc 1 yr..... | -1 | 1 | -1 | 2 | 0 | -2 | 0 | 1 | 0 | -2 | -1 | -1 | 0 | 1 | -5 | 1 | 5 | -3 | -4 | 0 |
| Single veh acc 1-4 yrs... | 1 | 4 | -2 | 1 | -2 | -2 | 0 | 1 | 1 | -2 | 0 | -3 | 0 | 3 | -4 | 0 | 7 | -5 | -7 | -2 |
| Drunk driv acc 1-4 yrs... | 0 | 0 | -1 | 5 | -1 | -1 | 3 | -3 | 0 | 2 | -3 | -2 | 0 | 1 | -5 | 2 | 2 | -2 | -2 | -2 |
| Part fault acc 1 yr..... | -1 | 1 | 2 | -1 | 0 | -1 | 1 | 0 | 0 | -2 | 0 | 0 | 0 | 0 | -8 | 5 | 5 | -7 | -8 | 0 |
| Part fault acc 1-4 yrs... | -1 | 0 | 1 | 1 | 0 | -2 | 0 | -1 | -1 | -2 | 1 | 0 | -1 | 0 | -7 | 4 | 5 | -7 | -11 | -2 |
| Accident cost 1 yr ..... | -4 | -1 | 2 | -1 | 2 | -1 | 1 | 0 | -1 | -2 | 0 | 4 | 0 | 0 | -6 | 4 | 4 | -6 | -8 | -2 |
| Accident cost 1-4 yrs.... | -4 | 0 | 1 | -1 | 2 | -1 | 0 | 0 | -2 | -3 | 1 | 3 | 0 | 0 | -5 | 3 | 5 | -7 | -12 | -3 |
| School data missing..... | -11 | -3 | -18 | -10 | 33 | -2 | -1 | -1 | 0 | 5 | -7 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Length license gap 1-4 yr | 1 | 0 | -3 | 0 | 1 | 3 | 2 | -1 | -3 | 14 | -17 | 0 | 11 | 10 | -21 | 19 | 15 | -20 | -16 | -3 |
| Accident rate 1-4 yrs.... | -7 | 2 | 0 | -1 | 5 | -2 | 1 | 2 | -4 | -3 | 1 | 6 | 1 | 4 | -5 | 3 | 3 | -4 | -13 | -6 |
| Convictions DT 1 yr..... | 0 | -1 | -14 | 0 | 13 | -4 | 0 | 0 | -4 | 0 | -6 | 8 | -2 | 8 | -20 | 12 | 17 | -16 | -29 | -5 |
| Accidents DT 1 yr..... | -4 | 0 | 0 | 0 | 3 | -3 | 1 | 2 | -1 | -3 | 1 | 4 | 1 | 2 | -4 | 3 | 2 | -2 | -10 | -3 |
| Quest data missing..... | 2 | 1 | 5 | 1 | 7 | -1 | -2 | -1 | -6 | 9 | -9 | -6 | 5 | 10 | -17 | 11 | 13 | -21 | -24 | -4 |
| Single lic renewal..... | 0 | -3 | 0 | -4 | 4 | 0 | -2 | 11 | 1 | -12 | 12 | 4 | 0 | -6 | 22 | -6 | -20 | 20 | 20 | 1 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
| Driv w susp viol 1-4 yrs. | -9 | 12 | -7 | -10 | 1 | -10 | -2 | 2 | 7 | -2 | -2 | -2 | 3 | 3 | 2 | 4 | 0 | 1 | -4 | -1 |
| Hit and run viol 1-4 yrs. | -9 | 7 | -5 | -5 | -1 | -7 | -1 | 2 | 3 | -4 | 1 | 1 | 0 | -2 | -2 | 1 | -3 | 1 | -1 | -2 |
| FTA/FTP viol 1-4 yrs..... | -20 | 21 | -12 | -15 | 0 | -21 | -4 | 10 | 13 | -1 | -7 | -4 | 2 | 4 | 4 | 9 | 7 | 4 | -8 | 3 |
| Equipment viol 1-4 yrs... | -30 | 24 | -10 | -21 | 1 | -26 | 2 | 9 | 17 | 1 | -3 | -4 | 6 | 6 | 8 | 11 | 0 | 4 | -12 | 7 |
| Misc moving viol 1-4 yrs. | -11 | 5 | -2 | -4 | 0 | -6 | -2 | 1 | 2 | 0 | -3 | 2 | 1 | 2 | 2 | 2 | 0 | 1 | -4 | 1 |
| Misc non-mov viol 1-4 yrs | -29 | 26 | -15 | -19 | -1 | -24 | -2 | 10 | 15 | 4 | -3 | -2 | 4 | 5 | 6 | 11 | 7 | 4 | -10 | 4 |
| Convictions 6 mos prior.. | -14 | 13 | -8 | -8 | 0 | -10 | 0 | 7 | 5 | 0 | 0 | -2 | 2 | 0 | 1 | 5 | 0 | 1 | -3 | 2 |
| Convictions 1 yr..... | -32 | 30 | -14 | -18 | -4 | -29 | -4 | 9 | 14 | 8 | -5 | 0 | 4 | 7 | 8 | 14 | 8 | 6 | -5 | 8 |
| Convictions 2 yr..... | -31 | 29 | -12 | -17 | 2 | -24 | -5 | 10 | 14 | 8 | -3 | -1 | 6 | 8 | 11 | 15 | 10 | 3 | -5 | 12 |
| Convictions 3 yr..... | -30 | 1[illegible] | -9 | -14 | 3 | -24 | -5 | 7 | 15 | 6 | -1 | -1 | 7 | 10 | 10 | 12 | 5 | 4 | -5 | 12 |
| Convictions 4 yr..... | -29 | 19 | -8 | -12 | 0 | -16 | -4 | 6 | 17 | 6 | -1 | -2 | 10 | 9 | 13 | 14 | 7 | 3 | -1 | 9 |
| Convictions 1-2 yrs..... | -39 | 35 | -16 | -22 | -1 | -32 | -6 | 12 | 17 | 10 | -5 | -1 | 7 | 9 | 12 | 18 | 11 | 5 | -6 | 13 |
| Convictinns 1-4 yrs..... | -44 | 35 | -16 | -23 | 0 | -34 | -7 | 12 | 23 | 10 | -4 | -2 | 11 | 13 | 16 | 20 | 11 | 5 | -6 | 16 |
| Convictions 3-4 yrs..... | -34 | 25 | -11 | -17 | 1 | -26 | -5 | 9 | 20 | 7 | -1 | -2 | 11 | 11 | 15 | 16 | 7 | 4 | -4 | 14 |
| Accidents 6 mos prior.... | -4 | 3 | -3 | -3 | 0 | -5 | -1 | 3 | 4 | 2 | -2 | -4 | 2 | 2 | 2 | 2 | 5 | -1 | 0 | 1 |
| Accidents 1 yr..... | -13 | 7 | -5 | -4 | -1 | -11 | -3 | 4 | 6 | 5 | -2 | 2 | 2 | 3 | 4 | 6 | 4 | 2 | 1 | 4 |
| Accidents 2 yr..... | -7 | 5 | -5 | -5 | 0 | -9 | -1 | 4 | 2 | 0 | 2 | -1 | 4 | 4 | 5 | 5 | 3 | 0 | 0 | 5 |
| Accidents 3 yr..... | -8 | 2 | 0 | 0 | 2 | -3 | 0 | 0 | 4 | 4 | 0 | 4 | 4 | 4 | 4 | 4 | -1 | 2 | 2 | 5 |
| Accidents 4 yr..... | -4 | 2 | -1 | -2 | -1 | -1 | -1 | 1 | 3 | 4 | -3 | 2 | 3 | 3 | 4 | 4 | 0 | 1 | 3 | 4 |
| Accidents 1-2 yrs..... | -15 | 8 | -6 | -7 | -1 | -14 | -3 | 6 | 5 | 3 | 0 | 3 | 4 | 5 | 6 | 7 | 5 | 1 | 1 | 6 |
| Accidents 1-4 yrs..... | -15 | 8 | -5 | -6 | 0 | -12 | -2 | 4 | 7 | 6 | -1 | 3 | 6 | 7 | 7 | 9 | 3 | 3 | 3 | 9 |
| Accidents 3-4 yrs..... | -7 | 5 | -1 | -1 | 0 | -3 | -1 | 0 | 5 | 5 | -2 | 4 | 4 | 5 | 6 | 6 | 0 | 3 | 3 | 6 |
| Fatal/injury acc 1 yr.... | -9 | 5 | -4 | -3 | -1 | -8 | -2 | 3 | 5 | 4 | -2 | 2 | 3 | 3 | 4 | 4 | 3 | 2 | 2 | 1 |
| Fatal/injury acc 1-4 yrs. | -14 | 7 | -6 | -8 | 0 | -11 | -1 | 5 | 5 | 5 | -3 | 3 | 5 | 5 | 6 | 6 | 4 | 1 | 0 | 4 |
| Property acc 1 yr..... | -9 | 4 | -3 | -3 | -1 | -7 | -2 | 3 | 3 | 3 | -1 | 1 | 1 | 1 | 2 | 3 | 3 | 0 | 0 | 4 |
| Property acc 1-4 yrs..... | -10 | 5 | -2 | -2 | -1 | -8 | -3 | 2 | 5 | 4 | 0 | 2 | 4 | 5 | 7 | 7 | 1 | 2 | 3 | 8 |
| Single veh acc 1 yr..... | -7 | 4 | -3 | -2 | -2 | -5 | 1 | 3 | 0 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | -1 | 0 |
| Single veh acc 1-4 yrs... | -8 | 5 | -5 | -6 | 0 | -6 | -1 | 3 | 1 | 4 | -1 | 2 | 2 | 3 | 4 | 3 | 1 | -1 | -1 | 2 |
| Drunk driv acc 1-4 yrs... | -2 | 3 | -2 | -3 | 2 | -2 | 2 | 1 | 2 | 2 | -1 | -1 | -2 | -1 | -2 | -1 | 2 | 1 | -3 | -1 |
| Part fault acc 1 yr..... | -7 | 4 | -4 | -3 | -2 | -8 | -1 | 3 | 4 | 4 | -2 | 2 | 3 | 5 | 6 | 6 | 2 | 3 | 0 | 1 |
| Part fault acc 1-4 yrs... | -12 | 5 | -6 | -6 | -1 | -10 | 0 | 4 | 3 | 6 | 0 | 2 | 3 | 5 | 5 | 6 | 3 | 3 | 0 | 3 |
| Accident cost 1 yr..... | -9 | 6 | -3 | -3 | -1 | -9 | -3 | 2 | 5 | 4 | -1 | 2 | 2 | 3 | 4 | 6 | 3 | 2 | 1 | 2 |
| Accident cost 1-4 yrs.... | -15 | 9 | -6 | -7 | 0 | -11 | -1 | 4 | 5 | 6 | -2 | 4 | 5 | 5 | 6 | 8 | 4 | 2 | 1 | 6 |
| School data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | -3 | -10 | -1 | 1 | 0 | 2 | -1 | 2 | 0 | 0 | -1 |
| Length license gap 1-4 yr | -19 | 13 | -8 | -9 | -3 | -16 | 3 | 9 | 2 | -3 | -4 | -5 | 0 | -1 | 0 | 4 | 3 | 1 | -5 | -2 |
| Accident rate 1-4 yrs.... | -14 | 7 | -7 | -6 | 0 | -12 | -4 | 4 | 6 | 4 | -1 | 2 | 1 | 3 | 3 | -2 | 0 | 1 | 2 | 1 |
| Convictions DT 1 yr..... | -29 | 24 | -12 | -17 | 0 | -26 | -6 | 9 | 15 | 9 | -4 | 0 | 6 | 8 | 11 | 15 | 9 | 6 | -4 | 12 |
| Accidents DT 1 yr..... | -11 | 7 | -2 | -2 | 1 | -11 | -4 | 4 | 4 | 3 | -2 | -1 | 3 | 4 | 5 | 5 | 4 | 1 | 0 | 4 |
| Quest data missing..... | -18 | 16 | -14 | -17 | 3 | -18 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Single lic renewal..... | 15 | -18 | 12 | 15 | -1 | 16 | -5 | -8 | -4 | 0 | 6 | 2 | -6 | 6 | -2 | -14 | -9 | -7 | 5 | -8 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equipped seat belts | Wear seat belts | Married | Divorced/separated | Number of children | Number of brothers | Number of older sibs | Parents married | Student | Housewife | Grade completed | Occupational goal | Social mobility | Unemployed | Social activities | Academic activities | Student activities | Intramural activities | Varsity letters | Non-varsity letters |
| Driv w susp viol 1-4 yrs. | .04 | .02 | 4 | 2 | 2 | 5 | 4 | -.05 | .07 | 0 | .015 | .010 | .02 | 2 | .04 | .04 | .04 | .04 | .02 | .03 |
| Hit and run viol 1-4 yrs. | .04 | .04 | 3 | .01 | 4 | 1 | 0 | 0 | .03 | 0 | .06 | .07 | .03 | 4 | .02 | .04 | 0 | .03 | .03 | .02 |
| FTA/FTP viol 1-4 yrs..... | .07 | .04 | 9 | 7 | 10 | 7 | 3 | .011 | .012 | 0 | .022 | .013 | 0 | 10 | .03 | .05 | .04 | .01 | .04 | .05 |
| Equipment viol 1-4 yrs... | .012 | .05 | 13 | 4 | 14 | 11 | 6 | .012 | .018 | 0 | .029 | .015 | 0 | 8 | .07 | .011 | .010 | .04 | .07 | .07 |
| Misc moving viol 1-4 yrs. | .04 | .01 | .01 | 6 | 0 | 0 | .01 | .04 | .04 | 0 | .07 | .03 | .01 | 1 | .01 | .03 | .03 | 1 | .02 | .01 |
| Misc non-mov viol 1-4 yrs | .010 | .07 | 10 | 7 | 9 | 11 | 5 | .013 | .014 | 0 | .027 | .016 | 0 | 8 | .03 | .010 | .08 | .03 | .06 | .05 |
| Convictions 6 mos prior.. | .05 | .03 | 7 | 2 | 8 | 9 | 6 | .010 | .08 | 0 | .014 | .09 | 0 | 4 | .06 | .07 | .05 | .03 | .04 | .02 |
| Convictions 1 yr..... | .06 | .07 | 10 | 5 | 15 | 5 | 5 | .011 | .017 | 0 | .026 | .013 | .03 | 4 | .03 | .018 | .07 | .04 | .08 | .07 |
| Convictions 2 yr..... | .07 | .09 | 13 | 8 | 12 | 7 | 5 | .09 | .019 | 0 | .023 | .013 | .02 | 4 | .03 | .010 | .07 | .01 | .04 | .03 |
| Convictions 3 yr..... | .08 | .07 | 8 | 4 | 6 | 4 | 3 | .05 | .016 | 0 | .019 | .013 | .01 | 7 | .04 | .09 | .08 | .03 | .05 | .03 |
| Convictions 4 yr..... | .04 | .08 | 4 | 4 | 3 | 4 | 3 | .08 | .09 | 0 | .015 | .010 | .01 | 9 | 0 | .05 | .04 | 1 | .01 | .02 |
| Convictions 1-2 yrs..... | .08 | .010 | 18 | 8 | 17 | 7 | 6 | .013 | .023 | 0 | .030 | .016 | .03 | 5 | .05 | .014 | .09 | .03 | .07 | .06 |
| Convictions 1-4 yrs..... | .09 | .012 | 15 | 8 | 13 | 7 | 6 | .012 | .023 | 0 | .030 | .019 | .03 | 9 | .04 | .013 | .010 | .03 | .06 | .05 |
| Convictions 3-4 yrs..... | .08 | .09 | 7 | 5 | 6 | 5 | 4 | .08 | .016 | 0 | .021 | .013 | .01 | 9 | .02 | .09 | .07 | .02 | .04 | .03 |
| Accidents 6 mos prior.... | .03 | .02 | 4 | 2 | 2 | 1 | 2 | .01 | .02 | 0 | .06 | .02 | .01 | 2 | 0 | .02 | .01 | .01 | .01 | 0 |
| Accidents 1 yr..... | 1 | .05 | 6 | 3 | 6 | 0 | 2 | .04 | .08 | 0 | .09 | .04 | .03 | 3 | 0 | .05 | .03 | .02 | .03 | .04 |
| Accidents 2 yr..... | 1 | .01 | 5 | 0 | 5 | .01 | 2 | .02 | .010 | 0 | .08 | .03 | .04 | 0 | .01 | .05 | .01 | 2 | .02 | 0 |
| Accidents 3 yr..... | 1 | .01 | 3 | 0 | 1 | 0 | 0 | .03 | .04 | 0 | .03 | .01 | .01 | 3 | .01 | .03 | .01 | 0 | .03 | 0 |
| Accidents 4 yr..... | 0 | .01 | 0 | 3 | .02 | .01 | 0 | .05 | .02 | 0 | .03 | .02 | 0 | 3 | 0 | .01 | 0 | 2 | 2 | 0 |
| Accidents 1-2 yrs..... | 1 | .04 | 8 | 2 | 7 | .01 | 3 | .04 | .012 | 0 | .012 | .08 | .05 | 2 | 0 | .07 | .02 | 0 | .04 | .03 |
| Accidents 1-4 yrs..... | 2 | .05 | 7 | 3 | 5 | .01 | 2 | .06 | .012 | 0 | .011 | .05 | .04 | 4 | .01 | .07 | .02 | 1 | .03 | .02 |
| Accidents 3-4 yrs..... | 1 | .03 | 2 | 2 | 0 | .01 | 0 | .05 | .04 | 0 | .04 | .02 | 0 | 4 | .01 | .03 | 0 | 1 | .01 | 0 |
| Fatal/injury acc 1 yr.... | .01 | .04 | 6 | .01 | 4 | 1 | 2 | .02 | .07 | 0 | .08 | .04 | .03 | 2 | .01 | .05 | .04 | 0 | .02 | .03 |
| Fatal/injury acc 1-4 yrs. | .02 | .05 | 8 | 2 | 6 | 0 | 1 | .06 | .011 | 0 | .011 | .06 | .04 | 3 | 0 | .05 | .04 | 0 | .01 | .01 |
| Property acc 1 yr..... | 1 | .04 | 3 | 4 | 5 | .01 | 1 | .03 | .05 | 0 | .06 | .02 | .02 | 2 | 1 | .03 | .01 | .02 | .02 | .03 |
| Property acc 1-4 yrs.. .. | 3 | .03 | 3 | 2 | 2 | .01 | 2 | .04 | .07 | 0 | .07 | .02 | .02 | 3 | .01 | .08 | 0 | 1 | .03 | .01 |
| Single veh acc 1 yr..... | 0 | 0 | 4 | 1 | 3 | 1 | 0 | .02 | .05 | 0 | .06 | .03 | .01 | 3 | 0 | .01 | 0 | 1 | .02 | 1 |
| Single veh acc 1-4 yrs... | 0 | .02 | 4 | 2 | 2 | 2 | 2 | .03 | .07 | 0 | .07 | .04 | .02 | 2 | 1 | 0 | .01 | 1 | .01 | 0 |
| Drunk driv acc 1-4 yrs... | .03 | 1 | 0 | .01 | 1 | 1 | 3 | .02 | 0 | 0 | .01 | .02 | 1 | .01 | 0 | .02 | .02 | .02 | 1 | .02 |
| Part fault acc 1 yr..... | 1 | .03 | 5 | .02 | 4 | 2 | 2 | .02 | .05 | 0 | .07 | .04 | .04 | 1 | .01 | .05 | .03 | .01 | .02 | .03 |
| Part fault acc 1-4 yrs... | .01 | .05 | 5 | 2 | 3 | 1 | 1 | .04 | .08 | 0 | .08 | .05 | .05 | 1 | 1 | .05 | .03 | .01 | .02 | .03 |
| Accident cost 1 yr..... | 0 | .05 | 7 | 0 | 4 | 0 | 1 | .03 | .07 | 0 | .08 | .03 | .02 | 2 | 0 | .05 | .03 | .02 | .03 | .03 |
| Accident cost 1-4 yrs.... | .01 | .05 | 8 | 2 | 6 | .01 | 1 | .06 | .011 | 0 | .011 | .06 | .04 | 3 | 0 | .08 | .04 | .01 | .02 | .02 |
| School data missing..... | .02 | 0 | .03 | .01 | 0 | 6 | 2 | 0 | 3 | 0 | .010 | .01 | .03 | 1 | 3 | 2 | 6 | 5 | 4 | 6 |
| Length license gap 1-4 yr | .05 | 0 | 5 | 2 | 6 | 6 | 2 | .08 | .010 | 0 | .014 | .08 | 1 | 3 | 0 | .03 | .01 | .01 | .01 | .03 |
| Accident rate 1-4 yrs.... | 2 | .05 | 5 | 2 | 4 | .01 | 2 | .06 | .010 | 0 | .010 | .03 | .04 | 5 | .01 | .07 | .01 | 1 | .04 | .02 |
| Convictions DT 1 yr..... | .07 | .08 | 14 | 6 | 14 | 5 | 5 | .010 | .017 | 0 | .024 | .012 | .04 | 6 | .03 | .010 | .06 | .03 | .06 | .04 |
| Accidents DT 1 yr..... | .01 | .07 | 3 | 2 | 5 | 0 | 2 | .04 | .09 | 0 | .08 | .03 | .01 | 2 | 2 | .04 | .02 | 1 | .01 | .01 |
| Quest data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Single lic renewal..... | 6 | 8 | .55 | .17 | .52 | .13 | .13 | 10 | 23 | 0 | 29 | 18 | .02 | 1 | 6 | 10 | 7 | 2 | 6 | 5 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drinking | Number of cigarettes | Number of jobs | Year own car | Hours driving | Percent motorcycle | Armed forces service | Response bias | Driver train not offer | Driv train taken w offer | Parents occupation / | Sign violation 1-4 yrs | Lane viol 1-4 yrs | Following viol 1-4 yrs | Passing violation 1-4 yrs | Right-of-way viol 1-4 yrs | Turning viol 1-4 yrs | Speed violation 1-4 yrs | Drunk driv viol 1-4 yrs | Reckless dr viol 1-4 yrs |
| Driv w susp viol 1-4 yrs. | 0 | 9 | 5 | 0 | -2 | 4 | -3 | 5 | 0 | -5 | -6 | 10 | 11 | 4 | 6 | 3 | 10 | 12 | 13 | 7 |
| Hit and run viol 1-4 yrs. | 0 | 1 | 2 | 1 | -2 | 0 | -3 | 2 | -1 | -4 | -3 | 4 | 0 | 0 | 2 | 1 | 5 | 5 | 6 | 4 |
| FTA/FTP viol 1-4 yrs..... | 1 | 11 | 12 | -4 | 5 | 1 | -2 | 11 | -1 | -10 | -8 | 27 | 16 | 8 | 4 | 10 | 20 | 25 | 6 | 9 |
| Equipment viol 1-4 yrs... | 2 | 12 | 18 | -12 | 5 | 9 | -4 | 9 | -4 | -10 | -13 | 26 | 18 | 9 | 8 | 13 | 20 | 31 | 5 | 13 |
| Misc moving viol 1-4 yrs. | 2 | 6 | 7 | -6 | 2 | 3 | 1 | 2 | -1 | -2 | -1 | 11 | 5 | 5 | 2 | 6 | 5 | 9 | 4 | 3 |
| Misc non-mov viol 1-4 yrs | 5 | 13 | 16 | -8 | 3 | 4 | -4 | 11 | -1 | -11 | -9 | 29 | 19 | 9 | 8 | 14 | 21 | 30 | 7 | 14 |
| Convictions 6 mos prior. | -1 | 2 | 4 | -5 | 1 | 4 | -2 | 4 | -3 | -5 | -7 | 10 | 8 | 2 | 4 | 3 | 8 | 12 | 2 | 5 |
| Convictions 1 yr..... | 4 | 19 | 11 | -19 | 5 | 6 | 0 | 7 | -4 | -14 | -7 | 39 | 25 | 9 | 14 | 20 | 25 | 44 | 8 | 14 |
| Convictions 2 yr..... | 5 | 14 | 16 | -13 | 4 | 6 | 1 | 8 | -3 | -8 | -8 | 39 | 24 | 13 | 14 | 20 | 25 | 51 | 6 | 15 |
| Convictions 3 yr..... | 2 | 17 | 18 | -9 | 8 | 7 | -2 | 6 | -1 | -5 | -5 | 39 | 24 | 15 | 12 | 17 | 26 | 54 | 7 | 14 |
| Convictions 4 yr..... | 5 | 9 | 14 | -8 | 10 | 10 | -12 | -3 | 1 | -6 | -4 | 36 | 22 | 17 | 11 | 14 | 23 | 47 | 11 | 10 |
| Convictions 1-2 yrs..... | 5 | 18 | 16 | -20 | 7 | 9 | 1 | 10 | -4 | -13 | -9 | 46 | 30 | 14 | 17 | 24 | 31 | 59 | 9 | 15 |
| Convictions 1-4 yrs..... | 6 | 18 | 22 | -18 | 11 | 11 | -5 | 7 | -2 | -12 | -9 | 59 | 35 | 20 | 19 | 26 | 37 | 73 | 12 | 20 |
| Convictions 3-4 yrs..... | 4 | 13 | 20 | -11 | 11 | 10 | -8 | 3 | 0 | -7 | -6 | 46 | 28 | 19 | 14 | 20 | 31 | 64 | 11 | 15 |
| Accidents 6 mos prior.... | 1 | 4 | 1 | -4 | 2 | 1 | -2 | 0 | -1 | -4 | -1 | 3 | 2 | 3 | 4 | 1 | 3 | 7 | 4 | 9 |
| Accidents 1 yr..... | 3 | 9 | 4 | -6 | 3 | 0 | 1 | 3 | 1 | -5 | -2 | 9 | 10 | 3 | 3 | 9 | 6 | 14 | 7 | 4 |
| Accidents 2 yr..... | 1 | 8 | 4 | -4 | 4 | 1 | 3 | 2 | 1 | 1 | -2 | 8 | 7 | 3 | 5 | 9 | 6 | 14 | 0 | 4 |
| Accidents 3 yr..... | 1 | 7 | 5 | -3 | 2 | 2 | -3 | 0 | -1 | 1 | -1 | 9 | 7 | 2 | 2 | 9 | 6 | 14 | 5 | 4 |
| Accidents 4 yr..... | 1 | 3 | 3 | -1 | 6 | 1 | -8 | -4 | 3 | 0 | -1 | 6 | 5 | 3 | 3 | 3 | 3 | 12 | 2 | 2 |
| Accidents 1-2 yrs..... | 3 | 11 | 6 | -9 | 5 | 1 | 3 | 3 | 1 | -2 | -2 | 12 | 12 | 4 | 6 | 13 | 9 | 19 | 5 | 5 |
| Accidents 1-4 yrs..... | 3 | 10 | 8 | -8 | 7 | 2 | -3 | 0 | 1 | -1 | -3 | 16 | 14 | 5 | 6 | 15 | 10 | 26 | 7 | 7 |
| Accidents 3-4 yrs..... | 2 | 4 | 5 | -3 | 5 | 3 | -7 | -3 | 1 | 1 | -2 | 11 | 8 | 4 | 3 | 9 | 6 | 16 | 5 | 4 |
| Fatal/injury acc 1 yr.... | 1 | 4 | 3 | -3 | 1 | 0 | 2 | 2 | -1 | -5 | -1 | 6 | 6 | 1 | 1 | 7 | 4 | 9 | 5 | 2 |
| Fatal/injury acc 1-4 yrs. | 4 | 9 | 8 | -4 | 2 | 4 | 0 | 3 | 0 | -3 | -2 | 12 | 11 | 3 | 3 | 15 | 7 | 19 | 6 | 7 |
| Property acc 1 yr..... | 3 | 7 | 3 | -5 | 3 | 0 | 0 | 1 | 1 | -2 | -1 | 7 | 7 | 4 | 3 | 6 | 5 | 11 | 5 | 3 |
| Property acc 1-4 yrs..... | 1 | 7 | 4 | -7 | 7 | 0 | -3 | -2 | 2 | 0 | -2 | 11 | 10 | 5 | 6 | 10 | 8 | 20 | 5 | 4 |
| Single veh acc 1 yr..... | 3 | 4 | 2 | -3 | 0 | -1 | 1 | 2 | 1 | -1 | -3 | 2 | 5 | 1 | -1 | 2 | 1 | 4 | 4 | 1 |
| Single veh acc 1-4 yrs .. | 5 | 4 | 4 | -2 | 2 | 3 | -1 | 3 | 1 | 0 | -3 | 6 | 8 | 1 | 1 | 4 | 3 | 11 | 1 | 4 |
| Drunk driv acc 1-4 yrs... | 2 | 2 | 0 | 4 | -3 | -1 | -1 | 2 | 0 | 0 | -1 | 3 | -1 | 1 | -1 | -1 | 1 | 2 | 17 | 14 |
| Part fault acc 1 yr..... | 2 | 4 | 2 | -4 | 1 | -2 | 2 | 2 | -1 | -4 | 0 | 5 | 7 | 0 | 2 | 7 | 3 | 9 | 4 | 4 |
| Part fault acc 1-4 yrs... | 4 | 8 | 4 | -2 | 2 | 0 | 1 | 3 | 0 | -2 | -1 | 11 | 11 | 3 | 5 | 14 | 6 | 17 | 3 | 9 |
| Accident cost 1 yr..... | 2 | 6 | 3 | -4 | 1 | 2 | 1 | 2 | 0 | -5 | -2 | 6 | 7 | 1 | 2 | 8 | 5 | 9 | 5 | 5 |
| Accident cost 1-4 yrs.... | 4 | 10 | 6 | -4 | 4 | 4 | -1 | 2 | 1 | -2 | -3 | 12 | 11 | 3 | 4 | 13 | 8 | 20 | 5 | 10 |
| School data missing..... | -1 | 1 | -1 | 1 | 0 | -1 | -8 | 0 | 96 | 3 | 5 | 7 | 5 | 4 | 2 | 4 | 5 | 1 | 2 | -1 |
| Length license gep 1-4 yr | 5 | 11 | 3 | -2 | -3 | 2 | 11 | 18 | -2 | -6 | -6 | -3 | 0 | -3 | -1 | -1 | 0 | -6 | 0 | 2 |
| Accident rate 1-4 yrs.... | 3 | 9 | 7 | -6 | 4 | 1 | -3 | 0 | 2 | -2 | -3 | 16 | 12 | 5 | 5 | 14 | 10 | 23 | 6 | 6 |
| Convictions DT 1 yr..... | 4 | 14 | 12 | -19 | 7 | 5 | -1 | 4 | -4 | -11 | -5 | 34 | 21 | 11 | 14 | 18 | 25 | 48 | 7 | 13 |
| Accidents DT 1 yr..... | 4 | 10 | 5 | -8 | 6 | -1 | 2 | 1 | 0 | -3 | -1 | 9 | 10 | 3 | 5 | 9 | 7 | 15 | 4 | 2 |
| Quest data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 100 | -10 | -8 | -19 | 2 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 3 |
| Single lic renewal..... | 3 | -10 | -12 | 4 | -7 | 2 | 6 | -3 | 2 | 8 | 11 | -9 | -6 | -1 | -2 | -3 | -5 | -11 | -1 | -4 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Driv w susp viol 1-4 yrs | Hit and run viol 1-4 yrs | FTA/FTP viol 1-4 yrs | Equipment viol 1-4 yrs | Misc moving viol 1-4 yrs | Misc non-mov viol 1-4 yrs | Convictions 6 mos prior | Convictions 1 yr | Convictions 2 yr | Convictions 3 yr | Convictions 4 yr | Convictions 1-2 yrs | Convictions 1-4 yrs | Convictions 3-4 yrs | Accidents 6 mos prior | Accidents 1 yr | Accidents 2 yr | Accidents 3 yr | Accidents 4 yr | Accidents 1-2 yrs |
| Driv w susp viol 1-4 yrs. | 100 | | | | | | | | | | | | | | | | | | | |
| Hit and run viol 1-4 yrs. | 5 | 100 | | | | | | | | | | | | | | | | | | |
| FTA/FTP viol 1-4 yrs..... | 22 | 9 | 100 | | | | | | | | | | | | | | | | | |
| Equipment viol 1-4 yrs... | 21 | 6 | 44 | 100 | | | | | | | | | | | | | | | | |
| Misc moving viol 1-4 yrs. | 6 | 9 | 8 | 19 | 100 | | | | | | | | | | | | | | | |
| Misc non-mov viol 1-4 yrs | 29 | 7 | 61 | 58 | 18 | 100 | | | | | | | | | | | | | | |
| Convictions 6 mos prior.. | 11 | 3 | 14 | 17 | 4 | 16 | 100 | | | | | | | | | | | | | |
| Convictions 1 yr..... | 24 | 9 | 33 | 40 | 12 | 41 | 24 | 100 | | | | | | | | | | | | |
| Convictions 2 yr..... | 24 | 5 | 33 | 40 | 16 | 46 | 13 | 32 | 100 | | | | | | | | | | | |
| Convictions 3 yr..... | 20 | 7 | 37 | 49 | 12 | 49 | 9 | 26 | 31 | 100 | | | | | | | | | | |
| Convictions 4 yr..... | 21 | 9 | 38 | 43 | 14 | 44 | 10 | 21 | 25 | 30 | 100 | | | | | | | | | |
| Convictions 1-2 yrs..... | 30 | 8 | 40 | 58 | 17 | 53 | 23 | 79 | 83 | 35 | 28 | 100 | | | | | | | | |
| Convictions 1-4 yrs..... | 33 | 9 | 52 | 69 | 20 | 67 | 21 | 83 | 70 | 72 | 66 | 82 | 100 | | | | | | | |
| Convictions 3-4 yrs..... | 23 | 9 | 47 | 58 | 16 | 58 | 12 | 29 | 35 | 64 | 77 | 40 | 65 | 100 | | | | | | |
| Accidents 6 mos prior.... | 11 | 1 | 7 | 5 | 6 | 6 | 10 | 4 | 7 | 7 | 5 | 9 | 9 | 8 | 100 | | | | | |
| Accidents 1 yr..... | 11 | 9 | 4 | 9 | 4 | 10 | 8 | 21 | 10 | 11 | 8 | 19 | 18 | 12 | 3 | 100 | | | | |
| Accidents 2 yr..... | 3 | 4 | 3 | 8 | 4 | 6 | 1 | 6 | 19 | 10 | 9 | 14 | 16 | 10 | 2 | 3 | 100 | | | |
| Accidents 3 yr..... | 0 | 4 | 3 | 6 | 1 | 5 | -2 | 4 | 7 | 19 | 8 | 7 | 15 | 17 | 0 | 4 | 2 | 100 | | |
| Accidents 4 yr..... | 0 | 7 | 2 | 4 | 4 | 4 | 2 | 4 | 5 | 5 | 17 | 5 | 12 | 14 | 2 | 1 | 1 | 4 | 100 | |
| Accidents 1-2 yrs..... | 10 | 7 | 5 | 12 | 5 | 11 | 5 | 16 | 21 | 14 | 10 | 24 | 23 | 15 | 3 | 70 | 74 | 4 | 2 | 100 |
| Accidents 1-4 yrs..... | 7 | 8 | 6 | 14 | 6 | 12 | 4 | 17 | 20 | 22 | 16 | 23 | 29 | 25 | 3 | 52 | 54 | 55 | 47 | 74 |
| Accidents 3-4 yrs..... | 0 | 5 | 4 | 8 | 3 | 6 | 0 | 6 | 8 | 14 | 17 | 9 | 18 | 22 | 1 | 4 | 3 | 76 | 67 | 4 |
| Fatal/injury acc 1 yr.... | 5 | 3 | 3 | 6 | 5 | 8 | 5 | 15 | 6 | 6 | 6 | 12 | 11 | 6 | 2 | 58 | 1 | -2 | 0 | 38 |
| Fatal/injury acc 1-4 yrs. | 5 | 6 | 5 | 11 | 6 | 11 | 4 | 15 | 16 | 14 | 13 | 19 | 21 | 17 | 3 | 31 | 30 | 31 | 27 | 43 |
| Property acc 1 yr..... | 10 | 4 | 3 | 7 | 2 | 7 | 4 | 15 | 8 | 9 | 7 | 14 | 14 | 10 | 3 | 83 | 3 | 6 | 1 | 58 |
| Property acc 1-4 yrs..... | 5 | 7 | 4 | 10 | 3 | 7 | 2 | 11 | 14 | 18 | 14 | 18 | 21 | 20 | 1 | 43 | 46 | 47 | 40 | 62 |
| Single veh acc 1 yr..... | 4 | 1 | 3 | 4 | 3 | 4 | 3 | 9 | 4 | 2 | 1 | 8 | 6 | 3 | 2 | 29 | 3 | -1 | 0 | 21 |
| Single veh acc 1-4 yrs... | 2 | 5 | 4 | 8 | 4 | 7 | 3 | 10 | 10 | 8 | 6 | 12 | 13 | 9 | 2 | 17 | 17 | 15 | 14 | 23 |
| Drunk driv acc 1-4 yrs... | 5 | -1 | 0 | 3 | 0 | 5 | 3 | 5 | 5 | 3 | 1 | 6 | 5 | 2 | 2 | 4 | 4 | 3 | 3 | 4 |
| Part fault acc 1 yr..... | 5 | 1 | 3 | 9 | 3 | 7 | 6 | 15 | 6 | 5 | 4 | 13 | 11 | 6 | 3 | 45 | 1 | -1 | 1 | 31 |
| Part fault acc 1-4 yrs... | 5 | 6 | 5 | 9 | 4 | 10 | 5 | 14 | 15 | 12 | 12 | 19 | 20 | 15 | 4 | 27 | 23 | 23 | 20 | 35 |
| Accident cost 1 yr..... | 6 | 3 | 3 | 6 | 4 | 8 | 5 | 16 | 6 | 7 | 5 | 15 | 12 | 7 | 2 | 88 | 3 | 0 | 1 | 48 |
| Accident cost 1-4 yrs.... | 6 | 5 | 5 | 11 | 6 | 11 | 4 | 15 | 17 | 15 | 14 | 20 | 23 | 18 | 3 | 37 | 38 | 37 | 32 | 52 |
| School data missing..... | 1 | -2 | 5 | 6 | 1 | 7 | 1 | 7 | 6 | 3 | 6 | 8 | 8 | 5 | -2 | 2 | 0 | 1 | 2 | 1 |
| Length license gap 1-4 yr | 1 | 1 | 10 | 2 | 0 | 10 | 3 | 7 | 1 | -7 | -5 | 5 | -2 | -8 | 0 | 1 | -5 | -9 | -7 | -3 |
| Accident rate 1-4 yrs.... | 5 | 9 | 8 | 15 | 5 | 10 | 3 | 16 | 19 | 21 | 16 | 29 | 28 | 24 | 1 | 50 | 53 | 52 | 48 | 71 |
| Convictions DT 1 yr..... | 16 | 6 | 25 | 44 | 11 | 37 | 18 | 72 | 46 | 34 | 93 | 72 | 44 | 30 | 8 | 16 | 9 | 7 | 3 | 17 |
| Accidents DT 1 yr..... | 6 | 5 | 3 | 10 | 3 | 8 | 4 | 16 | 11 | 13 | 9 | 17 | 18 | 14 | 4 | 88 | 28 | 10 | 4 | 84 |
| Quest data missing..... | 4 | 3 | 12 | 10 | 3 | 12 | 5 | 8 | 8 | 6 | -2 | 11 | 8 | 2 | 0 | 3 | 1 | 0 | -5 | 3 |
| Single lic renewal..... | -2 | -1 | -10 | -15 | 0 | -12 | -7 | -14 | -13 | -8 | -7 | -17 | -16 | -10 | -3 | -7 | -3 | -1 | -2 | -6 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15

APPENDIX B (Continued)
Correlation Matrix for Males

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 1-4 yrs | Accidents 3-4 yrs | Fatal/injury acc 1 yr | Fatal/injury acc 1-4 yrs | Property acc 1 yr | Property acc 1-4 yrs | Single veh acc 1 yr | Single veh acc 1-4 yrs | Drunk driv acc 1-4 yrs | Part fault acc 1 yr | Part fault acc 1-4 yrs | Accident cost 1 yr | Accident cost 1-4 yrs | School data missing | Length license gap 1-4 yr | Accident rate 1-4 yrs | Convictions DT 1 yr | Accidents DT 1 yr | Quest data missing | Single lic renewal |
| Accidents 1-4 yrs..... | 100 | | | | | | | | | | | | | | | | | | | |
| Accidents 3-4 yrs..... | 71 | 100 | | | | | | | | | | | | | | | | | | |
| Fatal/injury acc 1 yr.... | 26 | -1 | 100 | | | | | | | | | | | | | | | | | |
| Fatal/injury acc 1-4 yrs. | 37 | 40 | 90 | 100 | | | | | | | | | | | | | | | | |
| Property acc 1 yr..... | 45 | 5 | 0 | 4 | 100 | | | | | | | | | | | | | | | |
| Property acc 1-4 yrs..... | 65 | 60 | -1 | 5 | 92 | 100 | | | | | | | | | | | | | | |
| Single veh acc 1 yr..... | 15 | -1 | 51 | 27 | 1 | 1 | 100 | | | | | | | | | | | | | |
| Single veh acc 1-4 yrs... | 30 | 25 | 28 | 50 | 3 | 4 | 92 | 100 | | | | | | | | | | | | |
| Drunk driv acc 1-4 yrs... | 7 | 4 | 7 | 13 | 1 | 0 | 12 | 12 | 100 | | | | | | | | | | | |
| Part fault acc 1 yr..... | 22 | 9 | 78 | 40 | 2 | 1 | 46 | 24 | 9 | 100 | | | | | | | | | | |
| Part fault acc 1-4 yrs... | 45 | 35 | 40 | 79 | 5 | 6 | 26 | 49 | 16 | 53 | 100 | | | | | | | | | |
| Accident cost 1 yr..... | 34 | 9 | 49 | 46 | 22 | 11 | 49 | 24 | 8 | 38 | 37 | 100 | | | | | | | | |
| Accident cost 1-4 yrs.... | 70 | 48 | 44 | 89 | 15 | 27 | 28 | 49 | 14 | 35 | 57 | 59 | 100 | | | | | | | |
| School data missing..... | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | -1 | 1 | 1 | 1 | 2 | 100 | | | | | | |
| Length license gap 1-4 yr | -9 | -11 | 2 | -4 | 0 | -9 | 0 | -1 | 0 | 2 | -- | 3 | -5 | 5 | 100 | | | | | |
| Accident rate 1-4 yrs.... | 98 | 79 | 23 | 54 | 44 | 84 | 14 | 27 | 5 | 17 | 41 | 31 | 67 | 3 | -2 | 100 | | | | |
| Convictions DT 1 yr..... | 17 | 7 | 10 | 13 | 12 | 12 | 8 | 9 | 2 | 10 | 13 | 11 | 14 | 5 | 5 | 18 | 100 | | | |
| Accidents DT 1 yr..... | 52 | 19 | 36 | 29 | 55 | 44 | 18 | 14 | 3 | 28 | 23 | 44 | 36 | 1 | 1 | 51 | 20 | 100 | | |
| Quest data missing..... | -1 | -3 | 3 | 2 | 2 | -2 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 21 | 0 | 2 | 0 | 100 | |
| Single lic renewal..... | -8 | -2 | -4 | -6 | -5 | -3 | -3 | -2 | -2 | -3 | -3 | -5 | -6 | 0 | 0 | -4 | -13 | -5 | -3 | 100 |

NOTE: Decimal points and lead zeroes omitted. e.g., .5 = .05, 15 = .15

APPENDIX C

Correlation Matrix for Females

| Variable | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fresno county | 100 | | | | | | | | | | | | | | | | | | | |
| Sonoma county | -15 | 100 | | | | | | | | | | | | | | | | | | |
| Sacramento county | -27 | -19 | 100 | | | | | | | | | | | | | | | | | |
| Stanislaus county | -10 | -11 | -20 | 100 | | | | | | | | | | | | | | | | |
| Los Angeles county | -38 | -25 | -44 | -26 | 100 | | | | | | | | | | | | | | | |
| Height | -1 | 3 | 0 | -2 | 0 | 100 | | | | | | | | | | | | | | |
| Weight | 1 | 1 | 3 | 2 | -5 | 46 | 100 | | | | | | | | | | | | | |
| Single orig license | -4 | 0 | -1 | -5 | 4 | 5 | -1 | 100 | | | | | | | | | | | | |
| Drive test score | -8 | 9 | 0 | 6 | -3 | -11 | -3 | 3 | 100 | | | | | | | | | | | |
| Age licensed | 1 | -3 | 2 | 0 | -1 | -5 | 4 | -16 | -4 | 100 | | | | | | | | | | |
| Length instr permit | -10 | 4 | 5 | 0 | 0 | 0 | -8 | 11 | 1 | -20 | 100 | | | | | | | | | |
| Traffic density | -60 | -31 | -4 | -33 | 91 | -2 | -5 | 4 | -3 | 0 | 3 | 100 | | | | | | | | |
| Birth location | -6 | 0 | 7 | -4 | 1 | -2 | 2 | -2 | -3 | 11 | -7 | 9 | 100 | | | | | | | |
| Home status | -4 | -1 | -1 | 2 | 4 | 0 | 4 | -11 | -2 | 8 | -10 | 4 | 7 | 100 | | | | | | |
| Year left school | -6 | -2 | 0 | -2 | 8 | 5 | -1 | 19 | 3 | -2 | 8 | 9 | -6 | -12 | 100 | | | | | |
| Transfer | 2 | 3 | -2 | 0 | -2 | -2 | -1 | 0 | -2 | -2 | -5 | -3 | 7 | 7 | -60 | 100 | | | | |
| Dropout | 0 | 2 | 0 | 3 | -7 | -3 | 2 | -21 | -4 | 4 | -5 | -8 | 3 | 9 | -61 | -6 | 100 | | | |
| College transcript | -3 | -9 | 4 | -1 | 7 | 3 | -6 | 21 | 5 | -13 | 8 | 9 | -7 | -10 | 41 | -33 | -32 | 100 | | |
| Grade point average | -3 | -4 | 4 | 0 | 1 | 6 | -7 | 9 | 8 | -12 | 10 | 3 | -4 | -11 | 31 | -13 | -33 | 41 | 100 | |
| GPA trend | 2 | 1 | 1 | 1 | -4 | 0 | -1 | 4 | -1 | 0 | 1 | -4 | -4 | -2 | 6 | -1 | -7 | 3 | 2 | 100 |
| Citizenship grade | 0 | 0 | 0 | 0 | 0 | 3 | -3 | 6 | 6 | -7 | 5 | 0 | -1 | -8 | 21 | -12 | -22 | 31 | 71 | 7 |
| Absences | -3 | 1 | 0 | -3 | 4 | -5 | 4 | -7 | -5 | 4 | -11 | 5 | 6 | 11 | -20 | 11 | 29 | -28 | -47 | -6 |
| Non-language IQ | -11 | -8 | 11 | 5 | 0 | 3 | -2 | 4 | 4 | -10 | 7 | 0 | 2 | -5 | 10 | -4 | -12 | 23 | 48 | -2 |
| Achievement test | -2 | -7 | 8 | 0 | -1 | 7 | -5 | 6 | 5 | -11 | 10 | 2 | 2 | -7 | 13 | -5 | -16 | 30 | 67 | 2 |
| IQ discrepancy | -2 | 3 | -4 | 10 | -3 | -1 | 0 | -1 | 2 | 0 | 0 | -3 | 0 | 0 | -2 | 0 | 1 | -5 | -3 | 3 |
| Achievement index | 4 | 0 | -1 | 0 | -3 | 1 | -6 | 7 | 5 | -8 | 12 | -4 | -5 | -8 | 26 | -11 | -27 | 30 | 53 | 4 |
| Rural school | 21 | 29 | -20 | 19 | -33 | -1 | 2 | -3 | 5 | 0 | -4 | -44 | -1 | 0 | -9 | 3 | 6 | -15 | -3 | 2 |
| Quest response date | -3 | -2 | -5 | 0 | 8 | -1 | 0 | -2 | -1 | 3 | -5 | 6 | 1 | -3 | -6 | 1 | 6 | -5 | -13 | -4 |
| Attitude | 0 | -9 | -8 | 1 | 7 | -8 | -4 | -1 | -6 | -3 | -4 | 4 | -2 | -2 | -2 | -1 | 1 | -3 | -4 | 2 |
| Driver training safety | 5 | 4 | -1 | 0 | -7 | -4 | -3 | 3 | -3 | -4 | 3 | -5 | -3 | 1 | 3 | -2 | 0 | 3 | 6 | -2 |
| Driver education | -9 | 0 | -1 | 1 | 8 | 3 | -2 | 8 | 1 | -2 | 4 | 8 | -1 | -1 | 14 | -6 | -10 | 8 | 6 | 1 |
| Driver ed quality | 4 | -7 | 4 | 1 | -5 | 0 | 2 | 3 | -1 | -4 | 3 | -3 | -4 | 3 | 6 | -4 | -3 | 6 | 12 | -2 |
| Mileage work | -2 | 1 | -6 | -4 | 8 | 1 | 2 | 5 | 0 | -2 | 1 | 7 | -3 | 1 | 1 | 2 | -5 | 4 | 1 | 0 |
| Mileage other | -4 | 1 | 2 | 1 | -2 | 1 | 7 | 2 | -1 | -4 | 0 | -1 | 0 | 3 | -1 | 2 | 1 | 0 | -6 | 0 |
| Annual mileage | -2 | 7 | -2 | -2 | 4 | 2 | 5 | 4 | -1 | -3 | 0 | 4 | -1 | 3 | -2 | 4 | -2 | 1 | -4 | 1 |
| Total mileage | 3 | 7 | 2 | 1 | -6 | 3 | 7 | -1 | -1 | 4 | -5 | -6 | 1 | 6 | -5 | 7 | -1 | -8 | -14 | -1 |
| Prior mileage | 4 | 5 | 4 | 7 | -7 | 1 | 5 | 0 | 5 | -3 | -4 | -9 | -1 | 6 | -4 | 3 | 2 | -9 | -9 | -3 |
| Vehicle weight | 2 | 0 | 0 | 3 | -4 | -3 | 1 | -7 | -1 | 4 | -4 | -4 | 0 | 2 | -9 | 2 | 11 | -6 | -7 | 0 |
| Vehicle year | 0 | 7 | 2 | 1 | -4 | -1 | -7 | 5 | -3 | -8 | 4 | -4 | -3 | -5 | 6 | -2 | -5 | 2 | 1 | 2 |
| Vehicle mileage | 2 | 7 | 1 | 1 | -4 | 0 | 5 | -1 | 0 | 3 | -5 | -4 | -1 | 4 | 2 | 1 | -3 | 0 | -7 | 0 |

NOTE: Decimal points and lead zeroes omitted, e.g., [illegible] = .65, 15 = .15

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Citizenship grade..... | 100 | | | | | | | | | | | | | | | | | | | |
| Absences..... | -42 | 100 | | | | | | | | | | | | | | | | | | |
| Non-language IQ..... | 28 | -14 | 100 | | | | | | | | | | | | | | | | | |
| Achievement test..... | 39 | -22 | 97 | 100 | | | | | | | | | | | | | | | | |
| IQ discrepancy..... | 4 | 0 | 21 | -8 | 100 | | | | | | | | | | | | | | | |
| Achievement index..... | 65 | -47 | -1 | 28 | -3 | 100 | | | | | | | | | | | | | | |
| Rural school..... | 0 | -5 | -8 | -6 | 5 | 5 | 100 | | | | | | | | | | | | | |
| Quest response date..... | -7 | 9 | -8 | -10 | 0 | -9 | -1 | 100 | | | | | | | | | | | | |
| Attitude..... | -5 | -3 | -8 | -8 | 5 | 1 | 4 | 9 | 100 | | | | | | | | | | | |
| Driver training safety... | -4 | -1 | 4 | 9 | -3 | 4 | 6 | 0 | 3 | 100 | | | | | | | | | | |
| Driver education..... | -1 | -2 | 2 | 1 | 1 | 3 | -8 | -2 | 0 | -5 | 100 | | | | | | | | | |
| Driver ed quality..... | 6 | -3 | 10 | 14 | -1 | 5 | 4 | -1 | -6 | 24 | 0 | 100 | | | | | | | | |
| Mileage work..... | 2 | -1 | 1 | 2 | 1 | 1 | 3 | -5 | -3 | 2 | 2 | 4 | 100 | | | | | | | |
| Mileage other..... | -9 | 4 | 1 | -3 | 0 | -7 | 1 | -1 | 0 | 0 | 2 | 1 | 13 | 100 | | | | | | |
| Annual mileage..... | -6 | 4 | 1 | -1 | 1 | -5 | 3 | -2 | -3 | 1 | 3 | 9 | 77 | 67 | 100 | | | | | |
| Total mileage..... | -14 | 9 | -3 | -7 | 7 | -13 | 4 | 2 | 0 | 3 | -1 | 0 | 28 | 29 | 41 | 100 | | | | |
| Prior mileage..... | -8 | 7 | -7 | -8 | 2 | -7 | 10 | -1 | 1 | -1 | -1 | 0 | 9 | 15 | 17 | 27 | 100 | | | |
| Vehicle weight..... | -4 | 7 | -5 | -7 | 1 | -3 | 5 | 1 | 3 | -1 | -2 | -8 | -6 | -4 | -5 | -3 | 2 | 100 | | |
| Vehicle year..... | -2 | -5 | 0 | 1 | 2 | 0 | 2 | 1 | 0 | 3 | -1 | 1 | 6 | 7 | 9 | 4 | 4 | -19 | 100 | |
| Vehicle mileage..... | -7 | 4 | -1 | -1 | 3 | -5 | 4 | 0 | 0 | 4 | 0 | 2 | 28 | 27 | 37 | 68 | 22 | -8 | -1 | 100 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
| Equipped seat belts..... | 5 | 3 | 3 | 2 | -10 | 3 | -2 | 2 | 0 | -7 | 3 | -9 | -3 | -4 | 6 | 0 | -7 | 7 | 6 | 3 |
| Wear seat belts..... | -3 | -4 | 1 | -4 | 7 | 9 | 1. | 4 | 5 | 0 | 6 | 8 | 2 | -2 | 4 | -1 | -6 | 9 | 15 | 0 |
| Married..... | 7 | 5 | 0 | 10 | -15 | -7 | -2 | -16 | 1 | 17 | -10 | -16 | 7 | 6 | -16 | 9 | 16 | -34 | -25 | 2 |
| Divorced/separated..... | -1 | 3 | 2 | 0 | -2 | -1 | 0 | -7 | -1 | 4 | -2 | -2 | 3 | 3 | -7 | 4 | 9 | -14 | -14 | -1 |
| Number of children..... | 3 | 5 | 0 | 7 | -10 | -7 | 0 | -42 | 0 | 19 | -12 | -11 | 6 | 12 | -30 | 12 | 33 | -35 | -26 | -2 |
| Number of brothers..... | 5 | 5 | -2 | 7 | -9 | -6 | 2 | -7 | -4 | 13 | -9 | -11 | 7 | 3 | -12 | 6 | 10 | -15 | -10 | 1 |
| Number of older sibs..... | 6 | 3 | -5 | 6 | -6 | -4 | 3 | -6 | 1 | 7 | -7 | -9 | -3 | 2 | -11 | 2 | 10 | -13 | -13 | 4 |
| Parents married..... | -1 | 1 | 1 | 1 | -2 | -1 | -3 | 7 | 1 | -6 | 10 | -2 | -3 | -45 | 7 | -4 | -6 | 8 | 10 | 4 |
| Student..... | -2 | -4 | -1 | -5 | 8 | 6 | -3 | 9 | 4 | -18 | 10 | 8 | -6 | -6 | 9 | -6 | -10 | 34 | 43 | -5 |
| Housewife..... | 3 | 4 | -1 | 6 | -8 | -5 | 1 | -18 | 0 | 15 | -8 | -9 | 4 | 7 | -17 | 7 | 21 | -29 | -27 | 0 |
| Grade completed..... | 2 | -3 | 9 | -6 | -4 | 10 | -3 | 29 | 5 | -5 | 12 | -1 | -7 | -12 | 31 | -14 | -31 | 51 | 53 | 0 |
| Occupational goal..... | -3 | 1 | 4 | -5 | 2 | 6 | -5 | 11 | 6 | -9 | 8 | 4 | -2 | -6 | 15 | -9 | -15 | 28 | 38 | -4 |
| Social mobility..... | 11 | 2 | -3 | 11 | -14 | -6 | 5 | 0 | 2 | 8 | -8 | -17 | -8 | 0 | -2 | -2 | 2 | -2 | 2 | 0 |
| Unemployed..... | -1 | -4 | 3 | 0 | 0 | -2 | 4 | 1 | -2 | 2 | -4 | 2 | 3 | 3 | -2 | 1 | 1 | -5 | -7 | 0 |
| Social activities..... | 1 | -1 | 0 | -3 | 2 | 0 | -2 | 7 | 1 | -10 | 2 | 2 | -4 | -2 | 9 | -2 | -10 | 16 | 15 | 1 |
| Academic activities..... | 1 | -5 | 7 | 5 | -7 | 7 | 4 | 9 | 2 | -5 | 4 | -5 | -3 | -4 | 9 | -3 | -10 | 18 | 41 | 0 |
| Student activities..... | -1 | 2 | 6 | -2 | -5 | 4 | 0 | 7 | 5 | -10 | 5 | -2 | -5 | -5 | 11 | -3 | -12 | 18 | 25 | 1 |
| Intramural activities.... | 1 | 3 | -11 | 1 | 6 | 3 | 5 | 2 | 2 | -2 | -1 | 2 | -1 | 0 | -1 | 4 | -1 | 1 | 5 | 0 |
| Varsity letters..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-varsity letters..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Drinking..... | -5 | 5 | 3 | -3 | 0 | 7 | 1 | 2 | -1 | -2 | 2 | 1 | 1 | 1 | 1 | 1 | -4 | 9 | 4 | -1 |
| Number of cigarettes..... | -3 | 7 | 4 | -4 | 0 | 2 | 4 | -9 | -4 | 1 | -7 | 2 | 9 | 9 | -12 | 9 | 9 | -15 | -25 | -3 |
| Number of jobs..... | -2 | -1 | -1 | -2 | 4 | 1 | 0 | 6 | -5 | 0 | -1 | 4 | 2 | 3 | 2 | 2 | -4 | -5 | -14 | 2 |
| Year own car..... | 0 | -2 | 1 | 5 | -2 | 0 | -1 | -6 | -1 | 22 | -2 | -2 | -2 | -2 | 2 | -4 | 0 | 3 | 6 | 1 |
| Hours driving..... | 0 | -2 | -2 | -6 | 6 | -3 | 3 | -2 | -3 | -1 | 0 | 6 | -2 | 6 | -1 | 1 | 1 | -1 | -12 | 1 |
| Percent motorcycle..... | 1 | -2 | 2 | -1 | -1 | 5 | 2 | 1 | 0 | -4 | 1 | 0 | -2 | 0 | -1 | 2 | -1 | -1 | -2 | 1 |
| Armed forces service..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Response bias..... | 3 | 4 | 6 | 3 | -13 | -1 | 4 | -3 | -4 | 6 | -6 | -11 | 7 | 5 | -15 | 9 | 13 | -15 | -17 | -3 |
| Driver train not offer... | -4 | 4 | -1 | -9 | 6 | 2 | 2 | -2 | 3 | -1 | 2 | 6 | 1 | -2 | 1 | 0 | -2 | -6 | 0 | 0 |
| Driv train taken w off... | -2 | 12 | -4 | 14 | -12 | 1 | 3 | 7 | 6 | 4 | -2 | -13 | 1 | -1 | 8 | 0 | -9 | 0 | 6 | 1 |
| Parents occupation..... | -13 | -5 | 7 | -14 | 18 | 9 | -5 | 7 | 1 | -11 | 9 | 22 | 9 | -2 | 7 | 0 | -9 | 20 | 19 | -1 |
| Sign violation 1-4 yrs... | -2 | -5 | -8 | -6 | 15 | 2 | 2 | 0 | -2 | 1 | -4 | 13 | 2 | 3 | 1 | -3 | 2 | 0 | -9 | 0 |
| Lane viol 1-4 yrs..... | -2 | -1 | -3 | -4 | 7 | 0 | 0 | -1 | -3 | 1 | -3 | 7 | 0 | 2 | -2 | 4 | 1 | -1 | -6 | -1 |
| Following viol 1-4 yrs... | -4 | -2 | -5 | 2 | 8 | 0 | -1 | 0 | -2 | 0 | 0 | 9 | -2 | 2 | -1 | 1 | 1 | 1 | -4 | 0 |
| Passing violation 1-4 yrs | 0 | -1 | -2 | 3 | 0 | 2 | 2 | 0 | -2 | 3 | -2 | -1 | 3 | 2 | 0 | 0 | 0 | 0 | -3 | -1 |
| Right-of-way viol 1-4 yrs | 0 | -4 | -3 | -2 | 6 | 1 | 1 | 0 | -2 | -2 | -3 | 5 | -2 | 3 | 1 | 1 | -1 | 1 | -4 | 0 |
| Turning viol 1-4 yrs..... | -3 | -3 | -5 | -2 | 10 | -1 | -1 | -3 | -1 | 2 | -4 | 9 | 0 | 3 | -3 | 2 | 1 | 0 | -4 | 0 |
| Speed violation 1-4 yrs.. | 7 | -1 | -8 | -3 | 5 | 1 | 2 | 0 | -3 | -1 | -7 | 1 | -2 | 2 | -1 | 0 | 1 | -2 | -15 | -3 |
| Drunk driv viol 1-4 yrs.. | -1 | -1 | 2 | 3 | -2 | 2 | 1 | -3 | -1 | 1 | -2 | -1 | 1 | 1 | 0 | -1 | 2 | 0 | -5 | -1 |
| Reckless dr viol 1-4 yrs. | 0 | 3 | 0 | 1 | -2 | 0 | 0 | -6 | 0 | 1 | -1 | -2 | 0 | -1 | -3 | 4 | -1 | -3 | -3 | -1 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipped seat belts..... | 4 | -7 | 4 | 6 | -1 | 5 | 3 | -2 | -5 | 2 | 0 | 1 | 4 | 5 | 6 | 3 | 4 | -7 | 31 | 1 |
| Wear seat belts..... | 14 | -6 | 10 | 10 | 0 | 9 | -2 | -4 | -11 | -13 | 5 | -3 | 4 | -1 | 3 | -4 | -2 | 0 | -2 | -5 |
| Married..... | -18 | 15 | -11 | -18 | 2 | -19 | 13 | 9 | -5 | 1 | -3 | -3 | -14 | -10 | -13 | 1 | 6 | 5 | -5 | -7 |
| Divorced/separated..... | -10 | 8 | -3 | -7 | 3 | -14 | 0 | 5 | 1 | -2 | -1 | -3 | 0 | 2 | 2 | 8 | 2 | 2 | -2 | 6 |
| Number of children..... | -18 | 21 | -6 | -15 | 5 | -21 | 5 | 7 | 0 | -1 | -6 | -8 | -17 | -9 | -15 | -2 | 4 | 8 | -9 | -7 |
| Number of brothers..... | -4 | 9 | -5 | -10 | 4 | -6 | 15 | 2 | 4 | -4 | -5 | -2 | -3 | 0 | -2 | 3 | 0 | 4 | -5 | -2 |
| Number of older sibs..... | -8 | 10 | -9 | -14 | 5 | -7 | 13 | 2 | 6 | -1 | -4 | -4 | -2 | 3 | 0 | 2 | 3 | 1 | -2 | -1 |
| Parents married..... | 10 | -13 | 4 | 5 | -3 | 9 | 1 | -3 | -1 | -3 | 2 | 1 | 3 | -1 | 0 | -10 | -3 | 0 | 3 | -6 |
| Student..... | 30 | -21 | 27 | 39 | -4 | 29 | -7 | -9 | 2 | 5 | 0 | 9 | 1 | -6 | -4 | -13 | -10 | -3 | 1 | -6 |
| Housewife..... | -18 | 18 | -11 | -18 | 3 | -20 | 7 | 6 | -3 | -4 | -3 | -3 | -27 | -11 | -21 | -5 | 0 | 6 | -6 | -8 |
| Grade completed..... | 35 | -35 | 27 | 40 | -6 | 39 | -6 | -9 | -3 | 3 | 6 | 13 | 9 | -1 | 4 | -8 | -9 | -7 | 3 | 1 |
| Occupational goal..... | 22 | -23 | 25 | 34 | -3 | 25 | -6 | -8 | -3 | 7 | 5 | 11 | 4 | -2 | 1 | -9 | 0 | -7 | 5 | 2 |
| Social mobility..... | 8 | -7 | -5 | -5 | 5 | 9 | 20 | -2 | 2 | 2 | -1 | 0 | 5 | 2 | 5 | 2 | 6 | 6 | -5 | 4 |
| Unemployed..... | -4 | 5 | -4 | -6 | 1 | -6 | -1 | 4 | 3 | 1 | 1 | -1 | -2 | 5 | 2 | 2 | 1 | -1 | 0 | 2 |
| Social activities..... | 0 | -9 | 8 | 12 | -4 | 12 | -4 | -2 | -1 | 2 | 2 | 0 | 1 | 1 | 1 | -2 | -2 | -4 | 4 | 2 |
| Academic activities..... | 29 | -19 | 27 | 37 | -2 | 28 | 3 | -5 | -5 | 1 | -1 | 9 | 3 | 0 | 1 | -3 | -2 | -5 | 5 | 0 |
| Student activities..... | 14 | -14 | 12 | 18 | -2 | 20 | 4 | -8 | -2 | 0 | -2 | 2 | 0 | 0 | -1 | -2 | -1 | -3 | 5 | 0 |
| Intramural activities.... | 1 | -8 | -2 | -2 | 3 | 8 | 10 | 0 | -3 | -3 | -4 | -4 | 4 | 4 | 5 | 4 | 2 | -1 | 0 | 3 |
| Varsity letters..... | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-varsity letters..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Drinking..... | -5 | 1 | 11 | 13 | -1 | -5 | -6 | -1 | 4 | 14 | -2 | 8 | 0 | 7 | 3 | 8 | -2 | -3 | 2 | 7 |
| Number of cigarettes..... | -30 | 24 | -1 | -6 | 2 | -27 | -4 | 4 | -1 | 5 | -4 | 1 | -2 | 12 | 7 | 14 | 7 | -1 | -2 | 10 |
| Number of jobs..... | -13 | 9 | -8 | -13 | 1 | -11 | -1 | 5 | 0 | 0 | 2 | -3 | 11 | 10 | 12 | 10 | 4 | -5 | 1 | 7 |
| Year own car..... | 8 | -15 | 4 | 5 | 0 | 5 | 4 | 3 | 0 | -1 | 0 | -2 | -7 | -10 | -11 | -10 | -9 | -1 | 5 | -17 |
| Hours driving..... | -12 | 9 | -8 | -10 | 0 | -8 | -3 | -4 | -1 | 1 | 4 | 0 | 32 | 25 | 40 | 24 | 10 | -1 | 3 | 22 |
| Percent motorcycle..... | -0 | -1 | 3 | 2 | -2 | -3 | 0 | -1 | -1 | 4 | 0 | 0 | -1 | 8 | 5 | 5 | 3 | -2 | 0 | 3 |
| Armed forces service..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Response bias..... | -14 | 12 | -10 | -12 | -1 | -12 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Driver train not offer... | 0 | -1 | 4 | 3 | -3 | -2 | 25 | -1 | 3 | 0 | -30 | 11 | 0 | 0 | 1 | -3 | -1 | -1 | 2 | 0 |
| Driv train taken w off... | 5 | -12 | 1 | 3 | 3 | 6 | 23 | -7 | 2 | -3 | 13 | -5 | 1 | 1 | 1 | -1 | -2 | 0 | -2 | -1 |
| Parents occupation..... | 5 | -7 | 20 | 26 | -6 | 5 | -23 | 0 | -6 | 0 | 2 | 7 | -1 | 0 | -2 | -4 | -9 | -7 | 6 | -3 |
| Sign violation 1-4 yrs... | -14 | 7 | -3 | -5 | 1 | -10 | -7 | 1 | 7 | 4 | 2 | -1 | 6 | 9 | 10 | 9 | 4 | -3 | -1 | 9 |
| Lane viol 1-4 yrs..... | -8 | 2 | -5 | -3 | -3 | -5 | -5 | -1 | 4 | 0 | 2 | 3 | 3 | 1 | 4 | 5 | 1 | -2 | 0 | 6 |
| Following viol 1-4 yrs... | -4 | 2 | -1 | -2 | 2 | -4 | -5 | -1 | 3 | 6 | 1 | -2 | 5 | 0 | 2 | 7 | -1 | -5 | 0 | 9 |
| Passing violation 1-4 yrs | -4 | 4 | 1 | -1 | 1 | -3 | 0 | 0 | 2 | 0 | -2 | 1 | 3 | 4 | 4 | 3 | -1 | 0 | 1 | 2 |
| Right-of-way viol 1-4 yrs | -6 | 4 | 1 | 0 | 2 | -6 | -3 | 2 | 3 | 0 | 0 | 3 | 0 | 5 | 3 | 3 | -3 | 0 | 1 | 4 |
| Turning viol 1-4 yrs..... | -7 | 3 | 0 | -2 | 1 | -5 | -4 | 2 | 3 | 2 | 3 | -1 | 2 | 6 | 5 | 8 | 1 | 0 | 0 | 1 |
| Speed violation 1-4 yrs.. | -20 | 11 | -3 | -6 | 2 | -16 | -4 | 3 | 7 | 9 | -2 | 2 | 8 | 15 | 16 | 20 | 7 | -3 | 6 | 19 |
| Drunk driv viol 1-4 yrs.. | -8 | 0 | -2 | -3 | -1 | -4 | 0 | 0 | 0 | 0 | -3 | 1 | 0 | 1 | 1 | -1 | 1 | -3 | 0 | 0 |
| Reckless dr viol 1-4 yrs. | 0 | 4 | -3 | -3 | -1 | -2 | 1 | 2 | -5 | 3 | 0 | 4 | 3 | -1 | 2 | 1 | 0 | 0 | 1 | 3 |

NOTE: Decimal points and lesd zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equipped seat belts | Wear seat belts | Married | Divorced/separated | Number of children | Number of brothers | Number of older sibs | Parents married | Student | Housewife | Grade completed | Occupational goal | Social mobility | Unemployed | Social activities | Academic activities | Student activities | Intramural activities | Varsity letters | Non-varsity letters |
| Equipped seat belts..... | 100 | | | | | | | | | | | | | | | | | | | |
| Wear seat belts..... | 0 | 100 | | | | | | | | | | | | | | | | | | |
| Married..... | -2 | -7 | 100 | | | | | | | | | | | | | | | | | |
| Divorced/separated..... | -3 | -6 | 1 | 100 | | | | | | | | | | | | | | | | |
| Number of children..... | -7 | -12 | 50 | 17 | 100 | | | | | | | | | | | | | | | |
| Number of brothers..... | -7 | -2 | 11 | 1 | 14 | 100 | | | | | | | | | | | | | | |
| Number of older sibs..... | -2 | -3 | 8 | 1 | 11 | 56 | 100 | | | | | | | | | | | | | |
| Parents married..... | 3 | 3 | -8 | -5 | -13 | -4 | -9 | 100 | | | | | | | | | | | | |
| Student..... | 3 | 15 | -48 | -9 | -29 | -12 | -11 | 7 | 100 | | | | | | | | | | | |
| Housewife..... | -7 | -6 | 56 | 0 | 59 | 9 | 6 | -6 | -35 | 100 | | | | | | | | | | |
| Grade completed..... | 5 | 15 | -45 | -15 | -48 | -17 | -17 | 15 | 56 | -40 | 100 | | | | | | | | | |
| Occupational goal..... | 7 | 9 | -21 | -11 | -20 | -12 | -13 | 7 | 33 | -19 | 41 | 100 | | | | | | | | |
| Social mobility..... | -3 | -6 | 4 | -3 | 2 | 9 | 8 | -2 | -3 | 0 | 0 | 21 | 100 | | | | | | | |
| Unemployed..... | -3 | 3 | -2 | 9 | -2 | 0 | 2 | -4 | 1 | -5 | -4 | -4 | -2 | 100 | | | | | | |
| Social activities..... | 3 | 2 | -11 | -5 | -12 | -7 | -6 | 4 | 9 | -10 | 20 | 7 | -4 | -2 | 100 | | | | | |
| Academic activities..... | 4 | 10 | -17 | -7 | -15 | -5 | -10 | 5 | 27 | -15 | 34 | 21 | 0 | -2 | 17 | 100 | | | | |
| Student activities..... | 6 | 7 | -12 | -6 | -14 | -4 | -7 | 7 | 15 | -12 | 24 | 14 | -3 | -3 | 32 | 25 | 100 | | | |
| Intramural activities.... | -1 | 5 | -3 | -4 | -4 | 6 | 4 | 1 | 0 | -3 | 3 | -1 | 4 | -1 | 12 | 11 | 17 | 100 | | |
| Varsity letters..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | |
| Non-varsity letters..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Drinking..... | 3 | -3 | -15 | 6 | -8 | -5 | -3 | -1 | 10 | -13 | 11 | 6 | -9 | 0 | 9 | 3 | 7 | 1 | 0 | 0 |
| Number of cigarettes..... | -4 | -11 | 4 | 14 | 12 | 1 | 5 | -10 | -14 | 5 | -21 | -10 | -6 | 6 | -4 | -13 | -8 | -2 | 0 | 0 |
| Number of jobs..... | -1 | -5 | 1 | 9 | -18 | 4 | 5 | -4 | -32 | -24 | -15 | -14 | 3 | 5 | 3 | -6 | -1 | 5 | 0 | 0 |
| Year own car..... | -2 | 3 | -1 | -3 | 2 | 4 | 1 | 3 | 2 | 1 | 4 | 3 | -2 | -2 | -5 | 0 | -5 | -5 | 0 | 0 |
| Hours driving..... | 1 | -3 | -7 | 4 | -4 | -1 | 3 | -4 | -9 | -11 | -4 | -7 | -1 | 2 | 3 | -4 | 1 | 4 | 0 | 0 |
| Percent motorcycle..... | 3 | 3 | 0 | 2 | 0 | -1 | -1 | -1 | 1 | -1 | 0 | 0 | 0 | 3 | -1 | 1 | 0 | 1 | 0 | 0 |
| Armed forces service..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Response bias..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Driver train not offer... | -1 | -2 | -7 | -2 | -2 | 7 | 1 | 3 | 5 | -3 | 3 | 1 | -2 | 0 | 0 | 8 | 7 | 14 | 0 | 0 |
| Driv train taken w off... | -1 | -1 | -1 | -3 | -6 | 6 | 3 | 4 | 2 | -4 | 10 | 1 | 6 | 0 | 0 | 8 | 7 | 3 | 0 | 0 |
| Parents occupation..... | 7 | 12 | -18 | -2 | -16 | -13 | -16 | 4 | 23 | -14 | 25 | 17 | -49 | 1 | 10 | 12 | 10 | -4 | 0 | 0 |
| Sign violation 1-4 yrs... | 1 | -3 | -6 | 2 | -4 | -1 | 2 | -5 | -4 | -5 | -4 | -2 | -5 | 2 | 2 | -4 | -3 | 4 | 0 | 0 |
| Lane viol 1-4 yrs..... | -2 | 1 | 0 | 2 | -1 | 1 | 2 | -4 | -2 | -2 | -4 | -3 | -1 | -1 | 0 | -2 | 1 | 3 | 0 | 0 |
| Following viol 1-4 yrs... | -4 | -2 | -3 | 0 | -1 | -2 | -1 | -5 | -2 | 0 | -2 | -3 | 1 | -2 | -1 | -4 | -3 | 0 | 0 | 0 |
| Passing violation 1-4 yrs | 1 | 0 | -1 | 1 | 0 | 3 | 3 | -2 | -1 | 1 | -1 | 0 | -1 | -1 | -1 | -3 | -3 | 1 | 0 | 0 |
| Right-of-way viol 1-4 yrs | -1 | 0 | -2 | 1 | -1 | -2 | -2 | -4 | -1 | 1 | -2 | -2 | -3 | 3 | 2 | -2 | -1 | -1 | 0 | 0 |
| Turning viol 1-4 yrs..... | -1 | -2 | -4 | 0 | -2 | 1 | -1 | -5 | 2 | -5 | 1 | 1 | -1 | 1 | 0 | 1 | 0 | 2 | 0 | 0 |
| Speed violation 1-4 yrs.. | 3 | -7 | -2 | 4 | -4 | -2 | 1 | -4 | -7 | -3 | -7 | -6 | -1 | 3 | 0 | -5 | -2 | 1 | 0 | 0 |
| Drunk driv viol 1-4 yrs.. | 2 | -1 | 1 | 0 | -1 | -1 | 2 | -1 | -2 | 1 | 0 | -3 | -1 | -1 | -1 | -2 | -2 | 0 | 0 | 0 |
| Reckless dr viol 1-4 yrs. | 1 | -1 | 2 | 0 | -1 | 2 | 3 | -3 | -1 | -1 | -1 | 0 | 4 | 0 | -1 | 2 | -2 | -1 | 0 | 0 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Drinking | Number of cigarettes | Number of jobs | Year own car | Hours driving | Percent motorcycle | Armed forces service | Response bias | Driver train not offer | Driv train taken w off | Parents occupation | Sign violation 1-4 yrs | Lane viol 1-4 yrs | Following viol 1-4 yrs | Passing violation 1-4 yrs | Right-of-way viol 1-4 yrs | Turning viol 1-4 yrs | Speed violation 1-4 yrs | Drunk driv viol 1-4 yrs | Reckless dr viol 1-4 yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drinking | 100 | | | | | | | | | | | | | | | | | | | |
| Number of cigarettes | 25 | 100 | | | | | | | | | | | | | | | | | | |
| Number of jobs | 5 | 10 | 100 | | | | | | | | | | | | | | | | | |
| Year own car | -2 | -5 | -5 | 100 | | | | | | | | | | | | | | | | |
| Hours driving | 2 | 7 | 11 | -11 | 100 | | | | | | | | | | | | | | | |
| Percent motorcycle | 2 | 4 | 5 | -3 | 0 | 100 | | | | | | | | | | | | | | |
| Armed forces service | 0 | 0 | 0 | 0 | 0 | 0 | 100 | | | | | | | | | | | | | |
| Response bias | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | | | | | | | | | | | | |
| Driver train not offer | 4 | -1 | -2 | -3 | 1 | -1 | 0 | 1 | 100 | | | | | | | | | | | |
| Driv train taken w off | -2 | -5 | 0 | 7 | -3 | 1 | 0 | 0 | 0 | 100 | | | | | | | | | | |
| Parents occupation | 12 | 2 | -6 | 3 | -2 | 1 | 0 | -7 | 3 | -3 | 100 | | | | | | | | | |
| Sign violation 1-4 yrs | 7 | 8 | 7 | -5 | 10 | 2 | 0 | 2 | 0 | -6 | 3 | 100 | | | | | | | | |
| Lane viol 1-4 yrs | 3 | 4 | 4 | -1 | 1 | 0 | 0 | 3 | 0 | -1 | 0 | 12 | 100 | | | | | | | |
| Following viol 1-4 yrs | 2 | 4 | 1 | -2 | 2 | 0 | 0 | -1 | -2 | -1 | -1 | 6 | 2 | 100 | | | | | | |
| Passing violation 1-4 yrs | 4 | 2 | 2 | -2 | 2 | 5 | 0 | 1 | 2 | -2 | 0 | 9 | 0 | 1 | 100 | | | | | |
| Right-of-way viol 1-4 yrs | 1 | 4 | 2 | -4 | 2 | 1 | 0 | -1 | -1 | -2 | 2 | 8 | 6 | 1 | 5 | 100 | | | | |
| Turning viol 1-4 yrs | 4 | 4 | 5 | -1 | 3 | 4 | 0 | -1 | 0 | -3 | 2 | 11 | 12 | 5 | 3 | 3 | 100 | | | |
| Speed violation 1-4 yrs | 8 | 13 | 8 | -10 | 12 | 3 | 0 | 4 | -1 | -4 | 0 | 19 | 7 | 8 | 8 | 7 | 8 | 100 | | |
| Drunk driv viol 1-4 yrs | 3 | 1 | 2 | -3 | -1 | 0 | 0 | 2 | -1 | -3 | 0 | 3 | -1 | 0 | 6 | 2 | -1 | 1 | 100 | |
| Reckless dr viol 1-4 yrs | -2 | -1 | 3 | 1 | 3 | 0 | 0 | 4 | -1 | 0 | -2 | -1 | 5 | 0 | 0 | -1 | -1 | 1 | 0 | 100 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresno county | Sonoma county | Sacramento county | Stanislaus county | Los Angeles county | Height | Weight | Single orig license | Drive test score | Age licensed | Length instr permit | Traffic density | Birth location | Home status | Year left school | Transfer | Dropout | College transcript | Grade point average | GPA trend |
| Driv w susp viol 1-4 yrs. | 0 | 1 | -1 | 1 | 0 | -2 | 0 | -2 | -1 | 1 | -2 | 0 | -2 | 3 | -5 | -1 | 4 | -1 | -3 | -1 |
| Hit and run viol 1-4 yrs. | -1 | -1 | -1 | -1 | 3 | 0 | -1 | 1 | -3 | 0 | -1 | 3 | 1 | -2 | -1 | -1 | 2 | 2 | -2 | 1 |
| FTA/FTP viol 1-4 yrs..... | 4 | -3 | -2 | -1 | 1 | 2 | 4 | -8 | -2 | 6 | -6 | 0 | 4 | 5 | -7 | 5 | 7 | -3 | -12 | -2 |
| Equipment viol 1-4 yrs... | 2 | -1 | -8 | -1 | 6 | -1 | 5 | -7 | -3 | 2 | -7 | 3 | 0 | 2 | -4 | 1 | 5 | -7 | -12 | -2 |
| Misc moving viol 1-4 yrs. | 0 | -1 | -3 | 0 | 4 | -1 | -1 | -4 | 0 | 2 | -1 | 3 | -1 | -2 | 0 | 2 | -2 | 2 | -2 | 1 |
| Misc non-mov viol 1-4 yrs | 4 | 0 | -7 | 0 | 3 | 2 | 4 | -4 | -2 | 3 | -8 | 0 | 0 | 6 | -7 | 3 | 9 | -7 | -13 | -3 |
| Convictions 6 mos prior.. | 7 | -2 | -5 | -1 | 0 | -1 | 1 | -7 | -1 | 5 | -5 | -3 | -2 | 1 | -13 | 5 | 6 | -5 | -7 | 1 |
| Convictions 1 yr..... | 3 | -3 | -8 | -5 | 10 | -1 | 2 | -5 | -1 | 5 | -7 | 7 | 2 | 7 | -7 | 5 | 7 | -6 | -15 | -5 |
| Convictions 2 yr..... | 4 | -4 | -10 | -4 | 10 | 3 | 3 | -2 | -3 | 4 | -7 | 6 | -1 | 3 | -1 | -1 | 4 | -5 | -14 | -1 |
| Convictions 3 yr..... | 2 | -2 | -10 | -3 | 9 | 0 | 2 | -3 | -4 | -2 | -5 | 6 | -3 | 1 | 1 | -2 | 1 | 1 | -10 | -1 |
| Convictions 4 yr..... | -1 | -3 | -5 | -1 | 8 | 2 | 0 | 1 | -3 | -2 | -4 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | -9 | 0 |
| Convictions 1-2 yrs..... | 4 | -4 | -12 | -5 | 13 | 2 | 4 | -4 | -3 | 6 | -10 | 9 | 1 | 6 | -5 | 3 | 7 | -7 | -19 | -4 |
| Convictions 1-4 yrs..... | 3 | -5 | -13 | -5 | 15 | 2 | 3 | -3 | -5 | 2 | -10 | 10 | -1 | 5 | -2 | 1 | 4 | -4 | -20 | -3 |
| Convictions 3-4 yrs..... | 1 | -3 | -10 | -2 | 11 | 1 | 2 | -2 | -5 | -2 | -6 | 8 | -2 | 2 | 1 | -1 | 1 | 1 | -13 | -1 |
| Accidents 6 mos prior.... | 1 | 3 | -3 | 1 | 0 | 0 | -2 | -1 | 0 | 0 | -1 | -1 | 0 | 0 | -1 | 1 | -1 | 0 | 1 | 0 |
| Accidents 1 yr..... | -3 | -1 | -1 | -1 | 4 | 1 | 2 | -2 | -1 | 0 | -3 | 4 | 2 | 0 | -1 | 1 | 2 | -1 | -5 | -1 |
| Accidents 2 yr..... | -2 | 0 | 0 | -2 | 3 | 0 | 2 | 1 | 1 | -3 | 1 | 3 | 2 | 2 | 2 | -3 | -2 | 1 | -4 | -4 |
| Accidents 3 yr..... | -1 | -1 | 1 | -2 | 2 | 0 | -1 | 1 | -3 | -2 | -1 | 3 | 0 | 0 | 2 | 1 | -5 | 2 | -2 | 0 |
| Accidents 4 yr..... | -3 | -2 | 0 | -1 | 4 | 0 | 1 | 0 | -1 | 1 | -2 | 4 | 0 | 2 | 3 | -2 | -3 | 1 | -3 | -1 |
| Accidents 1-2 yrs..... | -4 | -1 | 0 | -2 | 5 | 1 | 3 | -1 | 1 | -2 | -2 | 5 | 3 | 2 | 1 | -1 | 0 | 0 | -6 | -4 |
| Accidents 1-4 yrs..... | -5 | -2 | 0 | -2 | 6 | 1 | 2 | -1 | -1 | -2 | -3 | 7 | 2 | 2 | 3 | -1 | -4 | 1 | -7 | -5 |
| Accidents 3-4 yrs..... | -3 | -2 | 1 | -2 | 4 | 0 | 0 | 0 | -3 | -1 | -2 | 5 | 0 | 1 | 4 | 0 | -6 | 2 | -4 | 0 |
| Fatal/injury acc 1 yr.... | -2 | -1 | 0 | 2 | 1 | -1 | 1 | -4 | -2 | 1 | -4 | 1 | 1 | 2 | -3 | 1 | 6 | -4 | -5 | 2 |
| Fatal/injury acc 1-4 yrs. | -3 | -2 | 1 | 0 | 3 | -1 | 2 | -2 | -2 | -2 | -3 | 4 | 3 | 3 | 0 | 0 | 1 | -1 | -7 | 0 |
| Property acc 1 yr..... | -2 | -1 | -1 | -2 | 4 | 2 | 1 | -1 | 0 | 0 | -1 | 4 | 1 | -1 | 1 | 1 | -1 | 1 | -3 | -3 |
| Property acc 1-4 yrs..... | -4 | -1 | 0 | -3 | 6 | 1 | 1 | 1 | 0 | -1 | -1 | 6 | 1 | 1 | 4 | -1 | -5 | 2 | -4 | -3 |
| Single veh acc 1 yr..... | -1 | 4 | 0 | 0 | -1 | 1 | 4 | -2 | -1 | 0 | -1 | -1 | 1 | 3 | -1 | 0 | 2 | -4 | -3 | 0 |
| Single veh acc 1-4 yrs... | 0 | 4 | 0 | -2 | -1 | -1 | 2 | -2 | 0 | 1 | -1 | -1 | 1 | 1 | -1 | 2 | 0 | -2 | -4 | 1 |
| Drunk driv acc 1-4 yrs... | -1 | -1 | 3 | -1 | -1 | -1 | 1 | 0 | -2 | -1 | -2 | 0 | 2 | 1 | -1 | -1 | 4 | -1 | -5 | -1 |
| Part fault acc 1 yr..... | -1 | -2 | 0 | 2 | 0 | 0 | 0 | -3 | 0 | 0 | -1 | 0 | 1 | 0 | -2 | -1 | 6 | -2 | -2 | 3 |
| Part fault acc 1-4 yrs... | -2 | -3 | 2 | 1 | 1 | -1 | 2 | 0 | 0 | -2 | -1 | 2 | 2 | 0 | -2 | -1 | 4 | -1 | -5 | 2 |
| Accident cost 1 yr..... | -1 | -1 | -1 | 2 | 1 | 0 | 1 | -5 | -1 | 0 | -4 | 1 | 1 | 3 | -2 | 1 | 5 | -3 | -6 | 1 |
| Accident cost 1-4 yrs.... | -3 | -2 | 0 | -1 | 4 | 0 | 2 | -2 | -1 | -3 | -3 | 4 | 3 | 5 | 1 | 0 | -1 | 0 | -8 | -1 |
| School data missing..... | -11 | -5 | -16 | -6 | 30 | 2 | 3 | -19 | 0 | 5 | -6 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Length license gap 1-4 yr | 1 | 0 | 0 | -2 | 1 | 1 | 2 | -7 | -4 | 11 | -8 | 1 | 8 | 7 | -20 | 19 | 12 | -14 | -10 | -1 |
| Accident rate 1-4 yrs.... | -4 | -3 | 0 | -4 | 7 | -1 | 2 | -1 | -2 | -2 | -2 | 8 | 2 | 3 | 2 | 0 | -5 | 3 | -7 | -3 |
| Convictions DT 1 yr..... | 2 | -2 | -8 | -5 | 10 | 1 | 2 | -3 | -1 | 4 | -8 | 7 | 2 | 6 | -5 | 4 | 6 | -6 | -15 | -3 |
| Accidents DT 1 yr..... | -3 | -1 | 0 | -2 | 4 | 1 | 3 | -3 | -2 | 1 | -3 | 5 | 3 | 1 | -1 | 2 | 1 | -2 | -5 | -1 |
| Quest data missing..... | 2 | 1 | 3 | 1 | -6 | 0 | 5 | -9 | -4 | 8 | -8 | -5 | 7 | 5 | -15 | 9 | 13 | -15 | -17 | -3 |
| Single l c renewal..... | -3 | -3 | 0 | -5 | 8 | 8 | 1 | 19 | 1 | -14 | 8 | 8 | -5 | -4 | 13 | -4 | -16 | 31 | 25 | 1 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Citizenship grade | Absences | Non-language IQ | Achievement test | IQ discrepancy | Achievement index | Rural school | Quest response date | Attitude | Driver training safety | Driver education | Driver ed quality | Mileage work | Mileage other | Annual mileage | Total mileage | Prior mileage | Vehicle weight | Vehicle year | Vehicle mileage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Driv w susp viol 1-4 yrs. | -2 | 3 | -2 | -2 | 0 | -1 | -1 | 0 | 0 | 1 | -3 | -1 | -1 | 2 | 1 | 0 | -1 | 1 | -2 | 1 |
| Hit and run viol 1-4 yrs. | -2 | 1 | -2 | -2 | -1 | -1 | -2 | -1 | 0 | -1 | 1 | -2 | 0 | 0 | 1 | -1 | -1 | -1 | 2 | 0 |
| FTA/FTP viol 1-4 yrs..... | -10 | 8 | -4 | -6 | -1 | -11 | -2 | 3 | 2 | 4 | -6 | 1 | -1 | 7 | 5 | 9 | 4 | 3 | -3 | 3 |
| Equipment viol 1-4 yrs... | -12 | 10 | -5 | -9 | 1 | -9 | 1 | 6 | 7 | 0 | -5 | -3 | -1 | 3 | 1 | 3 | 1 | 4 | -5 | -1 |
| Misc moving viol 1-4 yrs. | -3 | 1 | -1 | 0 | 1 | -3 | -1 | 5 | 2 | 0 | 0 | 0 | 2 | 2 | 4 | 6 | 1 | -1 | 2 | 6 |
| Misc non-mov viol 1-4 yrs | -17 | 10 | -6 | -6 | 0 | -13 | 0 | 6 | 4 | 5 | -5 | 0 | -1 | 5 | 2 | 3 | 0 | 3 | -4 | 1 |
| Convictions 6 mos prior.. | -11 | 6 | -5 | -7 | 1 | -5 | 2 | 1 | 2 | 1 | 0 | -3 | -2 | 3 | 0 | 1 | 1 | 0 | -2 | -1 |
| Convictions 1 yr..... | -21 | 13 | -3 | -7 | 1 | -16 | -5 | 2 | 5 | 4 | -1 | 2 | 3 | 6 | 6 | 9 | 5 | -1 | -1 | 8 |
| Convictions 2 yr..... | -18 | 11 | -3 | -6 | -1 | -15 | -6 | 2 | 7 | 6 | 0 | 1 | 3 | 9 | 10 | 14 | 4 | 1 | -1 | 12 |
| Convictions 3 yr..... | -12 | 7 | -3 | -5 | 0 | -11 | -3 | 4 | 6 | 5 | -1 | 0 | 7 | 8 | 10 | 11 | 3 | -3 | 1 | 11 |
| Convictions 4 yr..... | -14 | 5 | -3 | -4 | 3 | -10 | -4 | 2 | 9 | 5 | 0 | -1 | 7 | 13 | 13 | 13 | 1 | -2 | 5 | 13 |
| Convictions 1-2 yrs..... | -26 | 16 | -4 | -9 | 0 | -20 | -7 | 3 | 8 | 7 | 0 | 2 | 4 | 10 | 11 | 16 | 0 | 0 | -1 | 13 |
| Convictions 1-4 yrs..... | -26 | 15 | -5 | -9 | 2 | -21 | -8 | 5 | 11 | 9 | -1 | 1 | 9 | 15 | 16 | 20 | 5 | -3 | 2 | 18 |
| Convictions 3-4 yrs..... | -17 | 8 | -4 | -6 | 2 | -14 | -5 | 4 | 10 | 7 | -1 | 0 | 9 | 13 | 14 | 16 | 3 | -3 | 4 | 15 |
| Accidents 6 mos prior.... | 0 | 2 | -2 | -2 | 2 | 2 | 5 | 2 | 1 | -1 | 0 | -2 | -3 | 1 | 0 | -3 | 0 | -2 | -1 | -2 |
| Accidents 1 yr..... | -12 | 9 | -1 | 0 | -1 | -6 | -4 | 3 | 1 | 2 | -1 | 1 | -2 | 3 | 1 | 3 | 3 | 0 | 0 | 5 |
| Accidents 2 yr..... | -6 | 3 | 0 | -1 | 1 | -4 | 0 | 3 | 2 | 1 | 0 | 3 | 2 | 6 | 5 | 7 | 4 | -4 | 5 | 7 |
| Accidents 3 yr..... | -3 | 1 | -1 | 0 | 1 | -3 | -2 | 2 | -1 | 6 | 0 | 1 | 5 | 1 | 4 | 7 | 0 | -4 | 2 | 5 |
| Accidents 4 yr..... | -4 | 2 | -1 | -2 | -1 | -4 | -2 | -1 | 2 | 3 | 2 | -1 | 7 | 4 | 6 | 5 | 3 | -3 | 4 | 5 |
| Accidents 1-2 yrs..... | -13 | 8 | -1 | -1 | -1 | -7 | -3 | 4 | 2 | 2 | -1 | 3 | 0 | 6 | 4 | 7 | 5 | -3 | 3 | 8 |
| Accidents 1-4 yrs..... | -12 | 7 | -2 | -2 | 0 | -8 | -4 | 4 | 2 | 6 | 0 | 2 | 5 | 7 | 8 | 11 | 4 | -5 | 5 | 11 |
| Accidents 3-4 yrs..... | -5 | 2 | -1 | -2 | 0 | -5 | -3 | 1 | 0 | 6 | 1 | 0 | 8 | 4 | 7 | 8 | 2 | -5 | 4 | 7 |
| Fatal/injury acc 1 yr.... | -10 | 9 | -2 | -1 | 0 | -5 | -3 | 4 | 2 | 0 | -4 | -2 | 0 | 2 | 1 | 3 | 0 | 3 | -1 | 4 |
| Fatal/injury acc 1-4 yrs. | -12 | 9 | -1 | -2 | 1 | -8 | -4 | 3 | 0 | 4 | -3 | 0 | 2 | 3 | 5 | 9 | 2 | -2 | 1 | 6 |
| Property acc 1 yr..... | -7 | 4 | 0 | 0 | -2 | -5 | -3 | 1 | 0 | 2 | 1 | 2 | -2 | 3 | 0 | 1 | 3 | -2 | 1 | 3 |
| Property acc 1-4 yrs..... | -7 | 3 | -1 | -1 | -1 | -5 | -2 | 3 | 2 | 5 | 2 | 3 | 5 | 7 | 6 | 7 | 4 | -5 | 5 | 9 |
| Single veh acc 1 yr..... | -6 | 4 | -1 | -1 | 0 | -3 | -1 | 2 | 0 | 0 | -1 | -2 | 1 | 2 | 3 | 6 | 1 | 2 | -1 | 5 |
| Single veh acc 1-4 yrs... | -8 | 3 | -1 | -1 | 0 | -4 | -1 | -2 | -3 | 3 | -2 | 1 | 0 | 3 | 2 | 7 | 0 | -2 | -1 | 6 |
| Drunk driv acc 1-4 yrs... | -9 | 1 | -2 | -3 | -1 | -5 | -1 | -1 | -1 | 0 | -3 | 1 | 1 | 0 | 1 | 0 | 2 | -1 | 0 | 0 |
| Part fault acc 1 yr..... | -6 | 6 | -1 | 0 | 2 | -2 | -3 | 2 | 0 | 2 | -4 | 1 | 0 | 3 | 2 | 1 | -1 | 4 | 1 | 1 |
| Part fault acc 1-4 yrs... | -8 | 4 | 0 | -1 | 2 | -5 | -3 | 1 | -1 | 5 | -2 | 1 | 3 | 1 | 3 | 6 | -1 | -1 | 2 | 3 |
| Accident cost 1 yr..... | -12 | 9 | -2 | -1 | 0 | -6 | -4 | 4 | 0 | 2 | -3 | 0 | 1 | 2 | 2 | 4 | 0 | 2 | -2 | 8 |
| Accident cost 1-4 yrs.... | -13 | 9 | -1 | -3 | 1 | -9 | -4 | 3 | -1 | 5 | -1 | 1 | 4 | 4 | 6 | 10 | 2 | -3 | 1 | 9 |
| School data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | -17 | 2 | 0 | 3 | 2 | -1 | 1 | 2 | -1 | -1 |
| Length license gap 1-4 yr | -10 | 7 | -2 | -3 | 1 | -10 | 5 | 7 | 1 | 1 | -1 | 0 | -6 | 0 | -4 | -4 | -2 | 1 | -2 | -7 |
| Accident rate 1-4 yrs.... | -11 | 5 | -1 | -2 | -2 | -8 | -4 | 4 | 2 | 5 | 0 | 2 | 2 | 3 | 3 | 2 | 2 | -5 | 4 | 4 |
| Convictions DT 1 yr..... | -21 | 14 | -4 | -7 | 1 | -16 | -7 | 3 | 5 | 5 | 1 | 2 | 4 | 7 | 7 | 9 | 6 | -1 | -3 | 7 |
| Accidents DT 1 yr..... | -10 | 6 | -1 | 0 | -3 | -7 | -3 | 3 | 1 | 2 | -1 | 4 | 0 | 3 | 1 | 3 | 4 | -3 | 0 | 4 |
| Quest data missing..... | -14 | 12 | -10 | -12 | -1 | -12 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Single lic renewal..... | 16 | -16 | 13 | 20 | -2 | 17 | -6 | -6 | 2 | 1 | 2 | 3 | 11 | 9 | 11 | -2 | -5 | -5 | 4 | 5 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equipped seat belts | Wear seat belts | Married | Divorced/separated | Number of children | Number of brothers | Number of older sibs | Parents married | Student | Housewife | Grade completed | Occupational goal | Social mobility | Unemployed | Social activities | Academic activities | Student activities | Intramural activities | Varsity letters | Non-varsity letters |
| Driv w susp viol 1-4 yrs. | -3 | 0 | -2 | 0 | -1 | -1 | -1 | -1 | -2 | -1 | -1 | 0 | 0 | -1 | 0 | 2 | -1 | 3 | 0 | 0 |
| Hit and run viol 1-4 yrs. | 1 | 3 | -2 | 3 | -2 | -3 | -2 | 1 | 2 | -2 | 0 | -2 | -1 | 2 | 2 | 0 | 0 | -1 | 0 | 0 |
| FTA/FTP viol 1-4 yrs..... | -3 | 1 | 4 | 2 | 7 | 3 | 3 | -8 | -3 | 3 | -10 | -4 | -1 | 2 | -1 | -3 | -5 | 1 | 0 | 0 |
| Equipment viol 1-4 yrs... | -9 | -8 | 5 | 5 | 6 | 3 | 1 | -8 | -6 | 4 | -12 | -8 | 1 | 2 | -3 | -3 | -4 | 3 | 0 | 0 |
| Misc moving viol 1-4 yrs. | -1 | -1 | 2 | -1 | 0 | -4 | -2 | -1 | -1 | -1 | -1 | -3 | -2 | 2 | -1 | 0 | -1 | 0 | 0 | 0 |
| Misc non-mov viol 1-4 yrs | -6 | -6 | 3 | 4 | 5 | 3 | 2 | -7 | -1 | 2 | -12 | -4 | 2 | 2 | -2 | -5 | -5 | 2 | 0 | 0 |
| Convictions 6 mos prior.. | -3 | 1 | 1 | 6 | 7 | 5 | 7 | -6 | 0 | 0 | -9 | -6 | 1 | 4 | -3 | -3 | -4 | 0 | 0 | 0 |
| Convictions 1 yr..... | -1 | -5 | 5 | 5 | 4 | 3 | 2 | -6 | -5 | 5 | -9 | -6 | -4 | 5 | -1 | -4 | -4 | 0 | 0 | 0 |
| Convictions 2 yr..... | -2 | -4 | 0 | 1 | 0 | -1 | 1 | -6 | -5 | 0 | -7 | -4 | -1 | 2 | -1 | -7 | -4 | 2 | 0 | 0 |
| Convictions 3 yr..... | -1 | -4 | -3 | 3 | -4 | -2 | 1 | -6 | -4 | -4 | -7 | -4 | -1 | 1 | 0 | -4 | -3 | 2 | 0 | 0 |
| Convictions 4 yr..... | 0 | -5 | -9 | 3 | -5 | -1 | 0 | -6 | -4 | -9 | -4 | -6 | -2 | 1 | 1 | -3 | 0 | 4 | 0 | 0 |
| Convictions 1-2 yrs..... | -2 | -7 | 3 | 4 | 2 | 1 | 2 | -8 | -6 | 3 | -11 | -6 | -3 | 4 | -1 | -7 | -5 | 2 | 0 | 0 |
| Convictions 1-4 yrs..... | -2 | -8 | -4 | 5 | -3 | -1 | 1 | -11 | -7 | -4 | -11 | -4 | -3 | 4 | 0 | -7 | -4 | 3 | 0 | 0 |
| Convictions 3-4 yrs..... | -1 | -6 | -8 | 4 | -6 | -2 | 0 | -9 | -5 | -8 | -7 | -6 | -2 | 2 | 0 | -4 | -2 | 3 | 0 | 0 |
| Accidents 6 mos prior... | 1 | -2 | 2 | -1 | 1 | -1 | 2 | -1 | -1 | 5 | -2 | 0 | -1 | -1 | -2 | -1 | 1 | 0 | 0 | 0 |
| Accidents 1 yr..... | -2 | -3 | 3 | 1 | 4 | 0 | 1 | -2 | -4 | 4 | -6 | -3 | -4 | 3 | 1 | -4 | -1 | 0 | 0 | 0 |
| Accidents 2 yr..... | 3 | -2 | -2 | 0 | -1 | -5 | -2 | -1 | -2 | 2 | -3 | 1 | -1 | -2 | 1 | 0 | 0 | 1 | 0 | 0 |
| Accidents 3 yr..... | 2 | 0 | -4 | 4 | -6 | -4 | -4 | -1 | -1 | -6 | -2 | -3 | -1 | 0 | 2 | 2 | -2 | 0 | 0 | 0 |
| Accidents 4 yr..... | 1 | 2 | -7 | -1 | -4 | 0 | 2 | -1 | -1 | -4 | -2 | -3 | -4 | 0 | 1 | 2 | 0 | 1 | 0 | 0 |
| Accidents 1-2 yrs..... | 1 | -3 | 1 | 1 | 2 | -3 | 0 | -2 | -4 | 4 | -6 | -1 | -3 | 1 | 2 | -3 | -1 | 0 | 0 | 0 |
| Accidents 1-4 yrs..... | 2 | -2 | -5 | 2 | -3 | -4 | -1 | -3 | -4 | -2 | -6 | -4 | -4 | 1 | 3 | 0 | -2 | 1 | 0 | 0 |
| Accidents 3-4 yrs..... | 2 | 1 | -8 | 3 | -7 | -3 | -1 | -1 | -1 | -7 | -2 | -4 | -3 | 0 | 3 | 2 | -2 | 1 | 0 | 0 |
| Fatal/injury acc 1 yr.... | -3 | -5 | 0 | 3 | 4 | 3 | 3 | -3 | 0 | 1 | -4 | -2 | 1 | 5 | -1 | -1 | -4 | 2 | 0 | 0 |
| Fatal/injury acc 1-4 yrs. | 0 | -1 | -2 | 4 | 1 | 2 | 3 | -3 | -1 | -1 | -5 | -3 | -1 | 3 | 0 | 0 | -3 | 3 | 0 | 0 |
| Property acc 1 yr..... | -1 | -1 | 3 | -1 | 3 | -2 | 0 | -1 | -4 | 4 | -6 | -3 | -5 | 1 | 2 | -4 | 1 | -1 | 0 | 0 |
| Property acc 1-4 yrs..... | 3 | -1 | -5 | 1 | -4 | -6 | -3 | -1 | -4 | -2 | -4 | -3 | -5 | -1 | 4 | 0 | 0 | -1 | 0 | 0 |
| Single veh acc 1 yr..... | -1 | -3 | 0 | 3 | -1 | 0 | 3 | -1 | 0 | 1 | -3 | 0 | -4 | 2 | 0 | -1 | -3 | 1 | 0 | 0 |
| Single veh acc 1-4 yrs... | 1 | -3 | -1 | 4 | 0 | 1 | 2 | 0 | -1 | 0 | -4 | -1 | -3 | -1 | 0 | -2 | -2 | 2 | 0 | 0 |
| Drunk driv acc 1-4 yrs... | 1 | -1 | 0 | 0 | -1 | 1 | 3 | 1 | -2 | 2 | -2 | -3 | -1 | -1 | -2 | -2 | -3 | -2 | 0 | 0 |
| Part fault acc 1 yr..... | -2 | -4 | -1 | 1 | 1 | 1 | 3 | -3 | 1 | 1 | -2 | -1 | -1 | 4 | -1 | -1 | -1 | 1 | 0 | 0 |
| Part fault acc 1-4 yrs... | 0 | -3 | 0 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | -3 | -2 | -1 | 3 | -1 | 0 | -2 | 3 | 0 | 0 |
| Accident cost 1 yr..... | -2 | -5 | 2 | 2 | 3 | 2 | 3 | -5 | -1 | 2 | -5 | -2 | 1 | 4 | -1 | -2 | -4 | 1 | 0 | 0 |
| Accident cost 1-4 yrs.... | 1 | -2 | -3 | 3 | 0 | 0 | 2 | -3 | -2 | -2 | -6 | -4 | -2 | 2 | 1 | 0 | -3 | 2 | 0 | 0 |
| School data missing..... | -3 | -4 | -1 | 0 | 8 | 5 | 2 | -2 | 0 | 3 | -11 | -2 | -1 | 1 | -1 | 2 | 3 | 11 | 0 | 0 |
| Length license gap 1-4 yr | -2 | -2 | 6 | 4 | 13 | 8 | 4 | -9 | -2 | 10 | -9 | -4 | -1 | 2 | -4 | -1 | -3 | 0 | 0 | 0 |
| Accident rate 1-4 yrs.... | 2 | -2 | -5 | 1 | -2 | -4 | -1 | -2 | -3 | -2 | -6 | -4 | -5 | 1 | 3 | 0 | -1 | 0 | 0 | 0 |
| Convictions DT 1 yr..... | -2 | -4 | 4 | 3 | 3 | 1 | 1 | -8 | -5 | 3 | -8 | -6 | -3 | 4 | -2 | -4 | -4 | 2 | 0 | 0 |
| Accidents DT 1 yr..... | 0 | -2 | 3 | 0 | 4 | -3 | 0 | -3 | -5 | 3 | -6 | -1 | -3 | 4 | 0 | -2 | -1 | 1 | 0 | 0 |
| Quest data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Single lic renewal..... | 3 | 8 | -80 | -12 | -48 | -9 | -7 | 7 | 45 | -48 | 45 | 21 | -3 | 2 | 11 | 19 | 14 | 3 | 0 | 0 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = 15

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.



APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Drinking | Number of cigarettes | Number of jobs | Year own car | Hours driving | Percent motorcycle | Armed forces service | Response bias | Driver train not offer | Driv train taken w off | Parents occupation | Sign violation 1-4 yrs | Lane viol 1-4 yrs | Following viol 1-4 yrs | Passing violation 1-4 yrs | Right-of-way viol 1-4 yrs | Turning viol 1-4 yrs | Speed violation 1-4 yrs | Drunk driv viol 1-4 yrs | Reckless dr viol 1-4 yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Driv w susp viol 1-4 yrs. | 2 | 1 | 2 | -2 | 0 | 0 | 0 | 1 | -1 | 0 | -3 | 3 | 5 | 0 | 0 | 5 | 4 | 7 | 0 | 0 |
| Hit and run viol 1-4 yrs. | 3 | 1 | 3 | -1 | -2 | -1 | 0 | -1 | 1 | 0 | 2 | 1 | -1 | -1 | 0 | 1 | 1 | 3 | 0 | 0 |
| FTA/FTP viol 1-4 yrs..... | -1 | 8 | 4 | 0 | -2 | 6 | 0 | 6 | 0 | -4 | -1 | 17 | 17 | 2 | 5 | 7 | 11 | 22 | 6 | 6 |
| Equipment viol 1-4 yrs... | 1 | 8 | 5 | -2 | 3 | 0 | 0 | 6 | 1 | -3 | -4 | 13 | 15 | 1 | 4 | 4 | 8 | 16 | 3 | 1 |
| Misc moving viol 1-4 yrs. | 0 | -2 | 1 | -4 | 2 | -1 | 0 | 1 | 0 | -1 | 2 | 4 | 3 | 1 | -1 | 5 | 4 | 9 | 0 | 0 |
| Misc non-mov viol 1-4 yrs | 1 | 8 | 5 | -1 | 1 | 1 | 0 | 7 | -1 | -2 | -3 | 21 | 17 | 2 | 5 | 5 | 10 | 22 | 3 | 3 |
| Convictions 6 mos prior.. | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | -1 | -1 | -3 | 2 | 1 | 0 | 3 | 1 | 3 | 3 | 0 | 5 |
| Convictions 1 yr..... | 5 | 15 | 4 | -9 | 4 | 3 | 0 | 4 | 1 | -6 | 2 | 33 | 17 | 11 | 9 | 26 | 19 | 32 | 0 | 4 |
| Convictions 2 yr..... | 5 | 11 | 7 | -7 | 7 | 7 | 0 | 4 | -1 | -6 | -1 | 36 | 19 | 8 | 10 | 19 | 19 | 45 | -1 | 1 |
| Convictions 3 yr..... | 7 | 7 | 8 | -5 | 9 | 0 | 0 | 3 | -1 | -4 | 0 | 35 | 21 | 12 | 11 | 18 | 21 | 53 | 5 | 7 |
| Convictions 4 yr..... | 5 | 7 | 8 | -2 | 9 | 2 | 0 | 1 | 0 | -1 | 1 | 35 | 19 | 17 | 9 | 19 | 20 | 50 | 6 | -1 |
| Convictions 1-2 yrs..... | 7 | 17 | 7 | -11 | 8 | 6 | 0 | 5 | 0 | -8 | 0 | 46 | 24 | 12 | 13 | 29 | 25 | 51 | -1 | 3 |
| Convictions 1-4 yrs..... | 9 | 15 | 11 | -9 | 12 | 4 | 0 | 5 | -1 | -7 | 0 | 59 | 32 | 20 | 16 | 30 | 32 | 75 | 5 | 5 |
| Convictions 3-4 yrs..... | 7 | 8 | 11 | -5 | 12 | 1 | 0 | 3 | -1 | -3 | 1 | 45 | 26 | 19 | 13 | 20 | 26 | 66 | 7 | 4 |
| Accidents 6 mos prior.... | -1 | 1 | -1 | 1 | -3 | -1 | 0 | -1 | -2 | 0 | 0 | 1 | -1 | -1 | -1 | 2 | 0 | 1 | 0 | 0 |
| Accidents 1 yr..... | 3 | 9 | 2 | -6 | 1 | 1 | 0 | 4 | -2 | -4 | 3 | 8 | 6 | 6 | 4 | 11 | 4 | 8 | 5 | 1 |
| Accidents 2 yr..... | 2 | 7 | 4 | -7 | 6 | 4 | 0 | 2 | 3 | -1 | 0 | 7 | 4 | 4 | 4 | 6 | 5 | 11 | 1 | 1 |
| Accidents 3 yr..... | 6 | 4 | 5 | -5 | 3 | 1 | 0 | -1 | 0 | -1 | 0 | 10 | 4 | 7 | 3 | 6 | 6 | 10 | -1 | 3 |
| Accidents 4 yr..... | 1 | 3 | 6 | -1 | 6 | 0 | 0 | 0 | -2 | -2 | 2 | 7 | 4 | 5 | 2 | 6 | 4 | 11 | 4 | -1 |
| Accidents 1-2 yrs..... | 3 | 11 | 5 | -9 | 5 | 4 | 0 | 4 | 1 | -3 | 2 | 10 | 7 | 7 | 6 | 12 | 6 | 13 | 4 | 1 |
| Accidents 1-4 yrs..... | 6 | 11 | 8 | -9 | 7 | 3 | 0 | 2 | 0 | -4 | 3 | 16 | 8 | 11 | 7 | 14 | 9 | 19 | 4 | 2 |
| Accidents 3-4 yrs..... | 5 | 5 | 7 | -4 | 6 | 0 | 0 | -1 | -1 | -2 | 2 | 12 | 5 | 9 | 4 | 9 | 7 | 14 | 2 | 2 |
| Fatal/injury acc 1 yr.... | 0 | 4 | 1 | -4 | 1 | -1 | 0 | 7 | 0 | -5 | 0 | 6 | 4 | 2 | 4 | 4 | 4 | 5 | 0 | 3 |
| Fatal/injury acc 1-4 yrs. | 0 | 7 | 3 | -5 | 7 | 2 | 0 | 6 | 2 | -4 | 0 | 10 | 5 | 9 | 4 | 8 | 6 | 12 | 3 | 3 |
| Property acc 1 yr .... | 3 | 8 | 2 | -4 | 0 | 2 | 0 | 0 | -3 | -1 | 3 | 6 | 4 | 5 | 3 | 11 | 2 | 6 | 6 | -1 |
| Property acc 1-4 yrs... | 7 | 9 | 8 | -8 | 5 | 2 | 0 | -1 | -1 | -2 | 3 | 12 | 7 | 8 | 6 | 13 | 8 | 15 | 3 | 1 |
| Single veh acc 1 yr..... | -1 | 4 | 1 | -6 | 2 | 0 | 0 | 2 | 0 | -5 | 3 | 5 | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 |
| Single veh acc 1-4 yrs... | -1 | 4 | 3 | -3 | 6 | 0 | 0 | 2 | 1 | -4 | 3 | 5 | 4 | 4 | 2 | 0 | 0 | 5 | 4 | 0 |
| Drunk driv acc 1-4 yrs... | 2 | 2 | 2 | -3 | -2 | 0 | 0 | -1 | -1 | -3 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 2 | 63 | 0 |
| Part fault acc 1 yr..... | 1 | 9 | -1 | -2 | 1 | -1 | 0 | 9 | 1 | -4 | 1 | 4 | 4 | 0 | 3 | 7 | 4 | 5 | 0 | 4 |
| Part fault acc 1-4 yrs... | 0 | 5 | 0 | -5 | 5 | 1 | 0 | 4 | 0 | -3 | 0 | 9 | 4 | 5 | 2 | 11 | 6 | 10 | 5 | 5 |
| Accident cost 1 yr..... | 1 | 5 | 2 | -4 | 2 | 0 | 0 | 6 | -1 | -5 | 1 | 6 | 5 | 3 | 4 | 6 | 4 | 6 | 1 | 12 |
| Accident cost 1-4 yrs.... | 2 | 9 | 6 | -6 | 8 | 2 | 0 | 5 | 1 | -4 | 0 | 12 | 7 | 9 | 5 | 10 | 7 | 15 | 3 | 8 |
| School data missing..... | 0 | 0 | 0 | -1 | 1 | -3 | 0 | 0 | 42 | 2 | 0 | 4 | 2 | 1 | 1 | 3 | 2 | 1 | -2 | 2 |
| Length license gap 1-4 yr | 2 | 5 | -2 | 1 | -3 | 3 | 0 | 26 | -1 | -4 | -2 | -3 | -1 | -2 | 0 | -1 | -2 | -5 | 3 | 3 |
| Accident rate 1-4 yrs.... | 5 | 10 | 7 | -7 | 5 | 2 | 0 | 0 | 0 | -4 | 3 | 14 | 8 | 10 | 8 | 13 | 8 | 16 | 6 | 4 |
| Convictions DT 1 yr..... | 5 | 12 | 5 | -9 | 7 | 3 | 0 | 3 | -2 | -7 | 1 | 31 | 15 | 11 | 11 | 24 | 21 | 33 | 0 | 5 |
| Accidents DT 1 yr..... | 3 | 7 | 2 | -5 | 2 | 2 | 0 | 3 | 0 | -3 | 2 | 10 | 5 | 5 | 4 | 9 | 2 | 8 | 5 | 2 |
| Quest data missing..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | -10 | 0 | -6 | 3 | 3 | -2 | 1 | 1 | 0 | 3 | 1 | 4 |
| Single lic renewal..... | 17 | -9 | -1 | 1 | 4 | 1 | 0 | -2 | 6 | 2 | 16 | 4 | 0 | 2 | 0 | 1 | 4 | 3 | 0 | 0 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Driv w susp viol 1-4 yrs | Hit and run viol 1-4 yrs | FTA/FTP viol 1-4 yrs | Equipment viol 1-4 yrs | Misc moving viol 1-4 yrs | Misc non-mov viol 1-4 yrs | Convictions 6 mos prior | Convictions 1 yr | Convictions 2 yr | Convictions 3 yr | Convictions 4 yr | Convictions 1-2 yrs | Convictions 1-4 yrs | Convictions 3-4 yrs | Accidents 6 mos prior | Accidents 1 yr | Accidents 2 yr | Accidents 3 yr | Accidents 4 yr | Accidents 1-2 yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Driv w susp viol 1-4 yrs. | 100 | | | | | | | | | | | | | | | | | | | |
| Hit and run viol 1-4 yrs. | 0 | 100 | | | | | | | | | | | | | | | | | | |
| FTA/FTP viol 1-4 yrs..... | 0 | 4 | 100 | | | | | | | | | | | | | | | | | |
| Equipment viol 1-4 yrs... | 5 | 0 | 41 | 100 | | | | | | | | | | | | | | | | |
| Misc moving viol 1-4 yrs. | 11 | 4 | 6 | 9 | 100 | | | | | | | | | | | | | | | |
| Misc non-mov viol 1-4 yrs | 8 | 0 | 53 | 38 | 2 | 100 | | | | | | | | | | | | | | |
| Convictions 6 mos prior.. | 0 | 4 | 10 | 3 | 5 | 6 | 100 | | | | | | | | | | | | | |
| Convictions 1 yr..... | 7 | 9 | 22 | 22 | 13 | 26 | 6 | 100 | | | | | | | | | | | | |
| Convictions 2 yr..... | 9 | 2 | 25 | 29 | 6 | 29 | 4 | 15 | 100 | | | | | | | | | | | |
| Convictions 3 yr..... | 10 | 1 | 28 | 31 | 10 | 33 | 2 | 15 | 18 | 100 | | | | | | | | | | |
| Convictions 4 yr..... | 4 | 2 | 25 | 22 | 9 | 29 | 2 | 10 | 15 | 21 | 100 | | | | | | | | | |
| Convictions 1-2 yrs..... | 11 | 7 | 31 | 34 | 12 | 37 | 7 | 72 | 80 | 22 | 16 | 100 | | | | | | | | |
| Convictions 1-4 yrs..... | 12 | 5 | 41 | 43 | 15 | 48 | 5 | 52 | 60 | 68 | 61 | 74 | 100 | | | | | | | |
| Convictions 3-4 yrs..... | 9 | 1 | 34 | 34 | 12 | 40 | 2 | 16 | 21 | 80 | 76 | 29 | 83 | 100 | | | | | | |
| Accidents 6 mos prior.... | 0 | 0 | 0 | 1 | 3 | -1 | 15 | 1 | 3 | 0 | 0 | 2 | 1 | 0 | 100 | | | | | |
| Accidents 1 yr..... | 2 | 3 | 3 | 3 | 5 | 3 | 3 | 20 | 6 | 6 | 3 | 17 | 14 | 6 | 1 | 100 | | | | |
| Accidents 2 yr..... | 4 | 0 | 0 | 1 | 1 | 1 | 1 | 9 | 14 | 6 | 5 | 13 | 12 | 7 | 0 | 0 | 100 | | | |
| Accidents 3 yr..... | 1 | 2 | 2 | 1 | 2 | 3 | 1 | 3 | 4 | 18 | 8 | 5 | 15 | 17 | -2 | 3 | 4 | 100 | | |
| Accidents 4 yr..... | 3 | -1 | 1 | 1 | 3 | 2 | -1 | 2 | 4 | 6 | 10 | 4 | 12 | 14 | -1 | 0 | 1 | 3 | 100 | |
| Accidents 1-2 yrs..... | 5 | 2 | 2 | 3 | 4 | 3 | 3 | 18 | 14 | 9 | 6 | 21 | 19 | 9 | 1 | 71 | 70 | 5 | 1 | 100 |
| Accidents 1-4 yrs..... | 5 | 2 | 3 | 4 | 5 | 4 | 2 | 15 | 14 | 18 | 15 | 19 | 26 | 21 | 0 | 53 | 52 | 54 | 47 | 74 |
| Accidents 3-4 yrs..... | 3 | 1 | 2 | 2 | 3 | 3 | 0 | 3 | 6 | 18 | 16 | 6 | 19 | 22 | -2 | 2 | 4 | 75 | 69 | 4 |
| Fatal/injury acc 1 yr.... | 3 | 2 | 5 | 3 | 4 | 4 | 1 | 11 | 5 | 5 | 4 | 10 | 10 | 6 | -1 | 54 | -1 | 4 | 0 | 38 |
| Fatal/injury acc 1-4 yrs. | 7 | 2 | 6 | 3 | 4 | 6 | 1 | 8 | 10 | 12 | 12 | 12 | 17 | 15 | -2 | 30 | 29 | 28 | 27 | 41 |
| Property acc 1 yr..... | 1 | 2 | 0 | 2 | 3 | 1 | 2 | 17 | 4 | 4 | 1 | 14 | 11 | 4 | 2 | 85 | 1 | 1 | 0 | 61 |
| Property acc 1-4 yrs..... | 2 | 2 | 0 | 2 | 4 | 1 | 2 | 13 | 11 | 14 | 11 | 16 | 20 | 16 | 1 | 44 | 45 | 47 | 39 | 63 |
| Single veh acc 1 yr..... | 0 | 0 | 2 | 0 | 2 | 0 | 1 | 2 | 2 | 0 | 2 | 3 | 3 | 1 | 0 | 28 | -2 | -1 | -2 | 19 |
| Single veh acc 1-4 yrs... | 0 | -1 | 2 | 0 | 0 | 3 | 4 | 4 | 4 | 5 | 4 | 5 | 7 | 6 | -1 | 20 | 12 | 5 | 11 | 22 |
| Drunk driv acc 1-4 yrs... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -1 | 2 | 3 | -1 | 2 | 3 | 0 | 2 | 2 | -1 | 6 | 3 |
| Part fault acc 1 yr..... | 0 | 3 | 3 | 3 | 2 | 3 | -1 | 13 | 3 | 2 | 3 | 11 | 8 | 4 | -1 | 40 | -1 | 1 | -2 | 29 |
| Part fault acc 1-4 yrs... | 4 | 3 | 4 | 4 | 2 | 4 | -1 | 10 | 11 | 9 | 9 | 13 | 16 | 12 | -1 | 25 | 20 | 19 | 16 | 31 |
| Accident cost 1 yr..... | 11 | 2 | 5 | 3 | 4 | 5 | 2 | 14 | 6 | 5 | 4 | 13 | 12 | 6 | 0 | 69 | -1 | 4 | -1 | 49 |
| Accident cost 1-4 yrs.... | 11 | 2 | 5 | 3 | 4 | 7 | 1 | 11 | 12 | 14 | 14 | 15 | 21 | 18 | -1 | 39 | 36 | 37 | 34 | 54 |
| School data missing..... | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 7 | 3 | 3 | 4 | 6 | 7 | 4 | 0 | 3 | 2 | 0 | 0 | 4 |
| Length license gap 1-4 yr | -1 | 0 | 10 | 2 | 2 | 9 | 0 | 5 | 0 | -5 | -7 | 3 | -3 | -8 | 0 | 1 | -4 | -6 | -5 | -2 |
| Accident rate 1-4 yrs.... | 5 | 3 | 1 | 2 | 3 | 2 | 2 | 15 | 13 | 15 | 13 | 18 | 23 | 16 | -1 | 51 | 53 | 54 | 47 | 73 |
| Convictions DT 1 yr..... | 3 | 6 | 18 | 20 | 10 | 24 | 5 | 78 | 30 | 16 | 12 | 09 | 51 | 18 | 2 | 16 | 6 | 3 | 4 | 16 |
| Accidents DT 1 yr..... | -1 | 2 | 2 | 2 | 5 | 3 | 2 | 18 | 7 | 5 | 4 | 10 | 13 | 6 | 3 | 77 | 17 | 8 | 2 | 66 |
| Quest data missing..... | 3 | 0 | 7 | 4 | 3 | 7 | 4 | 5 | 6 | 4 | 0 | 7 | 6 | 2 | -1 | 4 | 2 | 0 | -2 | 4 |
| Single lic renewal..... | 2 | 2 | -1 | -4 | 1 | -1 | -1 | -4 | 0 | 5 | 7 | -2 | 4 | 7 | 0 | 0 | 1 | 2 | 5 | 0 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = 15

APPENDIX C (Continued)
Correlation Matrix for Females

| Variable | Variable | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accidents 1-4 yrs | Accidents 3-4 yrs | Fatal/injury acc 1 yr | Fatal/injury acc 1-4 yrs | Property acc 1 yr | Property acc 1-4 yrs | Single veh acc 1 yr | Single veh acc 1-4 yrs | Drunk driv acc 1-4 yrs | Part fault acc 1 yr | Part fault acc 1-4 yrs | Accident cost 1 yr | Accident cost 1-4 yrs | School data missing | Length license gap 1-4 yr | Accident rate 1-4 yrs | Convictions DT 1 yr | Accidents DT 1 yr | Quest data missing | Single lic renewal |
| Accidents 1-4 yrs..... | 100 | | | | | | | | | | | | | | | | | | |
| Accidents 3-4 yrs..... | 70 | 100 | | | | | | | | | | | | | | | | | |
| Fatal/injury acc 1 yr.... | 29 | 2 | 100 | | | | | | | | | | | | | | | | |
| Fatal/injury acc 1-4 yrs. | 55 | 38 | 94 | 100 | | | | | | | | | | | | | | | |
| Property acc 1 yr..... | 44 | 1 | 2 | 2 | 100 | | | | | | | | | | | | | | |
| Property acc 1-4 yrs..... | 85 | 69 | 1 | 3 | 92 | 100 | | | | | | | | | | | | | |
| Single veh acc 1 yr..... | 12 | -2 | 90 | 25 | 2 | -1 | 100 | | | | | | | | | | | | |
| Single veh acc 1-4 yrs... | 23 | 11 | 32 | 41 | 3 | 3 | 65 | 100 | | | | | | | | | | | |
| Drunk driv acc 1-4 yrs... | 5 | 4 | 0 | 5 | 3 | 3 | 0 | 7 | 100 | | | | | | | | | | |
| Part fault acc 1 yr..... | 20 | 7 | 75 | 40 | 1 | -1 | 37 | 24 | 0 | 100 | | | | | | | | | |
| Part fault acc 1-4 yrs... | 39 | 25 | 45 | 70 | 1 | 3 | 20 | 29 | 8 | 58 | 100 | | | | | | | | |
| Accident cost 1 yr..... | 37 | 3 | 90 | 50 | 26 | 13 | 49 | 32 | 0 | 66 | 41 | 100 | | | | | | | |
| Accident cost 1-4 yrs.... | 72 | 49 | 90 | 92 | 14 | 28 | 25 | 43 | 5 | 36 | 63 | 54 | 100 | | | | | | |
| School data missing..... | 3 | 0 | 2 | 2 | 3 | 2 | -1 | 1 | -1 | 0 | 1 | 3 | 3 | 100 | | | | | |
| Length license gap 1-4 yr | -8 | -7 | 1 | -2 | 1 | -6 | 1 | 0 | 0 | 0 | -2 | 1 | -4 | 6 | 100 | | | | |
| Accident rate 1-4 yrs.... | 96 | 70 | 26 | 53 | 44 | 86 | 11 | 22 | 6 | 18 | 37 | 34 | 70 | 3 | -3 | 100 | | | |
| Convictions DT 1 yr..... | 14 | 9 | 10 | 9 | 14 | 11 | 3 | 3 | -1 | 12 | 10 | 14 | 12 | 1 | 3 | 14 | 100 | | |
| Accidents DT 1 yr..... | 52 | 7 | 40 | 29 | 67 | 44 | 22 | 20 | 3 | 31 | 24 | 53 | 38 | 2 | -1 | 51 | 19 | 100 | |
| Quest data missing..... | 2 | -2 | 4 | 4 | 2 | 0 | 1 | 2 | -1 | 3 | 3 | 4 | 3 | 6 | 27 | 0 | 2 | 2 | 100 |
| Single lic renewal..... | 4 | 5 | 0 | 1 | 0 | 4 | -1 | 0 | 0 | 0 | 0 | -1 | 2 | -4 | 4 | 3 | -3 | -1 | -6 | 100 |

NOTE: Decimal points and lead zeroes omitted, e.g., 5 = .05, 15 = .15.