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Evaluation and rating of driver education programs in Michigan based on driver records of accidents and convictions

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EVALUATION AND RATING OF DRIVER EDUCATION PROGRAMS IN MICHIGAN BASED ON DRIVER RECORDS OF ACCIDENTS AND CONVICTIONS

BY

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ABSTRACT

EVALUATION AND RATING OF DRIVER EDUCATION PROGRAMS IN MICHIGAN BASED ON DRIVER RECORDS OF ACCIDENTS AND CONVICTIONS

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The primary objective of this study is to evaluate driver education programs based on convictions and, specific accident criteria such as type of accident and accidents under different weather and light conditions. There are two major reasons for undertaking this study. First, there has been a growing concern about the effectiveness of such driver education programs. Second, prior research on the effectiveness of various driver education programs has not been conclusive. In general, prior research studies have lacked a valid measure of accident exposure. In the present work, an indirect accident exposure measure, in addition to traditional methods (ie, accident and conviction frequency per student for each school and program) was utilized in the analysis of the effectiveness of driver education programs. This indirect accident exposure method is based on the assumption that the accident exposure of any group of drivers is proportional to the innocent victim (a driver who is not responsible in a multi-vehicle accident) involvements in multi-vehicle accident by that group of

drivers. Various statistical techniques were utilized to test various hypotheses for comparing different criterion variables and to determine the relationship between types of program and performance variables. A general rating score was then determined for all schools and programs on the basis of both frequency and severity of accidents.

Analyses indicated that students from competency program in commercial schools had significantly higher accident and conviction rates than the range, traditional, and competency programs in public schools. Whereas, no significant difference was found among all four programs when an indirect accident exposure measure was utilized in the analysis. Based on the rating score, developed on the combined criterion of accident frequency and severity, the range program was found to have the best performance. No significant relationship was found between types of programs and a set of their performance variables. Thus, as an overall conclusion there is no significant difference among public school based programs on various criterion variables; but the commercial school program had a significantly higher accident and conviction rate than public school programs.

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CHAPTER 1. INTRODUCTION

During the past half century, driver education programs have steadily become a standard curriculum in high school classrooms across the United States. From a shaky or unpromising start in a solitary school in Gilbert, Minnesota, in 1923, such programs have flourished to become the primary source of driver education today. Despite this growth and popularity, driver education programs have come under attack during recent years. Critics have charged that such programs are both inefficient and ineffective. They point to the fact that accident statistics among young drivers remain high despite the widespread use of driving education programs. Lastly, it is argued that the public is concerned about spending tax dollars on a program which has not been proven to be cost-effective.

Not surprisingly, proponents of driver education programs advocate that public instruction is crucial since it reaches young people right when they attain legal licensing age, and thus, right when they are most highly motivated to learn. Further, the proponents note that it makes intuitive sense that driver education is helpful in reducing the number of accidents and injuries since such courses teach proper driving maneuvers and the rules of the road. Finally, they argue that the potential consequences which result from a poorly trained driver being on the road are so serious that it is essential that society maintains driver education programs to ensure that quality instruction is provided.

In light of this controversy, the appropriate objectives of this study are 1) to develop and calibrate a model for estimating the differences in the accident potential of various driver education programs, 2) to evaluate driver education programs based on accidents and convictions and on more specific accident criterion such as types of accident and accidents under various light and weather conditions and 3) to develop a scoring system to rate driver education programs and schools within each program based on the frequency and severity of accidents and convictions.

In the next chapter, various articles about different types of driver education programs and their accident and conviction reduction performance on highways are reviewed. The methodology required to conduct this study is explained in chapter 3. Results of the data analyses are presented in chapter 4. The final chapter includes the summary and conclusion of this study. Recommendations made, based on this study, are also presented in the final chapter.

CHAPTER 2. LITERATURE REVIEW

The main purpose of a driver education program is to teach young drivers the minimum skill necessary to drive safely, with the ultimate objective of reducing the number of accidents and driving offenses. However, this objective is apparently not being acheived. Accident statistics for young drivers remain apallingly high despite the wide spread institution of driving education courses.

The review of literature concentrated on the following areas of young drivers: (a) characteristics of young drivers, (b) young drivers and fatal accident records, (d) types of driver education programs, and (d) performance of drivers licensed with different types of driver education programs and without formal driver education.

2.1 Characteristics of Young Drivers

Young drivers are most often characterized as inexperienced, aggressive, temperamental and competitive with greater self-confidence and higher risk taking behavior than older drivers. The mental and sensory abilities required for safe driving; such as visual acuity, visual field, night vision, perception and recognition power, and decision and reaction times are quite sound when compared to other age groups.

In spite of these physical advantages, the young drivers were found to have been over-involved in traffic accidents in many studies. Many research projects have been conducted to study the contribution of human factors in accidents. In one such study, McFarland found that youthfulness, temperament, and inexperience were major causes for higher accident frequencies of young drivers (1).

In another study Beamish and Malfetti investigated psychological characteristics of young male drivers with and without violations using a variety of personality tests (2). The test result showed a statistically significant difference on variables - emotional stability, conformity, objectivity and mood, between the two different groups.

In his study on minor driver performance, Ockert reported the finding of Gallagher and Moore who investigated the causes of accidents of young drivers by studying the relationship between a broad range of personal variables and accidents (3). The factors which were best predictors of accident history were the amount and quality of exposure. In addition to exposure, variables with a significant relationship to accident history were personal and emotional adjustment and dynamic personality traits.

In summary, the higher accident and violation rates of young drivers appear to be the result of (i) lack of experience at a new activity with a frequent lack cf awareness that certain actions may produce serious consequences, and (ii) psychological characteristics associated with a greater risk-taking behavior.

2.2: Young Drivers and Fatal Accidents

Young drivers were also found to be over-involved in fatal accidents by many researchers. According to statistics provided in "Accident Facts" published by the National Safety Council for 1976, young drivers of age 15 to 24, have the highest fatality rate of 46.2 fatalities per 100,000 population (4). Another study based on data obtained from the Fatal Accident Reporting System (FARS) for the year 1978 reported that male drivers encounter the greatest rate of involvement in fatal accidents at the age of 18 (5). The greatest rate of involvement in fatal accidents by female drivers occurred at the age of 16.

Based on data from the Fatal Accident File (FAF), as maintained by NHTSA, for the years 1973 to 1974, Wuerdeman et al. in their study titled "Drivers in Fatal Crashes With or Without Driver Training" indicated that of all the reported fatal accidents involving drivers through age 30, 51.4% had not completed a driver training program (6). Slightly fewer, 48.6% had completed driver training.

According to Highway Statistics for the year 1985, publlished by the U.S. Department of Transportation, Federal Highway Administration, young drivers of age 15 through 24 were involved in approximately 46% of total fatal traffic accidents, even though they comprised only 18.36% of the total driver population nation-wide (7). This disproportinate trend has been consistent for several years.

2.3 Driver Training and Education

The terms driver training and driver education refer to the task of producing drivers who are able to drive safely on the roadway. The training part refers to actual driving by the candidate - i.e. time spent in the automobile to get familiar with vehicle handling and to practice driving according to the traffic regulations that drivers have to obey. The education part refers to the the instruction that is given to the student driver out of the automobile, regarding traffic regulations, legal and moral responsibilities, as well as special theoretical maneuvers of the automobile. The objective of such instruction is to teach students the minimum skills necessary to drive and to enable students to make sound decisions under various driving circumstances. The ultimate purpose of all of this is, of course, to decrease the number of accidents and driving offences committed by young motorists.

There are several methods of driver training and education in use, ranging from simple classroom teaching, to costly simulators. There are four types of driver education programs which are as follows (8):

(1) the two-phase competency or traditional program, which involves classroom and behind the wheel (on-street) instruction;

(2) the three-phase range program, which consists of a two-phase program with range training added;

(3) the three-phase simulator program, which combines a two phase program with simulator training; and

(4) the four-phase program, which combines classroom, behind-the-wheel, simulator, and range training.

An explanation of various elements of these four driver education program may give further insight into these programs.

A simulator, as the name suggests, imitates on-road driving. It is an immobile unit, closely resembling the inside of an automobile and is replete with safety belt, gear shift lever, steering wheel, gauges, speedometer etc. At the front of the unit is a screen which depicts various driving scenarios a person may encounter when on the road. The student sits in the unit and operates the simulator as if it were a moving vehicle. The instructor who also sits beside the student, can immediately correct the student's action. The adequacy of simulator training varies widely. In most commonly used simulators, there is no interaction between the actions of the student and the simulator, e.g. change of the scene on the screen acordingly to steering wheel or brake application input (9). More sophisticated simulators with interaction between the actions of the driver and the simulated road environment are available, but due to their very high cost, are rarely used in driver training courses. The theory behind the use of the simulator is that once a student begins to drive,they will be able to transfer the skills learned on the machine to the operation of a real car. The main advantage of simulators is that it allows students to be trained without the risk of an accident.

On the other end of the spectrum is the "behind-the-wheel" program which takes the student out onto the public roadways to put into practice those skills which have been taught in the classroom. Typically, the instructor sits next to the student and has access to a dual brake pedal. This allows the instructor to slow down and stop the vehicle when necessary. The behind-the-wheel program has been in use since the beginning of driving instruction, and is an integral part of most courses.

Another driver education teaching tool is known as an off-street driving range. Usually driving ranges contain elements of the roadway system like intersections, curves, and merging lanes, painted street markings, signs, and curbs very similiar to those actually used in real life. A range consists of a large driving area constructed seperate and apart from any public roadway. This type of range training provides students with an opportunity to drive an automobile without being exposed to the dangers inherent in on-road, in-traffic driving.

2.4 Performance of Drivers Licensed with Different Types of Driver Education Programs:

The majority of the early studies on driver education programs have mainly focused on comparing different types of training. Comparison between trained and untrained drivers was not made in many studies. However, a comparison in performance between trained and untrained young drivers was made in the Dekalb study, which was a very comprehensive study conducted in Dekalb county schools, in Georgia (10). The primary objective of this study was to determine the crash reduction potential of a competency based driver training program known as Safe Performance Curriculum (SPC).

The experiment design called for the random assignment of 18,000 volunteer high schools students in Dekalb county schools, Georgia, to one of the following: (1) Safe Performance Curriculum (SPC) - 70-hour course including classroom, simulation, range, and on-street training; (2) Pre-Driver Licensing (PDL) - a modified curriculum containing only the minimum training required to obtain a license; and (3) Control - no formal driving education in the secondary school.

The student driving records were monitored for a period of 2 to 4 years to assess measures of intermediate and ultimate performance. Comparative analyses of SPC vs.

PDL vs. Control groups were then made in terms of crashes and violations.

The results of this study showed that students who had completed the SPC or PDL driver education courses had 13% fewer accidents and 16% fewer violations during the first 6 months of driving than those students who had been placed in the control group. This difference was found to be statistically significant. However, this initial difference between these groups was marginal during the next year, and completly diminished over the two year observation period.

These findings led the author to conclude that students receiving the SPC or the PDL instruction performed no better than students with no formal driver education. In addition, this study determined that there was no statistically significant difference in performance of those students who had received the lengthy SPC driver education instruction and those who had received PDL driver education instruction. In light of these facts, the researchers in the Dekalb county project concluded that the Safe Performance Curriculum was not an effective accident reduction countermeasure and there were no significant differences among the three experimental groups in either accident or violation rates over a two year observation period.

Lund et al. reexamined the Dekalb study regarding the variables of licensure, crashes and violations (11).

By fitting a log-linear model to each variable, these researchers estimated the relative hazard (likelihood) of students becoming licensed, or having their first crash or violation, at each month following their sixteenth birthday. Conclusions reported were different than the original Dekalb report. The more recent study found that students assigned to the Safe Performance Curriculum program were at significantly greater risk of crashing and of receiving violations than were the comparable control group of students. This report indicated that even during the first six months of licensing eligibility, there was no evidence that the Safe Performance Curriculum or the Pre-Driver Licensing programs reduced the per capita likelihood of crashes or violations.

There have been criticisms of the Dekalb study. First, while the students who participated in the project were randomly assigned, the initial group of 18,000 people consisted of only those individuals who had volunteered to be a part of the experiment. In his dissertation, Ockert reported that about 18 percent of the control group students had completed a formal commercial driver training program (3). Thus, their may have been an initial self selection bias and the students who participated may not have been an accurate cross section of high school students in Dekalb County, Georgia. Second, although the 18,000 students were originally divided evenly among three programs, a number of people dropped out of their assigned program or did not go on to become licensed. Again this self-selection factor may have skewed the data. Third, it is possible that driver education graduates reduced their mobility as a result of a cautious approach to driving learned in the courses. Finally, there has been an opportunity to track these students's performance for only a few years. It may turn out that the SPC contains latent benefits which will not be fully evident for a number of years.

In addition to these problems, the study was also criticized for not considering any kind of accident exposure measures such as vehicle-miles of travel, in its analysis. The higher accident frequency per student in one program may indicate that students in that program are worse drivers than students in other program, or it may simply be that students in this particular driver education program drive more miles than students in the other programs. Therefore, direct comparision, based on crash and conviction records without recognizing exposure, may be misleading.

Proponents of driver education programs were disappointed in the Dekalb study as it did not fulfill their expectations. This is not surprising as several other studies on driver education program comparisions reported mixed results. In one such study in Michigan in 1977, the researcher asserted that students who had been exposed to only behind-the-wheel and classroom instruction programs had a higher average incidence of violations and accidents than those students who had also been exposed to simulator training (12). This finding was later supported by an author of another study conducted in Texas (13). In this study, 4,759 matched pairs of drivers from the same school environment licensed with or without public school driver education programs, were evaluated using accident and conviction records. Drivers without public school driver education were defined as having received "other training" in vehicle operation, where as the counterpart driver had 3-phase simulator training. All the drivers had a minimum of 18 months driving experience. No accident exposure measure was considered in this study. The conclusion was that those drivers who completed the 3-phase simulation program experienced fewer accidents and moving violations than the drivers having completed other training.

However, two other studies, one conducted in Illinois and the other in California contradicted this finding (14). These two studies reported that there were no statistically significant differences in the number of crashes and convictions experienced by those students who had been enrolled in a simulator-enhanced program as compared to those students who had been enrolled in a behind-the-wheel program.

In another study in Virginia, the Virginia Department of Highways & Transportation compared the performance of different types of programs - two phase, three phase (simulator and range) and four phase programs, using accident and conviction records for three driver experience levels (less than one year of driving experience, 1 to 2 years and 2 to 3 years) (15). The comparisions among programs showed that young people who received their training in the two phase program generally accumulated fewer convictions per 100 students than did their counterparts who received training which included a simulator, a range or both. However, the data concerning the number of crashes per 100 students for each different type of program did not show a consistent pattern for the three different levels of driver experience. That is, the program which had the fewest number of accidents during one level of driving experience, had the highest number of accidents during another period of driving experience, as shown in table 2.1. Therefore no definite conclusions could be reached regarding the crash reduction potential of any particular program.

One of the reasons stated in the study for the absence of any pattern was that the number of crashes is too small and too volatile. An important factor which might have a potential effect on the accident frequency per student, is the identification of the guilty and innocent driver in the computation of an accident rate. It is not evident that this factor or any kind of accident exposure measure was considered in this study.

Table 2.1: Crashes per 100 drivers, by program types for different level of driver experience (15).

Types of program	Level of experience		
	< 1 years	1-2 years	2-3 years
2-phase	5.9	11.8	10.3
3-phase simulator	6.3	11.2	12.3
3-phase range	6.9	10.4	12.9
4-phase	5.5	13.5	8.8

Due to the high cost of simulator programs, many researchers directed their interest towards the range program. In 1977, the California State Department of Motor Vehicles made a study of range versus nonrange (two phase) driver training in the San Juan area using accident and conviction frequencies of young drivers (16). The study indicated that range students had fewer total accidents per student than non-range students in the year following the begining of training. However, a North Carolina Highway Safety Research Center Study indicated that there was no significant difference between the performance levels of the range students and those students who had received other types of driving instruction (17).

Thus one can see that there is no consistent evidence that enhanced programs using simulators and/or ranges are more effective than programs consisting strictly of classroom instruction and behind-the-wheel training.

Research was also conducted to determine the performance of public and commercial schools. One study conducted by the Washington Division of Motor Vehicles in 1969 found that commercial driving schools are more effective in teaching safe driving habits than are public high schools (18). The researchers argued that this was particularly true for men, because they found that the male commercial school students had significantly fewer accidents and violations than their public school counterparts. However, a 1973 California report indicated that there was no difference in the accident rate observed between publicly and commercially trained students (19). A Virginia study found that students graduating from commercial driving schools in Virginia had a significantly greater incidence of accident involvement and a higher rate of convictions for motor vehicle offenses than students who received their driver training at a public school (15).

In a comparision between public and commercial schools in Ohio, a total of 59,496 driver records of public schools trainees were compared to a total of 37,642 driver records of commercial trainees in terms of the number of accidents and convictions accumulated over a time period of 6, 12, 18, 24, and 30 months immediately following the issuance of a license (19). The analysis of data led to the finding (at a very high level of confidence) that public school graduates had a greater percentage of records without accidents and violations, a lower accident involvement rate and a lower conviction rate than their commercially trained peers for all time intervals.

3.4 Conclusions:

Despite the obvious benefits gained from previous studies, there are some limitations and deficiencies in each study. The overall general deficiencies and limitations found in the reported studies are as follows:

1. Conclusions drawn from previous studies (either large scale or small-scale) are not free from various external contaminating factors (e.g. lack of control for exposure, enforcement irregularities, etc.).
2. Students receiving different driver education programs may have been psychologically, physiologically or socio-economically different from each other, as well as from those students who did not receive driver education.
3. Since the analysis periods are short, the data on conviction and specifically on accident records are too small to allow for a conclusive result.
4. Accident exposure measures were not considered in any of the above mentioned studies. Therefore, direct comparisons between different groups of young people based on their accident and conviction records while ignoring their average miles driven or other exposure measures which could be an essential factor in their crash and conviction statistics, may be misleading.
5. An additional concern is the accuracy in accident and conviction records, which might significantly affect the accident and conviction rate - the criterion variables used for evaluating driving education programs. Although in theory there is standardization in the reporting of accidents, in

practice, this is not always the case. For instance, two-car accidents involving no personal injuries and no major vehicle damage may be underreported in large urban area. Similarly, there is almost certainly a sizeable variance among jurisdictions in regards to the type of driving behavior which will prompt a citation for a traffic violation. Sometimes drivers are not correctly reported as the guilty or innocent drivers in multi-vehicle accidents, and this will bias the result. Moreover, it is not clear that previous studies considered the concept of innocent driver and guilty driver in computing the accident rate.

6. Finally, studies on the effectiveness of existing driver education programs are not conclusive.

This study was undertaken to overcome some of these concerns. The major deficiency in previous studies, that of not considering an exposure measure in their analysis, will be overcome by using an accident exposure measure in this study.

Vehicle-miles of travel on a specific highway under specific condition is generally considered to be the most appropriate measure of exposure. However, it is quite cumbersome to collect these data. This problem has led to the use of some kind of indirect exposure measure method, among them is the quasi-induced accident exposure method.

This method is based on the assumption that accident exposure by any group of drivers is proportional to the innocent victim involvements in multi-vehicle accidents by that group of drivers (20). This method will be further elaborated in the following chapter.

Like many other studies, this study has also some limitations which are mentioned below:

1. This study concentrates on a comparison of performances of various driver education programs. There is no control group in this study - that is performance of various drivers with and without driver training are not compared. This is because 16 and 17 year old drivers can not obtain a driver license in Michigan without receiving driver training.
2. There are various external contaminating factors which might affect the results. Such factors include: Geographical location of schools: Drivers from schools in different geographical areas may encounter different driving conditions which might affect their road performance as well as the performance of the school and program. However, this factor is partially reduced by considering schools from three major geographical areas - Detroit metropolitan area, other urban areas and rural areas. However, there is still room for variation in driver exposure in each area.

   The reporting of accident and conviction incidents also varies from place to place which might also affect the results.

Drivers with different socio-economic background: Students receiving different driver education programs may have been psychologically, physiologically or socio-economically different from each other, as well as from those 18 year old students who did not receive driver education. This factor may also bias the results.

3. The analysis period for this study is limited to two years because driver school codes were not captured prior to 1987.

However, some of the important relationships that remain unknown following this review of the literature will be addressed by testing the major hypotheses in this study:

1. There is no difference in the mean accident rate (number of accidents/student) among various driver education programs.
2. There is no difference in the mean single-vehicle accident rate (number of single-vehicle accidents/student) among various driver education programs.
3. There is no difference in the mean conviction rate (number of convictions/student) among various driver education programs.
4. There is no difference in the mean relative involvement ratio (IR) among various driver education programs.

5. There is no difference in the mean relative involvement ratio among various driver education programs under different weather and light conditions.
6. There is no difference in the mean relative involvement ratio for different types of accidents, among various driver education programs.
7. There is no difference in the mean relative involvement ratio among different types of schools for different types of accidents and under different weather and light conditions.

CHAPTER 3. METHODOLOGY

The general purpose of this study was to determine the crash reduction performance of various driver education programs in Michigan. The performance was evaluated on the basis of accident and conviction records of drivers who received their driver training under each of the programs tested. A scoring system was developed, and a model was calibrated to predict the crash performance under each of the different driver education programs, and individual schools within these programs.

To accomplish these objectives, the following methodology was followed:

3.1 Data Base:

A new data base was created by extracting required information from three existing data files, and merging them together in one file. These three data files are the Highway Accident Master file (accident file), Driver Accident and Conviction Record file (driver license file), and Driver Education Program and School Information file (school file).

The Highway Accident Master file contains information about each accident that occurred within the State of Michigan, including the accident location (time and place), road and weather condition, type and severity of the accident and data regarding drivers and vehicles involved in the accident. This file also contains the identification of the driver most at fault and the driver considered to be the "innocent victim" which are coded as the first and second driver respectively as determined by the investigating officer.

The Driver Accident and Conviction Record file contains accident and conviction records of each driver, as well as driver parameters such as age, sex, residence etc. For 16, 17, and 18 years old drivers this file also contains a code number for the driving school where they completed their driver education program. The lay out of this file is different from the accident file. A fortan prgram (shown in appendix A) was written to change the format of the driver accident file to make it compatible with the accident file.

The Driver Education Program & School Information file contains information regarding each driving school such as school code, school location, number of students graduated each year and types of program offered.

The accident file and the driver accident file share a common element (the accident report number). Using this common variable it was possible to merge the accident and license file into one file. The driving school file was merged with the license file on the basis of a common variable - the school code.

3.2 Data Variables

From the three original data files a new data base was created that included the data necessary to accomplish the objectives of this research. The variables that were selected from the three original data files and included in the new data file were as follows:

-- the environmental characteristics at the time of the accident: that is time, date, weather and light condition;

-- general characteristics of the accident such as accident type, type of violation and accident report number;

-- conviction, type of offense code, date of conviction;

-- the characteristics of the driver: such as age, sex, date of birth, driver license number, original and issue license date, driving school;

-- driving school information: such as type of school (public or commercial), location of school, number of students, type of program offered.

Once the entire new data file was built, a subset of this data file was created which included only those schools which graduated a minimum of one hundred students each year for the two year analysis period (1988 and 1989).

3.3 <u>Induced Exposure Method:</u>

The traditional method of determining whether a certain driving school or a particular driver education program has a better performance than other driving schools or driving programs is to compare accident rates. These rates are traditionally based on the number of accidents per driver in each school or program. This method is not a very accurate representation of true risk, since it is based on the implicit assumption that drivers in all the schools or programs have an equal exposure to accident situations.

To overcome this problem, an alternative method was utilized in this research (20, 21). This method uses an indirect measure of accident exposure, generally called the quasi-induced exposure method. This method is based on the assumption that the accident exposure by any group of drivers is proportional to the innocent victim involvements in multi-vehicle accidents by that group of drivers. An innocent victim in an accident is defined as the driver not responsible for the accident. Those drivers who are involved in multi-vehicle accidents and are at-fault, or responsible for accidents, are defined as driver-1, whereas drivers who are not at-fault, or not responsible for the accident, are defined as driver-2.

Driver-2 is used as a measure of accident exposure. This measure of accident exposure provides a tool to study the relative accident propensity of different groups of drivers from different driving schools and programs under different driving conditions.

To obtain a measure similiar to an accident rate for groups of drivers from different driver education programs, a ratio that indicates the involvement of drivers of that specific group to their respective exposure measure, was used. This ratio is defined as the ratio of the percentage of accidents where driver-1 comes from a given driver education scenerio to the percentage of accidents where driver-2 comes from the same scenerio. This ratio is called the relative accident involvement ratio (IR), which is a measure of the relative frequency of accident involvement for the various groups of drivers from different driver education programs.

A value of 1.00 for this relative involvement ratio denotes equality between the accident involvement and accident exposure for drivers from a given scenerio. Similarly, when the ratio is less than 1.00, this means the driver group is less likely to be responsible for an accident, which constitutes under-involvement. When the ratio is greater than 1.00 the driver is more likely to be responsible for an accident which constitutes over-involvement.

However, there were certain limitations or issues related with this technique as identified by many previous studies (20, 22). These are discussed as follows:

1) How one-vehicle accidents are considered in this concept of exposure. Studies have shown that if the characteristics (proportion) of the at-fault drivers are the same for both types of accidents (i.e. single-vehicle & multi-vehicle accidents), the involvement ratio is uneffected (20). However, there is no compelling reason that the characteristics of at-fault drivers in one and multi-vehicle crashes should be the same. If the characteristics of at-fault drivers in one-and multi-vehicle crashes are different, these two types of accidents should be analyzed separately. Therefore, in this study one- and multi-vehicle accidents are analyzed separately.

2) Another important issue related with this concept of exposure measure is that innocent drivers (driver-2) should constitute a random sample of all drivers. That is driver-1's choose their innocent victim at random from all drivers present on the system. It implies that subsets of driver-1's should choose driver-2's in the same proportion - that is, the row proportion should be identical. Therefore, in this study only those schools under each program were selected which had a high number of accidents.

The relative involvement ratio for each school within each program was computed. An average value of the relative involvement ratio was determined for all schools within each program. This average value represents the relative involvement ratio for each driver education program.

In addition to this approach of computing IR value for different driver education programs (i.e. using the average of IR value for all schools under each program), the IR value for each program was also computed separately for three different geographical areas. These areas are the Detroit metropolitan area, other urban areas and rural areas. The purpose behind this was to reduce the differences in driver exposure due to different geographical areas.

The performance of drivers from different schools or programs was determined under different driving conditions, to find out if drivers from a particular school or program have specific problems under certain driving conditions.

The variables considered for defining various driving scenarios are as follows:

1) light condition: day, dawn or dusk, and night,
2) weather condition: clear, raining, and snowing, and
3) types of accidents.

For each school, the relative involvement ratio was obtained for each level of the above mentioned variables. The relative involvement ratio for each program was then determined by computing the average value of this ratio for all schools under each program.

In addition to the analyses using the accident exposure, other traditional methods were also used to analyze the data. These methods involved the calculation of the value of certain criterion variables for each selected school and then for each program. The criterion variables used were:

1) total number of accidents per student;
2) number of single vehicle accidents per student;
3) number of convictions per student;

These criterion variables in addition to the IR value were used for hypothesis testing as discussed in the next section.

3.4 Hypotheses testing:

After the values of all criterion variables were determined, hypotheses were tested using the "t" test and analysis of variance models (ANOVA). ANOVA procedures permit the analysis of unequal sample sizes and the simulataneous testing of more than two samples, where as the "t" procedure can test only two samples at a time. First, ANOVA procedure was utilized to examine the differences in the mean criterion variable among different groups. If any difference among different groups was found statistically significant, then the "t" test was used to find out exactly which two groups differed. The Statistical Analysis System (SAS) software was used for performing the tests (23).

The major hypotheses which were tested are as follows:

1. There is no difference in the mean accident rate (number of accidents/student) among various driver education programs.
2. There is no difference in the mean single-vehicle accident rate (number of single-vehicle accidents/student) among various driver education programs.
3. There is no difference in the mean conviction rate (number of convictions/student) among various driver education programs.
4. There is no difference in the mean relative involvement ratio among various driver education programs.
5. There is no difference in the mean relative involvement ratio among various driver education programs under different weather and light conditions.
6. There is no difference in the mean relative involvement ratio for different types of accidents, among various driver education programs.
7. There is no difference in the mean relative involvement ratio among different types of schools for different types of accidents under different weather and light conditions.

3.5 <u>Development of a Scoring System:</u>

Comparisons among different schools and programs based on the criterion variables, classified certain schools as being either higher or lower ranked under certain conditions. However, it may be misleading to draw a conclusion regarding the over-all performance of various driving schools and programs using total accident rate as a criterion variable. This is because students from different schools may experience accidents of different types and degree of severity. It may not be appropriate to rate a school which had a fewer number of accidents with a high degree of severity better than another school which had a higher number of accidents but with lesser degree of severity.

To determine the rating of different schools and programs based on frequency and severity of accidents, an attempt was made to define a common base for all types of accidents. Previous studies have determined the average dollar value of accidents by degree of severity (such as fatal, injury and property damage) but these averages did not account for the various types of accidents (24, 25). To determine the average dollar value by type of accident, three steps were followed:

1) the percentage of fatal, injury, and property damage accidents in each type of accident were determined from the state-wide accident data for the year 1988 (26), then

2) these percentages were multiplied by the respective average dollar value of fatal, injury and PDO accidents; and finally

3) these three products were summed .

For the purpose of developing a scoring system based on accident frequency and severity, a weighting score is required for each type of accident. And this weighting score is taken to be equivalent to the dollar value for each type of accident. The score for each school was then obtained by summing the product of the frequency of each type of accident and their respective weights. Each school and program was rated on the basis of the score/student for each school. The same concept was utilized for developing the score for different types of convictions. Points associated with different types of conviction was used as weight for their respective type of convictions. The conviction rating score for each school was obtained by summing the product of frequency of each type of conviction and their respective weight. Each school and program was also rated based on the conviction score/student for each school.

In order to determine the consistency of various schools in their performance on different criterion variables over the two year period, the following steps were followed:

1. For each of the two years, schools were ranked based

on each of the three criterion variables - IR value, number of accidents/student and score/student.

2. In each year's ranking, schools were classified into two groups for each criterion variable. The first group constitutes those schools whose criterion variable value is lower than the mean value. The second group includes those schools whose criterion variable is higher than the mean value. The first and second groups are called higher and lower ranked groups according to a specific criterion variable.
3. Those schools which appear in both years higher or lower ranked group under each criterion variable, were identified as consistent schools on a given criterion variable. Schools which were consistent across different criterion variables were also identified.

These rating scores, in addition to other criterion variables, were further used in developing models, as discussed in the next section.

3.6 Model Development:

One of the prime objectives of this study, was the development of a model to estimate the performance of various driving schools and driving programs. The independent variables used in developing the model included the number of students, number of accidents, relative accident involvement ratio, accidents/student, convictions/student; and dummy variables for the type of program (range, competency public, competency commercial, and traditional. The simulator and the 4-phase programs were not considered due to small sample size.), and geographical location of school (Detroit metropolitian area, other urban area and rural area).

The dependent variable (year 1989 score/student) for each school was regressed against the year 1988 values of the independent variables for the same school. The purpose was to use the information from the first year accident and conviction records for each school to calibrate a model which predicts the score/student for the following year.

Models were calibrated for the following cases:

1. For each combination of type of program and geographical location of school (such as range-urban, range-rural, etc.)
2. For each type of program irrespective of geographical location.
3. For each geographical location of school irrespective of type of program.
4. An overall model for all types of programs and geographical locations.

In each of the above cases, two types of regression models were calibrated. The first one was the simple linear regression model between the dependent variable (score/ student) for the year 1989 and the independent variable (score/student) for the year 1988. This was done to determine the consistency between year 88 and year 89. The second type of model was a multiple linear regression model, using all the possible independent variables.

The tool of analysis was STEPWISE regression, which either allows each variable to enter into the model at each step if it makes a significant contribution to the model, or drops the variable out of the model at each step if it does not make a significant contribution to the model. The level of significance selected for variables to enter into the model or stay in the model was 0.1. SAS software were utilized for performing the stepwise regression analysis.

3.7 Discriminant Analysis:

Discriminant analysis was performed to determine if it was possible to classify schools into different driver education programs, based on discriminant functions developed from a set of performance predictor variables. A comparision between the actual classification of schools under each program and the predicted classification would determine how successfully schools can be discriminated into different programs based on these performance variables. A small difference between criterion groups with respect to predictor variables results in more error in classification in discriminant analysis. Any relationship between qualitative criterion groups and quantitative predictor variables could be identified based on this analysis (27).

For performing discriminant analysis, discriminant functions were developed from the first year data, using types of program as a classification variable and IR value, score/student, accidents/student and convictions/student for each school as a set of predictor variables. Using these discriminant functions, the classification of schools into various programs was predicted. The accuracy of classification was examined by comparing the actual with the predicted classification of schools into different programs.

The comparision between the actual and the predicted classification of schools into different programs was also made for the second year, using the same discriminant functions which were developed from the first year data. Based on these comparisons, it can be inferred whether a relationship between types of program and a set of performance variables exists. This will further indicate whether there is any difference among the programs based on this set of performance variables.

CHAPTER 4. DATA ANALYSIS

The newly created data file, which contains information regarding accidents, convictions, and driver education programs for a two year analysis period (1988 and 1989) was used to evaluate relationships. Analyses were conducted to assess differences in accident characteristics when different driver education programs and driving schools were compared. Additionally, a scoring system was developed to rate various schools and programs. Models were calibrated for predicting program and school performance under varrious conditions. This chapter reports the examination and assessment of the data.

4.1 Data Statistics:

For years 1988 and 1989, the total number of 16, 17 and 18 year old drivers in the state of Michigan was 222,647. About 41 percent of these total drivers come from the Detroit metropolitan area counties. The male and female drivers were 49.6 and 50.4 percent respectively.

Female drivers were found to have a better accident record than male drivers in this age group. Of 75.6 percent of the drivers with no accident records, there were 52.4 and 47.6 percent female and male drivers respectively. For those drivers who had at least one accident, the male and female drivers were 55 and 45 percent respectively. There were only 4 percent of the drivers who had two or more accident records.

The most common type of accident which drivers in the given population experienced was the rear-end accident. Rear-end accidents constituted about 27 percent of the total accidents. The percentage of other types of accidents is as follows:

fixed object hit	= 13.6%
angle straight	= 11.5%
head-on-left turn	= 7.1%
rear-end drive	= 7.1%
angle turn	= 6.6%

Female drivers had an even better record in convictions than they had in accidents. Of 68 percent of the total drivers who had no conviction record, there were 57 percent female and 43 percent male. For drivers with a minimum of one conviction record, female and male drivers were 35 and 65 percent respectively. Only 12 percent of the drivers had two or more convictions on their record. The most common type of conviction reported in the data set was related to speed violations, which constituted 48 percent of total convictions. Convictions involving violations of basic traffic laws were about 18 percent.

There were a total of 517 public and 75 commercial schools in the data set. About 85 percent of total driver records in the age group studied had the code number for schools where the drivers obtained their driver training.

To perform a detailed analysis of the data, the data set was reduced to contain data from only those schools which had at least one hundred graduates each year for the two year analysis period. This data set included 255 public schools and 35 commercial schools and includes about 69% of the total number of students. For the selected subset, the distribution of schools under various training programs was as follows:

(i) 124 public schools using the range program

(ii) 63 public schools using the traditional program

(iii) 57 public schools using the competency program

(iv) 35 commercial schools using the competency program

(v) 5 public schools using the simulator program

(vi) 6 public schools using the 4-phase program.

4.2 Accident and Conviction rate:

The total number of state wide accidents that involved 16, 17 and 18 years old drivers for years 1988 and 1989,was 54,500. The accident rate, that is accidents per student, for all selected schools stratified by program, is shown in appendix C. The frequency distribution of accidents/student for all programs is shown in appendix D, whereas the frequency distribution curve for the range program is shown in figure 4.1. The frequency distribution of accidents/student for all programs were found to be slightly skewed to the the right, indicating relatively fewer schools with higher accident rate. The range program had the least skewness among all programs (fig. 4.1). About 50% of schools (which are to the left of the mean) fall between the mean (.220) and the mean-1*std.dev. (.179) and 43% of the schools (which are to the right of mean) fall between the mean (.220) and mean+1*std. dev. (.261). The competency program had the maximum skewness in its distribution (appendix D). About 70% of schools whose accident rate is less than the overall mean accident rate, lie between the mean (.226) and the mean-1*std.dev. (.186) and about 61% of schools whose accident rate is greater than the overall accident rate fall between the mean (.226) and the mean+1* std.dev.(.266).

Thus, due to the uniformity in accident rate values at both ends of the frequency distribution curve for all programs, there is no obvious cut-point for separating higher and lower ranked schools from the rest of the schools.

A sample of about 20% of all schools with the lowest and highest accident rates under each program are shown in tables 4.1 to 4.4. Table 4.1 shows the accident rate for a sample of twenty four from the top and twenty three from the bottom schools using the range program, in order of increasing accident rate. These top and bottom schools are called "higher" and "lower" ranked schools respectively in the following analysis. The same table shows that the accident rate for the lower ranked schools

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Figure 4.1: Histogram of accident rate for the Range program.

Table 4.1: Accident rate for higher and lower ranked public schools using the range program.

S.N.	Code for higher ranked schools	Accident rate	S.N.	Code for lower ranked schools	Accident rate
1.	740	0.130	1.	377	0.260
2.	623	0.136	2.	252	0.263
3.	171	0.143	3.	622	0.265
4.	785	0.152	4.	267	0.266
5.	543	0.153	5.	347	0.266
6.	736	0.154	6.	258	0.266
7.	462	0.157	7.	081	0.267
8.	795	0.158	8.	303	0.267
9.	741	0.159	9.	348	0.267
10.	042	0.160	10.	366	0.268
11.	420	0.165	11.	616	0.270
12.	547	0.167	12.	492	0.273
13.	701	0.169	13.	559	0.276
14.	256	0.169	14.	560	0.278
15.	020	0.170	15.	394	0.280
16.	706	0.173	16.	323	0.289
17.	276	0.174	17.	541	0.290
18.	746	0.175	18.	549	0.298
19.	750	0.175	19.	059	0.301
20.	760	0.176	20.	471	0.302
21.	738	0.177	21.	301	0.302
22.	535	0.177	22.	332	0.308
23.	365	0.178	23.	544	0.313
24.	555	0.179			

is approximately 2.2 times higher than that of the higher ranked schools.

The accident rate for higher and lower ranked schools under the traditional program are shown in table 4.2. The accident rate for lower ranked schools is slightly more than 2.5 times the accident rate for higher ranked schools in this program.

The ratio of the accident rate between higher and lower ranked public schools using the competency program are approximately the same as the range program, as shown in table 4.3. For the competency program in commercial schools, the accident rate for the lower ranked eight schools are 67 percent higher than the accident rate for the higher ranked seven schools in the same program as shown in table 4.4. The same table indicates that there is less variation in the accident rate among commercial schools as compared to the variation among public schools.

Table 4.5 shows the average value of accident rate for different programs which is weighted by number of students in each program. The competency program in commercial schools had the highest accident rate among all programs. A detailed comparison among the various schools and programs using statistical methods is discussed in the hypotheses testing section.

Single-vehicle accident rate (number of single vehicle accidents/student) was also computed for all schools and is shown in appendix C. A large difference (up to 13

Table 4.2: Accident rate for higher and lower ranked public schools using the traditional program.

S.N.	Code for higher ranked schools	Accident rate	S.N.	Code for lower ranked schools	Accident rate
1.	763	0.120	1.	163	0.273
2.	675	0.154	2.	114	0.278
3.	260	0.155	3.	483	0.279
4.	009	0.156	4.	153	0.282
5.	198	0.163	5.	506	0.283
6.	635	0.166	6.	545	0.283
7.	439	0.173	7.	707	0.288
8.	770	0.176	8.	416	0.304
9.	188	0.178	9.	350	0.309
10.	103	0.180	10.	450	0.314
11.	772	0.187	11.	455	0.332
12.	486	0.189			

Table 4.3: Accident rate for higher and lower ranked public schools using the competency program.

S.N.	Code for higher ranked schools	Accident rate	S.N.	Code for lower ranked schools	Accident rate
1.	790	0.135	1.	495	0.267
2.	226	0.143	2.	412	0.270
3.	429	0.168	3.	507	0.272
4.	777	0.170	4.	431	0.286
5.	136	0.173	5.	633	0.290
6.	618	0.174	6.	134	0.293
7.	570	0.181	7.	629	0.298
8.	769	0.184	8.	194	0.305
9.	442	0.184	9.	538	0.313
10.	670	0.186	10.	269	0.315
11.	128	0.188	11.	413	0.325
12.	425	0.189			

Table 4.4: Accident rate for higher and lower ranked commercial schools using the competency program.

S.N.	Code for higher ranked schools	Accident rate	S.N.	Code for lower ranked schools	Accident rate
1.	A77	0.217	1.	966	0.296
2.	980	0.218	2.	A45	0.302
3.	OSS	0.222	3.	A48	0.307
4.	A56	0.226	4.	A65	0.307
5.	975	0.228	5.	A82	0.310
6.	984	0.236	6.	A24	0.325
7.	A35	0.238	7.	A62	0.341
			8.	959	0.353

Table 4.5: Weighted average accident rate for various programs.

S.N.	Type of program	Number of schools in each program	Weighted average accident rate
1.	Range	124	0.219
2.	Competency (Public)	57	0.227
3.	Competency (Commercial)	35	0.281
4.	Traditional	63	0.228
5.	Simulator	5	0.265
6.	Four-phase	6	0.243

times) in the single-vehicle accident rate exists between various schools as can be observed in appendix C. However, the average (weighted by number of students) value of the single-vehicle accident rate for all programs lies in a close range of .048 to .063 accidents /student, as shown in table 4.6.

There were about 80,000 conviction records for 16, 17 & 18 years old drivers in the state of Michigan for the two year period of 1988 and 1989. The conviction rate (number of convictions/student) for all schools under all programs is also shown in appendix C. The conviction rate for lower ranked schools was approximately 2.7 times higher under the traditional and competency (public) program and 3.5 times higher under the range and competency (commercial) than the higher ranked schools in their respective programs. Conviction rates of commercial higher and lower ranked school were respectively 1.75 times and 2.0 times higher than public higher and lower ranked schools under any program (appendix C). The average conviction rate (weighted by number of students) for all programs are shown in table 4.7.

Similiar to the case for accident rates, the competency program in commercial schools had the highest conviction rate, which is approximately 1.6 times higher than the rate in public schools under any program (excluding 4-phase and simulator programs which had very few schools).

This review of the data indicates that:

Table 4.6: Weighted average accident rate for single-vehicle accidents for various programs.

S.N.	Type of program	Number of schools in each program	Weighted average accident rate
1.	Range	124	0.048
2.	Competency (Public)	57	0.054
3.	Competency (Commercial)	35	0.050
4.	Traditional	63	0.061
5.	Simulator	5	0.063
6.	Four-phase	6	0.048

Table 4.7: Weighted average conviction rate for various programs.

S.N.	Type of program	Number of schools in each program	Weighted average accident rate
1.	Range	124	0.284
2.	Competency (Public)	57	0.262
3.	Competency (Commercial)	35	0.448
4.	Traditional	63	0.274
5.	Simulator	5	0.378
6.	Four-phase	6	0.344

1) There are relatively small differences in the average number of accidents per student and the average number of convictions per student across various programs used in the public schools. The commercial schools have a higher rate in both measures than that for public schools. The 16, 17 and 18 years old drivers were about 11% more involved in accidents than the drivers of all age group in the state of Michigan for the two year period (1988 and 1989) (26). Of the 24.4% of the 16, 17 and 18 years old drivers with accidents there were about 17% of the drivers who had more than one accident as compared to 14% of the total driver population who had at least one accident, and 14% of drivers with accidents, who had two or more accidents.

   Similarly 16, 17 and 18 years old drivers are 12.5% more involved in convictions than the total driver population (26). Of the 32.5% of 16 to 18 age group drivers with a minimum of one conviction there were 36.5% drivers who had more than one conviction. About 20% of all drivers had convictions and 35% of drivers with convictions, had two or more convictions in their record.

2) There are large differences in the rates among various schools within each of the driver education program categories.

   The data above describes the performance of schools and programs based on the traditional method of determining the accident and conviction rate; that is accidents or convictions per student. However, the main thrust of this study was to modify the analysis by introducing an accident exposure measure to assess the performance of driver education programs and schools. The application of one such method called, the quasi-induced exposure measure, is discussed in the following sections.

4.3 Quasi-induced accident exposure method:

In this method a criterion variable called the relative accident involvement ratio (IR), as explained in the previous chapter, was computed for each school under each program.

Relative accident involvement ratio (IR) for all schools under consideration are shown in appendix C. The frequency distribution of IR values for different program is shown in appendix D. The IR distribution for all the four programs were found to be skewed to the right. In each case schools with a low value of IR were predominant and there were relatively few schools with higher values. The competency (public) program had the maximum skewness in its distribution as can be seen in figure 4.2. About 99 percent of all schools whose IR value is less than the overall mean value, lie between the mean (1.75) and mean-1*std.dev. (1.0) and about 52 percent of all schools whose IR value is greater than the overall mean value,

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Figure 4.2 : Histogram of IR values for the competency (pub.) program.

fall between the mean (1.75) and mean + 1*std.dev. (2.50). The mean and the standard deviation statistics are shown at the end of this section in table 4.12. The competency program in commercial schools had the least skewness in its distribution (appendix D). About 78% of all schools (whose IR value is less than the mean) fall between the mean (1.63) and the mean-1*std.dev. (1.0) and about 75% of the higher scores lie between the mean and mean + 1* std. dev. (2.24). Thus due the to higher uniformity in IR values in the beginning of the distribution curve, there is no obvious cut-point for separating higher ranked schools. However, due to the skewness in the distribution curve, there is a more obvious cut-point of lower ranked schools.

Like the previous section 20 percent of the schools with lowest and highest IR values under each program are shown in table 4.8-4.11. Those schools with lowest and highest IR value are called "higher ranked" and "lower ranked" schools respectively according to this criterion. An overall review of these tables reflects that except for very few schools, drivers were over involved in multi-vehicle accidents. In other words, the 16, 17 and 18 year old drivers were responsible for more multi-vehicle accidents than would be expected based on their exposure.

The IR value is fairly consistent across higher ranked schools (according to this criterion) for all four programs i.e. range, competency (pub.), traditional and competency (comm.) as shown in table 4.8 to 4.11. This was also found in the frequency distribution of IR values for each program. Under the traditional program (table 4.9) the IR value for higher ranked schools varies in a very close range of 0.9 to 1.15. The IR value for lower ranked schools was approximately 2.20 times higher than the IR value for their respective higher ranked schools under the range and traditional program. The IR value for lower ranked schools under the competency program varies in a wide range (1.9 to 4.25) as can be seen in table 4.10. The IR value for lower ranked schools under the competency (pub.) program are approximately 2.7 times higher than the IR value for their respective higher ranked schools. That is, drivers from lower ranked schools under these programs were respectively 2.2 to 2.7 times more over-involved or responsible for multi-vehicle accidents than their counterpart drivers in higher ranked schools under the same program.

The IR value for lower ranked commercial school groups were 1.8 times greater than their respective higher ranked schools, as indicated in table 4.11. There is more variation in the IR value for public schools under any program as compared to the variation in commercial schools. The average values of IR for all programs (table 4.12) shows that drivers under the competency program (public schools) were approximately 10 percent more over-involved in multi-vehicle accidents than drivers in the range,

Table 4.8: Relative involvement ratio (IR) for higher and lower ranked public schools using the range program.

S.N.	Code for higher ranked school	IR ratio	S.N.	Code for lower ranked school	IR ratio
1.	623	0.700	1.	059	1.931
2.	365	0.889	2.	314	1.938
3.	062	1.000	3.	529	1.968
4.	170	1.023	4.	307	2.000
5.	548	1.042	5.	323	2.000
6.	547	1.054	6.	651	2.000
7.	597	1.125	7.	701	2.000
8.	674	1.156	8.	785	2.000
9.	733	1.159	9.	492	2.045
10.	750	1.184	10.	183	2.149
11.	738	1.191	11.	556	2.159
12.	624	1.218	12.	420	2.250
13.	553	1.219	13.	081	2.308
14.	760	1.231	14.	349	2.308
15.	430	1.235	15.	270	2.318
16.	535	1.250	16.	165	2.321
17.	549	1.254	17.	706	2.333
18.	508	1.273	18.	166	2.348
19.	255	1.278	19.	795	2.538
20.	037	1.286	20.	331	2.556
21.	736	1.286	21.	391	2.667
22.	680	1.300	22.	256	3.091
			23.	043	4.000

Table 4.9: Relative involvement ratio (IR) for higher and lower ranked public schools using the traditional program.

S.N.	Code for higher ranked school	IR ratio	S.N.	Code for lower ranked school	IR ratio
1.	450	0.935	1.	439	1.929
2.	198	0.941	2.	103	2.000
3.	114	0.976	3.	147	2.000
4.	385	1.000	4.	705	2.109
5.	506	1.015	5.	153	2.118
6.	725	1.034	6.	187	2.118
7.	482	1.053	7.	776	2.150
8.	457	1.107	8.	217	2.214
9.	635	1.121	9.	009	2.286
10.	483	1.125	10.	763	2.375
11.	486	1.137	11.	772	2.545
12.	753	1.147	12.	035	3.000
13.	295	1.158	13.	675	3.800

Table 4.10: Relative involvement ratio (IR) for higher and lower ranked public schools using the competency program.

S.N.	Code for higher ranked school	IR ratio	S.N.	Code for lower ranked school	IR ratio
1.	053	0.800	1.	781	1.938
2.	641	1.000	2.	669	2.000
3.	650	1.094	3.	570	2.100
4.	478	1.111	4.	554	2.136
5.	670	1.120	5.	778	2.565
6.	629	1.156	6.	136	2.700
7.	615	1.160	7.	128	2.824
8.	029	1.190	8.	469	3.500
9.	182	1.294	9.	186	4.091
10.	036	1.300	10.	618	4.167
11.	425	1.300	11.	226	4.250

Table 4.11: Relative involvement ratio (IR) for higher and lower ranked commercial schools using the competency program.

S.N.	Code for higher ranked school	IR ratio	S.N.	Code for lower ranked school	IR ratio
1.	A04	1.147	1.	A10	1.820
2.	975	1.179	2.	977	1.875
3.	A05	1.222	3.	A86	1.889
4.	984	1.263	4.	A08	1.912
5.	980	1.330	5.	A56	1.933
6.	A45	1.362	6.	A35	2.077
7.	999	1.384	7.	A83	2.400

Table 4.12: Average relative involvement ratio (IR) for various programs.

S.N.	Types of program	Number of schools in each program	IR ratio	Std. Dev.
1.	Range	124	1.650	0.444
2.	Competency (Public)	57	1.750	0.732
3.	Competency (Commercial)	35	1.637	0.256
4.	Traditional	63	1.591	0.513
5.	Simulator	5	1.883	0.640
6.	Four-phase	6	1.604	0.238

traditional and competency (comm.) program.

The IR value was also computed for 16 to 18 year old age group of drivers for various programs under the three different geographical areas of schools. These three geographical areas are the Detroit metropolitan area, other urban areas and rural areas. It is assumed that drivers from different geographical area have different driving exposure. That is driving conditions or traffic patterns in Detroit metropolitan area may be different than the driving conditions in rural areas. It may be further assumed that driver exposure may be more uniform within the same geographical boundry. The accident exposure of drivers with different driver education training is assumed to be similiar within the same geographical area.

The IR value of young drivers under various programs for the three geographical areas are shown in table 4.13. The same table 4.13 shows that the IR value is consistent for various programs in the Detroit metropolitan and other urban areas. In rural areas the IR value for the competency program indicates that drivers from commercial schools were 12 percent more over-involved than drivers from the public school programs. One of the possible reasons for this higher IR value may be that there are very few commercial schools in rural areas. There are small differences in the IR value (a maximum of 10% in competency (comm.) program) across different geographical

Table 4.13: Relative involvement ratio for various programs under different geographical areas.

Type of program	Detroit metropolitan area	Urban area	Rural area	Average value
Range	1.513	1.662	1.581	1.583
Traditional	1.532	1.572	1.457	1.513
Competency (pub.)	1.652	1.643	1.595	1.621
Competency (comm.)	1.584	1.630	1.742	1.663

areas within each program.

The drivers from public school programs in rural areas are approximately 7 percent less over-involved in multi-vehicle accidents than drivers from the same programs in other urban areas as well as in the Detroit metropolitan area (except for the range program). The comparisions between the average IR value for various programs computed in table 4.12 (i.e. average of all schools IR value under each program) and in table 4.13 (i.e. average of IR value for all three geographical areas) shows a maximum of a 7.5% difference which in the competency (pub.) program. The above discussion indicates that there are small differences in IR values among various programs and schools due to different geographical areas.

To determine the performance of schools and programs under different driving conditions, a sample of higher and lower ranked schools based on the IR value under each program was used for further analyses.

4.4 Weather Condition:

The IR value for each higher and lower ranked school under each program, for the three different weather conditions - clear, raining, and snowing condition is given in appendix C. The average IR values of higher and lower ranked schools under each program for these three different weather conditions are shown in table 4.14 and 4.15. Table 4.14 shows that all average IR values of even

Table 4.14: Average relative involvement ratio (IR) for higher ranked schools under various programs, for different weather conditions.

S.N.	Type of program	# of schools per program	Average IR ratio for Clear weather	Rainy weather	Snowy weather
1.	Traditional	13	1.117	1.115	1.218
2.	Range	22	1.211	1.149	1.317
3.	Competency (Public)	11	1.194	1.192	1.268
4.	Competency (Commercial)	7	1.145	1.371	1.261

Table 4.15: Average relative involvement ratio (IR) for lower ranked schools under various programs, for different weather conditions.

S.N.	Type of program	# of schools per program	Average IR ratio for Clear weather	Rainy weather	Snowy weather
1.	Traditional	13	2.408	2.439	2.654
2.	Range	22	2.072	2.545	2.386
3.	Competency (Public)	11	2.917	2.574	3.545
4.	Competency (Commercial)	7	1.894	1.964	3.147

the higher ranked schools under each program and each weather condition, are greater than 1.0. The average IR for each weather condition was consistent across each program for both higher and lower ranked schools. The IR value under snowy weather condition was 10 and 25 percent higher than the IR value under clear weather conditions for the higher and lower ranked schools respectively for all programs. Table 4.15 shows high IR values for lower ranked schools under snowy condition, indicating a very high over-involvment of drivers from these schools across all programs on snowy days. The average IR value of lower ranked schools averaged two times higher than the IR of their respective higher ranked schools under the same program and same weather condition.

These data indicate that none of the driver education programs prepare students to drive under adverse weather conditions. The traditional program results in the lowest and second lowest IR value under snowy and rainy weather conditions for higher and lower ranked schools respectively.

4.5 Light Conditions:

Appendix C shows the IR values for higher and lower ranked schools under each program and three different light conditions - day, dawn/dusk, and night time. The average IR for higher ranked schools under each program were consistent under each light condition as shown in table 4.16. There is a clear-cut pattern of higher night

Table 4.16: Average relative involvement ratio (IR) for higher ranked schools under each program, for different light conditions.

S.N.	Type of program	number of schools under each program	Average IR ratio for light condition under day time	dawn/dusk time	night time
1.	Traditional	13	1.107	0.831	1.275
2.	Range	22	1.197	1.423	1.314
3.	Competency (Public)	11	1.254	1.366	1.375
4.	Competency (Commercial)	7	1.343	1.276	1.433

Table 4.17: Average relative involvement ratio (IR) for lower ranked schools under each program, for different light conditions.

S.N.	Type of program	number of schools under each program	Average IR ratio for light condition under day time	dawn/dusk time	night time
1.	Traditional	13	2.399	1.805	2.771
2.	Range	22	2.499	2.085	2.568
3.	Competency (Public)	11	2.745	2.136	2.864
4.	Competency (Commercial)	7	2.172	2.370	2.418

time IR values over day time IR values across all programs for higher ranked schools.

The same pattern of higher night time IR values was found for lower ranked schools, as shown in table 4.17. Under day and night conditions, the average IR values of lower ranked schools was almost two times greater than their respective higher ranked schools.

These data indicate that young drivers are about 15% more likely to be involved in a night accident than a day accident (after correcting for exposure). The ratio is even higher among the bad schools, with very high values of the IR exhibited by all public school programs. This ratio means that young drivers from these schools are involved in between 2 and 3 accidents as the guilty party for each accident in which they are the innocent victim.

The commercial school program results in the highest and lowest IR value for higher and lower ranked schools respectively for night time accidents. The lowest IR value for night time accidents for lower ranked schools might reflect the fact that most of the commercial schools are in the urban areas where street lighting mitigates the difference between day and night driving.

4.6 <u>Types of Accidents:</u>

The four accident types which constitute the highest percentage in total accidents were considered in determining the performance of higher and lower ranked schools under different programs. These four types of accidents were rear-end, angle turn, angle-straight, and head-on-left turn. Fixed object accidents could not be considered because there is no innocent victim in one vehicle accidents. The IR value of the higher and lower ranked schools under each program by accident types is shown in appendix C. Table 4.18 shows the average IR values for higher ranked schools for different types of accidents under each program. It can be observed from this table that the average IR for angle-turn accidents under the traditional program was less than 1.0. All other average IR values were between 1.01 to 1.5.

For lower ranked schools, the IR values for all types of accidents ranged between between 1.9 and 3.2, as evident from table 4.19. Tables 4.18 & 4.19 illustrate that the IR of lower ranked schools for different types of accidents under different types of programs averages two times higher than their counterpart higher ranked schools average IR value.

An interesting result of this analysis is that the traditional program had a lower IR value for all four accident types than the range program. Thus, at least for those four common accident types, the additional driving experience gained on the driving range did not result in a lower accident experience (after counting for exposure).

In this section, the quasi-induced accident exposure measure method was used to determine a criterion variable

Table 4.18: Average relative involvement ratio (IR) for higher ranked schools under each program, for different types of accidents.

S.N.	Type of program	number of schools under each program	Average IR ratio for angle-strait accd	rear-end accd	angle turn accd	head-on left turn accident
1.	Traditional	13	1.012	1.159	0.949	1.025
2.	Range	22	1.477	1.189	1.352	1.500
3.	Competency (Public)	11	1.285	1.363	1.198	1.437
4.	Competency (Commercial)	7	1.308	1.366	1.412	1.288

Table 4.19: Average relative involvement ratio (IR) for lower ranked schools under each program, for different types of accidents.

S.N.	Type of program	number of schools under each program	Average IR ratio for angle-strait accd	rear-end accd	angle turn accd	head-on left turn accident
1.	Traditional	13	2.415	1.980	2.442	2.135
2.	Range	22	2.953	2.339	2.625	2.278
3.	Competency (Public)	11	2.962	2.270	3.187	2.583
4.	Competency (Commercial)	7	2.066	2.198	1.981	2.369

- IR, for different schools and programs under various driving conditions. This exposure measure criterion variable, in addition to other traditional criterion variables was used for hypotheses testing in the following section.

4.7 Hypotheses Testing:

Based on the hypotheses defined in the previous chapter, the hypotheses were tested using the ANOVA and student "t" test. These tests were performed by comparing the mean value of criterion variables for two or more than two groups by the use of "t" and ANOVA procedures respectively. The ANOVA procedure was first applied to determine the significant difference in criterion variables among different groups. If this difference was found to be statistically significant, then the "t" test was used to determine exactly which two groups differ. All these hypotheses were tested at 95 percent level of confidence. Some of the results of ANOVA and "t" tests are shown in table 4.20, however the complete results are shown in appendix E. The result from the test for each hypothesis is discussed below:

Hypothesis 1:

HO: There was no difference in the mean accident rate among various driver education programs.

Table 4.20: The ANOVA and "t" results from hypotheses testing.

Hypothesis number	Comparing groups	Dependent variable	F /"t" value	PR > F/ "t"
1(a)	R, C, T & P	accds/stud	14.41	0.0001
1(b)	R, C, & T	accds/stud	0.44	0.6458
2	2 Ph. & 3 Ph.	accds/stud ("t")	0.92	0.3588
3(a)	R, C, T & P	convs/stud	52.11	0.0001
3(b)	R, C, & T	convs/stud	1.02	0.1510
4	2 Ph. & 3 Ph.	convs/stud ("t")	2.23	0.0263
5(a)	P & T	sngl/stud ("t")	2.24	0.0271
5(b)	R & T	sngl/stud ("t")	2.76	0.0061
5(c)	C & T	sngl/stud ("t")	1.15	0.2577
6	R, C, T & P	IR	1.06	0.3651
7	2 Ph. & 3 Ph.	IR	0.11	0.7560
8(a)	R, C, T & P	IR (Detroit area)	0.71	0.5500
8(b)	R, C, T & P	IR (Urban area)	1.54	0.2090
8(c)	R, C, T & P	IR (Rural area)	0.48	0.6950
9(a)	GLC1 GLC2 & GLC3	IR (Range)	2.42	0.0935
9(b)	GLC1 GLC2 & GLC3	IR (Comp., Pub.)	0.83	0.4398
9(c)	GLC1 GLC2 & GLC3	IR (Trad.)	0.05	0.9510
9(d)	GLC1 GLC2 & GLC3	IR (Comp., Comm.)	3.17	0.0654
10(a)	R1, C1, T1 & P1	IRCLR (Hig. grp.)	0.49	0.6910
10(b)	R1, C1, T1 & P1	IRRAN "	0.69	0.6910
10(c)	R1, C1, T1 & P1	IRSNW "	0.07	0.9770
11(a)	R1, C1, T1 & P1	IRDAY "	1.86	0.1483
11(b)	R1, C1, T1 & P1	IRDWN "	1.51	0.2283
11(c)	R1, C1, T1 & P1	IRNGT "	0.20	0.8960
12(a)	R1, C1, T1 & P1	IRRER "	1.25	0.3024
12(b)	R1, C1, T1 & P1	IRATR "	0.55	0.6485
12(c)	R1, C1, T1 & P1	IRAST "	0.99	0.4041
12(d)	R1, C1, T1 & P1	IRHLT "	0.78	0.5122
13(a)	R2, C2, T2 & P2	IRCLR (Lwr. grp.)	2.01	0.1238
13(b)	R2, C2, T2 & P2	IRRAN "	0.48	0.6967
13(c)	R2, C2, T2 & P2	IRSNW "	1.08	0.3680
14(a)	R2, C2, T2 & P2	IRDAY "	0.49	0.6871
14(b)	R2, C2, T2 & P2	IRDWN "	1.21	0.3194
14(c)	R2, C2, T2 & P2	IRNGT "	0.24	0.8714
15(a)	R2, C2, T2 & P2	IRRER "	0.35	0.7909
15(b)	R2, C2, T2 & P2	IRATR "	0.49	0.6939
15(c)	R2, C2, T2 & P2	IRAST "	1.08	0.3682
15(d)	R2, C2, T2 & P2	IRHLT "	0.13	0.9440
16(a)	R1 & R2	IRDAY	24.58	0.0001
16(b)	R1 & R2	IRNGT	9.91	0.0030
17(a)	C1 & C2	IRDAY	17.91	0.0004
17(b)	C1 & C2	IRNGT	30.91	0.0001
18(a)	P1 & P2	IRDAY	13.29	0.0034
18(b)	P1 & P2	IRNGT	4.89	0.0472

Tabl2 4.20 (Continued on next page)

Table 4.20: Continued.

Hypothesis number	Comparing groups	Dependent variable	F /"t" value	PR > F/ "t"
19(a)	T1 & T2	IRDAY	50.77	0.0001
19(b)	T1 & T2	IRNGT	110.91	0.0001
20(a)	R1 & R2	IRCLR	98.25	0.0001
20(b)	R1 & R2	IRRAN	21.99	0.0001
20(c)	R1 & R2	IRSNW	5.88	0.0204
21(a)	C1 & C2	IRCLR	9.20	0.0066
21(b)	C1 & C2	IRRAN	11.99	0.0025
21(c)	C1 & C2	IRSNW	12.13	0.0028
22(a)	P1 & P2	IRCLR	61.04	0.0001
22(b)	P1 & P2	IRRAN	3.88	0.0732
22(c)	P1 & P2	IRSNW	5.75	0.0356
23(a)	T1 & T2	IRCLR	13.90	0.0011
23(b)	T1 & T2	IRRAN	17.69	0.0003
23(c)	T1 & T2	IRSNW	10.91	0.0034
24(a)	R1 & R2	IRRER	25.88	0.0001
24(b)	R1 & R2	IRAST	5.88	0.0204
24(c)	R1 & R2	IRATR	5.63	0.0234
24(d)	R1 & R2	IRHLT	4.09	0.0504
25(a)	C1 & C2	IRRER	4.89	0.0441
25(b)	C1 & C2	IRAST	25.08	0.0001
25(c)	C1 & C2	IRATR	12.76	0.0034
25(d)	C1 & C2	IRHLT	2.85	0.0810
26(a)	P1 & P2	IRRER	15.35	0.0020
26(b)	P1 & P2	IRAST	15.08	0.0022
26(c)	P1 & P2	IRATR	3.49	0.0914
26(d)	P1 & P2	IRHLT	2.90	0.1140
27(a)	T1 & T2	IRRER	26.48	0.0001
27(b)	T1 & T2	IRAST	29.27	0.0001
27(c)	T1 & T2	IRATR	23.36	0.0002
27(d)	T1 & T2	IRHLT	16.41	0.0009

T = traditional, R = range, C = competency (pub.), P = competency (comm.), T1, R1, C1, P1 = higher ranked schools using traditional, range, competency (pub.& comm.) program, T2, R2, C2, P2 = lower ranked schools using traditional, range, competency (pub.& comm.) program, GLC1=Detroit, GLC2 & GLC3 = urban & rural areas, IRCLR, IRRAN & IRSNW = IR value under clear, rainy and snowy weather conditions, IRDAY, IRNGT & IRDWN = IR value under day, night & dawn/dusk time light conditions, IRRER, IRAST, IRATR & IRHLT = IR value for rear-end, angle-straight, angle-turn & head-on-left turn accident respectively.

The results from this test (F=14.4) showed that this hypothesis (hypothesis 1(a) in table 4.20) can be rejected at the 95 percent level of confidence. However, no statistically significant difference (F=0.44) was found among all the three public school driving programs (hypothesis 1(b)) as can be seen in table 4.20. The mean accident rate for the competency program in commercial schools was found to be significantly different (higher) than the mean accident rates for public school.

The average number of accidents per student for the commercial school competency program was 0.281, compared to 0.219, 0.227 and 0.228 for the public school range, competency and traditional program respectively.

Hypothesis 2:

HO: There was no difference in the mean accident rate between the three phase program (range) and the two phase program (traditional and competency) in public schools.

The results from this test ("t" = 0.92) showed that this hypothesis can not be rejected at the 95 percent level of confidence. And it can be concluded that there was no difference in the mean accident rate between the two and the three phase program in public schools.

Hypothesis 3:

HO: There was no difference in the mean conviction rate among various driver education programs.

The test for this hypothesis (F=52.1) (hypothesis 3(a) in table 4.20) led to the rejection of the hypothesis. There was no statistically significant difference (F=1.02) in the mean conviction rate among various programs in public schools (hypothesis 3(b)). The mean conviction rate for the competency (commercial schools) program was significantly higher than the rest of the programs.

The number of convictions per student for the commercial (competency) schools was 0.448, compared to 0.284, 0.262 and 0.274 for the range, competency (public) and traditional program respectively.

Hypothesis 4:

HO: There was no difference in the mean conviction rate between the three phase program (range) and the two phase program (traditional and competency) in public schools.

The test for this hypothesis led to the rejection of the hypothesis. The mean conviction rate for the three phase program was significantly higher than the two phase program in public schools.

Hypothesis 5:

HO: There was no difference in the mean single vehicle accident rate among various driver education programs.

The result of this test showed that this hypothesis can be rejected. Further tests showed that the mean single vehicle accident rate for the traditional program was significantly different (greater) than the mean single vehicle accident rate for the range and competency (commercial) programs.

The average number of single vehicle accidents per student from the traditional program was 0.061 compared to 0.048, 0.054 and 0.50 for the range, competency (public) and competency (commercial) program respectively.

Hypothesis 6:

HO: There was no difference in the mean IR value among various driver education programs.

The test showed that this hypothesis can not be rejected and concluded that there was no difference in the mean IR value among various education programs.

Hypothesis 7:

HO: There was no difference in the mean IR value between the three phase program (range) and the two phase program (traditional and competency) in public schools.

The test showed that this hypothesis can not be rejected and concluded that there was no difference in the mean IR value between the two and three phase program in public schools.

Hypothesis 8:

HO: There was no difference in the mean IR value among various driver education programs in each of the three geographical areas - (a) Detroit metropolitan area, (b) urban areas and (c) rural areas.

The test showed that this hypothesis can not be rejected and concluded that there was no difference in the mean IR value among various education programs in each of the three geographical areas.

Hypothesis 9:

HO: There was no difference in the mean IR value for each driver education program across the three different geographical areas - Detroit metropolitan area, urban areas and rural areas.

The test showed that this hypothesis can not be rejected and concluded that there was no difference in the mean IR value for each of the four driver education programs across the three different geographical areas.

Hypothesis 10:

HO: There was no difference in the mean IR value among various driver education programs for higher ranked schools under (a) clear, (b) rainy and (c) snowy weather conditions.

The result of this test indicates that there is no significant difference in the mean IR value among various driver education programs at the higher ranked schools under clear, rainy and snowy weather conditions.

Hypothesis 11:

HO: There was no difference in the mean IR value among various driver education programs for higher ranked schools under (a) day, (b) dawn/dusk and (c) night time light conditions.

The test result shows that there was no significant difference in the mean IR value among various driver education programs under day, dawn/dusk and night time light conditions.

Hypothesis 12:

HO: There was no difference in the mean IR value among different driver education programs for higher ranked schools for the following types of accidents (a) rear-end (b) angle turn (c) angle straight and (d) head-on-left turn.

The test result shows that there was no significant difference in the mean IR value among various driver education programs at the higher ranked schools for rear-end, angle-turn, angle straight and head-on-left turn accidents.

Hypothesis 13:

HO: There was no difference in the mean IR value among various driver education programs for lower ranked schools under (a) clear, (b) raining and (c) snowing weather conditions.

The results of this test indicate that there is no significant difference in the mean IR value among various driver education programs for lower ranked schools under clear, rainy and snowy weather conditions.

Hypothesis 14:

HO: There was no difference in the mean IR value among various driver education programs for lower ranked schools under (a) day, (b) dawn/dusk, and (c) night light conditions.

Based on the test results, it can be concluded that there was no significant difference in the mean IR value among various programs under all the three light conditions.

Hypothesis 15:

HO: There was no difference in the mean IR value among different driver education programs for lower ranked schools for the following types of accidents (a) rear -end (b) angle turn (c) angle straight and (d) head-on-left turn.

The test results showed that the above null hypothesis can not be rejected, as no significant differences in the mean IR value was found for the four different types of accidents among the various programs.

Hypothesis 16:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the range program for the three different light conditions - (a) day (b) dawn/dusk and (c) night.

The results from this test showed that there was a significant difference in the mean IR value for day, dawn/dusk and night time light conditions, and no difference in the dawn/dusk light condition, between higher and lower ranked schools under the range program.

Hypothesis 17:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competancy (public) program, for three different light conditions - (a) day (b) dawn/dusk and (c) night time.

The results from this test showed that there was a significant difference in the mean IR value for day and night light conditions and no significant difference in the case of dawn/dusk light conditions, between higher and lower ranked schools under the competency (public) program.

Hypothesis 18:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competancy (commercial) program for three different light conditions - (a) day (b) dawn/dusk and (c) night.

The results from this test showed that there was a significant difference in the mean IR value for day, dawn/dusk and night time light conditions between higher and lower ranked schools under the competancy (comm.) program.

Hypothesis 19:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the traditional program for the three different light conditions - (a) day (b) dawn/dusk and (c) night.

The result from this test showed that there was a significant difference in the mean IR value for day, night and dawn/dusk time light conditions between higher and lower ranked schools under the traditional program.

Hypothesis 20:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the range program for three different weather conditions - (a) clear (b) raining and (c) snowing conditions.

The results from this test showed that there was a significant difference in the mean IR value for all the three weather conditions between higher and lower ranked schools under the range program.

Hypothesis 21:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competency (public) program for the three different weather conditions - (a) clear (b) raining and (c) snowing conditions.

The results from this test showed that there was a significant difference in the mean IR value for all the three weather conditions between higher and lower ranked schools under the competency (public) program.

Hypothesis 22:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competency (commercial) program, for the three different weather conditions - (a) clear (b) raining and (c) snowing conditions.

The test showed that there was no difference in the mean IR value for raining conditions but there was a significant difference in the clear and snowing weather conditions between higher and lower ranked schools under the competency (commercial) program.

Hypothesis 23:

HO: There was no difference in the mean IR value between higher and lower schools under the traditional program for the three different weather conditions - (a) clear (b) raining and (c) snowing conditions.

The test showed that there was a significant difference in the mean IR value for all the three weather conditions between higher and lower ranked schools under the traditional program.

Hypothesis 24:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the range program for four different types of accidents - (a) rear-end (b) angle-straight (c) angle turn and (d) head-on-left turn accident.

The results showed that there was a significant difference in the mean IR value for all the four types of accident between higher and lower ranked schools under the range program.

Hypothesis 25:

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competency (public) program for four different types of accidents - (a) rear-end (b) angle-straight (c) angle-turn and (d) head-on-left turn accident.

The results showed that there was a significant difference in the mean IR value for rear-end, angle-straight and angle turn accidents between higher and lower ranked schools under the competency (public) program. There was no significant difference IR values for head-on-left turn accidents for the same groups.

<u>**Hypothesis 26:**</u>

HO: There was no difference in the mean IR value between higher and lower ranked schools under the competency (commercial) program, for four different types of accidents - (a) rear-end (b) angle-straight (c) angle turn and (d) head-on-left turn accident.

The resuls showed that there was a significant difference in the mean IR value for rear-end and angle-straight accidents and no difference in the case of angle-turn accidents and head-on-left turn accidents for the same groups of schools under the competancy (comm.) program.

<u>**Hypothesis 27:**</u>

HO: There was no difference in the mean IR value between higher and lower ranked schools under the traditional program for four different types of accidents - (a) rear-end (b) angle straight (c) angle turn and (d) head-on-left turn.

The results showed that there was a significant difference in the mean IR value for rear-end, angle turn, angle-straight and head-on-left turn accidents between higher and lower ranked schools under the traditional program.

Results from these tests of hypotheses are concluded as follows:

The competency program in commercial schools had significantly higher accident and conviction rates than the range, traditional, and competency programs in public schools. There was no statistically significant difference in the mean accident rate between the 3-phase range program and the 2-phase traditional and competency programs in public schools. However, the range program had a significantly higher conviction rate than the two-phase traditional and competency programs in public schools.

There was no statistically significant difference in the mean IR value among all four programs including two-phase and three-phase programs. There was no difference in the performance of drivers from different driving education programs due to different geographical areas (i.e. different driver exposure), as no statistically significant difference was found in the mean IR value (i) among all the programs in each geographical area and (ii) for each program under three different geographical areas.

There was no statistically significant difference in the mean IR value among all four programs under different weather and light conditions for both sample of higher and lower ranked (according to IR criterion) schools. However, a significant difference was found in the mean IR value, for different weather and light conditions, between higher and lower ranked schools under each program.

No significant difference was found in the mean IR value for all the four accident types among all programs for both higher and lower ranked schools.

These results indicate that, when corrected for exposure, there is no difference in the accident patterns for young drivers based on the type of driver training program they attend. This conclusion extends to type of accidents, weather conditions and light conditions as well as the total accident experience. However, there are significant differences in performance across various schools within any program type. This may mean that it is the instructor, rather than the mode of instruction, that determines driver performance.

4.8 Rating Score:

The above analysis described the performance of schools and programs based on the frequency of accidents. It may not be appropriate to rate a school better which had a fewer number of accidents with a high degree of severity than another school which had a higher number of accidents but with lesser degree of severity. To determine the performance of schools and programs on the basis of accident frequency and severity, a rating score was derived for each school. This score is the sum of the products of the frequency and weights for each type of accident. The weight was taken as the equivalent dollar value of each type of accident, determined by summing the product of the percentage of fatal, injury, and property damage in accidents by the corresponding average dollar values of fatal, injury, and PDO accidents. The weights obtained for each type of accident is shown in appendix F. The score per student for each school is also shown in appendix F.

Based on ascending values of score/student for each school, fifteen higher and fifteen lower ranked schools are shown in table 4.21. The score for each program is shown in table 4.22. These values were obtained by taking the average score/student for all schools under each program. According to this measure, the range program had the best performance in terms of a criterion which combines the number and severity of accidents.

Nine of the fifteen high ranked schools come from those using the range program. In contrast, none of the commercial schools ranked in this group. Four commercial schools were ranked in the lowest 15 schools, where there were also four schools from the range program. The public (competency) and traditional program had about equal representation in both the highest and lowest rated schools.

Similarly, using frequency and offense points associated with each type of conviction as weights, a conviction rating score for all schools was obtained. The ranking of schools, based on this score, is shown in

Table 4.21: Rating of schools by accident frequency and severity criterion.

Rank	School Code	Types of Program	Score per student	Rank	School Code	Types of Program	Score per student
1	763	T	6.20	276	A62	P	16.94
2	790	C	6.67	277	471	R	16.97
3	740	R	7.07	278	059	R	17.00
4	623	R	7.10	279	545	T	17.02
5	785	R	7.46	280	616	R	17.13
6	795	R	7.56	281	506	T	17.14
7	462	R	7.76	282	450	T	17.32
8	226	C	7.84	283	A48	P	17.36
9	260	T	7.98	284	416	T	17.74
10	736	R	8.01	285	538	C	17.76
11	042	R	8.22	286	A24	P	17.79
12	420	R	8.22	287	544	R	18.50
13	198	T	8.38	288	413	C	18.70
14	020	R	8.42	289	959	P	21.41
15	035	T	8.71	290	044	S	33.01

T = traditional, R = range, C = competency (pub.), P = competency (comm.), S = simulator and F = 4-phase

Table 4.22: Rating of programs by accident frequency and severity criterion.

Rank	Program	Score/student
1	Range	11.790
2	Traditional	12.206
3	Competency (Public)	12.500
4	Four-phase	12.791
5.	Competency (Commercial)	14.563
6.	Simulation	17.111

appendix F. Fifteen higher and lower ranked schools are shown in table 4.23. The score for each program is shown in table 4.24 which indicates that the competency (pub.) program had the best performance in average conviction points per student.

Based on points, the public school competency and traditional program had three and six schools in the highest fifteen and no school in the lowest fifteen schools. Conversly, the commercial schools had no representation in the highest fifteen schools while ten of the fifteen lowest rated schools come from this group.

The consistency of schools in their performance on various criterion variables - IR value, accidents/student and score/student, were also investigated for the two year period. All schools were classified into two groups for each year according to each criterion variable. The first group constitutes those schools whose criterion variable value is lower than the average value. The second group includes those schools whose criterion variable value is higher than the average value. The first and the second groups are termed as higher and lower ranked groups according to a particular criterion variable. The number of schools which appeared in each group for both years by each criterion variable is shown below:

(1) The number of schools which appeared in both year above average ranked group according to IR

Table 4.23: Rating of schools by conviction frequency and seriousness criterion.

Rank	School Code	Types of Program	Score per student	Rank	School Code	Types of Program	Score per student
1	182	C	0.216	276	966	P	0.943
2	256	R	0.287	277	039	S	0.969
3	457	T	0.307	278	A48	P	0.983
4	442	C	0.317	279	316	R	0.991
5	187	T	0.328	280	951	P	1.028
6	530	R	0.334	281	A10	P	1.039
7	411	T	0.335	282	A09	P	1.052
8	367	T	0.335	283	A62	P	1.084
9	421	R	0.338	284	509	R	1.113
10	446	C	0.339	285	317	R	1.134
11	042	R	0.347	286	A88	P	1.374
12	169	R	0.347	287	975	P	1.401
13	177	R	0.370	288	A04	P	1.454
14	675	T	0.377	289	959	P	1.478
15	188	T	0.381	290	044	S	1.641

T = traditional, R = range, C = competency (pub.), P = competency (comm.), S = simulator and F = 4-phase

Table 4.24: Rating of programs by conviction frequency and seriousness criterion.

Rank	Program	Score/student
1	Competency (Public)	0.538
2	Traditional	0.565
3	Range	0.575
4	Four-phase	0.714
5.	Competency (Commercial)	0.886
6.	Simulation	0.915

criterion = 130

The number of schools which appeared in both year below average ranked group according to IR criterion = 41

Thus 130 and 41 of a total of 290 schools (i.e. 45 and 14 percent of the schools) were consistent for two consecutive years in acheiving above or below average rank respectively on a criterion of IR value. These schools are shown in appendix F.

(2) The number of schools which appeared in both year above average ranked group according to accidents per student criterion = 100

The number of schools which appeared in both year below average ranked group according to accidents per student criterion = 98

According to accidents/student criterion 34 and 33 percent of total schools were consistent. These schools are also shown in appendix F.

(3) The number of schools which appeared in both year above average ranked group according to score per per student criterion = 90

The number of schools which appeared in both year below average ranked group according to score per student criterion = 88

According to score/student criterion 31 and 30 percent of the total schools were consistent. These schools are also shown in appendix F. Based on all the three criterion variables, a very poor consistency was found among schools in both the groups. Only fourteen and five schools were found to be above average or below average for two consecutive years according to all three criterion variables.

4.9 Model Development:

Models were developed to estimate the performance of various driving schools and programs in terms of the rating score. The dependent variable (1989 score per student) $(SCR/STU)_2$ for each school was regressed against the 1988 values of various independent variables for the same schools. The independent variables used in developing models were; number of students in each school for year 1989 $(NSTU)_2$, number of accidents $(NACC)_1$, number of convictions $(NCNV)_1$, relative accident involvement ratio $(IR)_1$, accidents per student $(ACC/STU)_1$, convictions per student $(CNV/STU)_1$, year 1988 rating score per student $(SCR/STU)_1$, dummy variables for the four types of program (PRGM) - range, traditional , competency in public schools and competency in commercial schools and for the three different types of geographical location of schools (GLOC) - Detroit metropolitan area, urban area and rural area.

The variable GLOC was considered because the driving pattern differs from place to place. Drivers in the Detroit metropolitan area encounter a higher density of traffic as compared to drivers in the rural or small urban area. Exposure of different driving conditions also affects the driving performance. In order to take into account or reduce the variation in different driving patterns due to different driving locations, models were developed separately for each type of geographical location, as well as for different types of programs as described below.

Models were calibrated for the following cases:

1. For each combination of type of program and geographical location of school.
2. For each type of program irrespective of geographical location.
3. For each geographical location of school irrespective of type of program.
4. For all programs and geographical locations combined.

In each of the above cases, two types of regression models were calibrated. The first one was the simple linear regression model between the dependent variable $(SCR/STU)_2$ and the independent variable $(SCR/STU)_1$. This was to determine if this measure was reasonably consistent between the year 1988 and 1989. The second type of model was a multiple linear regression model using all the identified independent variables. The multiple regression model was run using the STEPWISE regression procedure, with a 0.1 level of significance criterion (p =.1) for variables to enter into the model (for forward selection procedure) or drop out of the model (in case of backward selection procedure).

Case 1: Models for each combination of program and location

The simple and multiple regression models along with the R^2 value and significance level (p) of the calibrated models for each case, are given below:

Range and Detroit Metropolitan area: (Sample size = 37)

(i) $(SCR/STU)_2 = 1.37 + 0.73*(SCR/STU)_1$

$R^2 = 0.40$ and $p = .0001$

(ii) $(SCR/STU)_2 = 2.0 + 0.69*(SCR/STU)_1 - 0.02*(NCNV)_1$

$R^2 = 0.52$ and $p = .0001$

The simple regression model shows that the score per student for schools in the Detroit metropolitan area under the range program, is not very consistent between the year 1988 and 1989. The multiple regression model shows a moderate relationship between the dependent variable (i.e. score/student for 1989) and the independent variables score per student and total number of convictions for year 1988. The number of convictions per school for year 1988 has a negative relationship with score/student for year 1989. This indicates that those schools under this category that had a high number of convictions in the first year, had an overall better accident performance in the following year.

Range and Urban area: (Sample size = 53)

(i) $(SCR/STU)_2 = 2.50 + 0.364*(SCR/STU)_1$

$R^2 = 0.09$ and $p = .02$

(ii) $(SCR/STU)_2 = 2.2 + 0.34*(SCR/STU)_1 - 0.19*(IR)_1$

$R^2 = 0.14$ and $p = .02$

Both simple and multiple regression models show a very poor relationship between the dependent and the independent variables. The exposure variable IR in the multiple regression model had a negative relationship with score per student variable for year 1989. This relationship indicates a high involvement of students in multi-vehicle accidents in the first year results in a better performance of these schools in the second year.

Range and Rural area: (Sample size = 34)

(i) $(SCR/STU)_2 = 2.17 + 0.316*(SCR/STU)_1$

$R^2 = 0.13$ and $p = .11$

(ii) $(SCR/STU)_2 = 2.75 + 10.85*(CNV/STU)_1$

$R^2 = 0.18$ and $p = .01$

The multiple regression model shows a poor positive relationship between score/student and the previous year conviction rate. This is the opposite results from that found in the Detroit area.

<u>Traditional and Detroit metropolitan area:</u>

(Sample size = 18)

(i) $(SCR/STU)_2 = 1.69 + 0.639*(SCR/STU)_1$

$R^2 = 0.28$ and $p = .02$

(ii) $(SCR/STU)_2 = 1.69 + 0.639*(SCR/STU)_1$

$R^2 = 0.28$ and $k = .02$

Under this category, both the simple and multiple regression models had the same variable i.e. score per student for year 1988. However, both the models show a poor relationship in score/student between the year 1988 and 1989.

<u>Traditional and Urban area: (Sample size = 16)</u>

(i) $(SCR/STU)_2 = 1.92 + 0.513*(SCR/STU)_1$

$R^2 = 0.10$ and $p = .14$

(ii) $(SCR/STU)_2 = 5.59 - 0.95*(IR)_1$

$R^2 = 0.42$ and $p = .006$

The only significant model obtained in this category was the multiple regression model, which shows a moderate negative relationship between score per student and the previous year exposure variable IR. Urban area public driving schools using the traditional program improved their performance following a high involvement in multi-vehicle accidents.

Traditional and Rural area: (Sample size = 29)

(i) $(SCR/STU)_2 = 2.32 + 0.24*(SCR/STU)_1$

$R^2 = 0.08$ and $p = .11$

(ii) $(SCR/STU)_2 = 2.13 + 10.53*(ACC/STU)_1$

$R^2 = 0.11$ and $p = .07$

Under this category, the simple linear regression model showed a low correlation. The second model also shows a very poor relationship between the dependent variable and the independent variable accident rate $(ACC/STU)_1$. The nature of the relationship shows that schools which had high/low accident rates tends to have high/low scores (i.e. bad/good performance) in the following year respectively.

Competency (public) and Detroit metropolitan area:

(Sample size = 23)

(i) $(SCR/STU)_2 = 2.03 + 0.48*(SCR/STU)_1$

$R^2 = 0.27$ and $p = .01$

(ii) $(SCR/STU)_2 = 2.03 - .007*(STU)_1 + 0.09(NACC)_1$

$R^2 = 0.44$ and $p = .0003$

Score per student for schools in the Detroit metropolitan area under the competency (public) program is not consistent between the year 1988 and 1989. However, the second model shows a moderate positive correlation to the number of accidents per school for year 1988 and a negative correlation to the number of students in each school. It appears that the proportional increase in number of accidents is less than the increase in the number of students which causes a negative relationship between the score per student and the size of the school.

Competency (public) and Urban area: (Sample size = 12)

(i) $(SCR/STU)_2 = 3.05 + 0.245*(SCR/STU)_1$

$R^2 = 0.08$ and $p = .17$

(ii) $(SCR/STU)_2 = 2.12 + 0.075*(NACC)_1$

$R^2 = 0.11$ and $p = .15$

No significant simple or multiple regression model was obtained.

Competency (public) and Rural area: (Sample size = 22)

(i) $(SCR/STU)_2 = 3.23 + 0.23*(SCR/STU)_1$

$R^2 = 0.09$ and $p = .17$

(ii) same as the above

Both simple and multiple regression models for schools under this category had the same variable - score per student. The model is not statistically significant at 90% level of confidence.

Competency (commercial) and Detroit metropolitan area:

(Sample size = 16)

(i) $(SCR/STU)_2 = 3.07 + 0.36*(SCR/STU)_1$

$R^2 = 0.18$ and $p = .09$

(ii) $(SCR/STU)_2 = 1.07-2.19*(SCR/STU)_1+68.3*(ACC/STU)_1 + 1.29*(IR)_1$

$R^2 = 0.57$ and $p = .0002$

The simple regression model, like the above cases, shows an inconsistent relationship between the two years data. The multiple regression model shows a moderate correlation. The dependent variable is positively related with accident rate and the exposure variable (IR) and negatively related with score/student for the year 1988. The simple regression model shows a positive relationship in score/student between the two years, which indicates a multi-collinearity problem between accident rate and score per student. When the variable score/student was dropped out of the model, the explanatory power of the model reduces to 40% (R^2=.40).

Competency (commercial) and Urban area: (Sample size = 15)

(i) $(SCR/STU)_2 = 1.87 + 0.522*(SCR/STU)_1$

$R^2 = 0.13$ and $p = .08$

(ii) $(SCR/STU)_2 = 1.10 + 16.81*(CNV/STUD)_1$

$R^2 = 0.35$ and $p = .011$

The model in this case shows a relationship between score/student and conviction rate. This leads to the interpretation that schools with a high conviction rate tend to have a bad performance in the year after.

Competency (commercial) and Rural area: (Sample size = 4)

No model was calibrated due to the very small sample.

It can be observed that most of these models were both insignificant at a high level of confidence and very poor in explaining the variance (R^2) of the dependent variable (score per student) except for the models for range and competency programs in the Detroit metropolitan area. In these cases, the models were significant with R^2 values varying from .44 to .57. However, there are some concerns regarding the sign of parameters. The conclusion from this set of models is that there is no consistent relationship between the score/student for 1989 and the selected set of independent variables for 1988. Schools with a bad performance in 1988 could have either a better, the same or a worse performance in the following year.

<u>Case 2: Models for different geographical location</u>

<u>Detroit metropolitan area:</u> (Sample size = 94)

(i) $(SCR/STU)_2 = 1.61 + 0.65*(SCR/STU)_1$

$R^2 = 0.40$ and $p = .001$

(ii) same as the above.

The regression model for schools in the Detroit metropolitan area, irrespective of their types of program, show a moderate relationship (R^2=.40) in score per student between the year 1988 and 1989. This relationship indicates that schools with low/high score per student tends to have the same pattern in the second year.

<u>Urban area:</u> (Sample size = 96)

(i) $(SCR/STU)_2 = 2.99 + 0.24*(SCR/STU)_1$
$R^2 = 0.06$ and $p = .01$

(ii) $(SCR/STU)_2 = 3.01 + 6.15*(CNV/STU)_1$
$R^2 = 0.13$ and $p = .002$

The regression model calibrated in this category had a low correlation.

<u>Rural area:</u> (Sample size = 89)

(i) $(SCR/STU)_2 = 3.07 + 0.17*(SCR/STU)_1$
$R^2 = 0.06$ and $p = .01$

(ii) $(SCR/STU)_2 = 3.22 + 6.12*(CNV/STU)_1 - 0.17*(IR)_1$
$R^2 = 0.10$ and $p = .009$

The multiple regression model for schools in rural areas show a weak correlation.

Except for the Detroit metropolitan area, models by areas explain only about 10% of the total variance. Even the model for the Detroit metropolitan area was only moderately successful as its R^2 value is 0.40.

<u>Case 3: Models for different types of program</u>

<u>Range:</u> (Sample size = 124)

(i) $(SCR/STU)_2 = 2.26 + 0.40*(SCR/STU)_1$

R^2 = 0.13 and p = .0001

(ii) same as the above.

The only significant variable which entered the regression model for schools using the range program was score per student for the year 1988. The model shows a poor consistency in the overall performance of schools for the two year period.

<u>Competency (public):</u> (Sample size = 57)

(i) $(SCR/STU)_2 = 2.93 + 0.24*(SCR/STU)_1$

R^2 = 0.09 and p = .02

(ii) $(SCR/STU)_2 = 3.7 - 0.005*(STU)_2 + 0.05*(NACC)_1$

R^2 = 0.14 and p = .01

The regression model for all schools under the competency program show the same independent variables with the same parameter sign as in the case of the competency program in the Detroit metropolitan area. However, the explanatory power is quite low (R^2=.11) in this case as compared to the explanatory power (R^2=.44) in the Detroit case. This shows a wide variation in the performance of public schools under competency program in areas other than the Detroit metropolitan area.

<u>Competency (commercial):</u> (Sample size = 35)

(i) $(SCR/STU)_2 = 1.53 + 0.427*(SCR/STU)_1$

$R^2 = 0.09$ and $p = .12$

No significant model was obtained .

<u>Traditional:</u> (Sample size = 63)

(i) $(SCR/STU)_2 = 2.63 + 0.27*(SCR/STU)_1$

$R^2 = 0.07$ and $p = .02$

(ii) $(SCR/STU)_2 = 3.26 - 6.4*(NCNV)_1 - 0.255*(IR)_1$

$R^2 = 0.16$ and $p = .005$

The regression model for schools under the traditional program shows a negative relationship with the number of convictions and IR with a very low R^2 value of .16.

All the models for different types of programs were both statistically insignificant and had a very low R^2 value.

Case 4: Over all model for all types of program and locations

(Sample size = 290)

(i) $(SCR/STU)_2 = 2.48 + 0.37*(SCR/STU)_1$

$R^2 = 0.13$ and $p = .001$

(ii) $(SCR/STU)_2 = 2.22 + 8.5*(ACC/STU)_1 + 3.72*(CNV/STU)_1$

$R^2 = 0.17$ and $p = .0001$

Although the overall model is statistically significant, (at 99% level of confidence) it has a very low R^2 value of .17. The significant variables which entered into the model are accident and conviction rate. These variables had a positive relationship with score/student for year 1989 which indicates schools with high or low accident and conviction rate tends to have the same pattern in the second year.

Based on these analyses it can be concluded that except for the models for the range and competency programs in the Detroit metropolitan area, all the models were statistically not significant (at 90% level of confidence) and had very low R^2 values, and thus can not be used for prediction purposes. There is more consistency in the performance of schools in the Detroit metropolitan area as compared to schools in other areas. The regression models for the range and competency programs in the Detroit metropolitan areas were statistically significant, but had only a moderate R^2 value. These models can not be used confidently for prediction purpose.

4.10 Discriminant analysis:

Discriminant analysis was performed to determine if it was possible to classify schools into different driver education programs, based on a discriminant function derived from a set of predictor variables. A comparision between the actual classification of schools under each program and the predicted classification would determine how successfully schools can be discriminated into different programs based on these performance variables. A small difference between criterion groups with respect to predictor variables results in more error in classification in discriminant analysis. Any relationship between types of programs and a set of performance predictor variables could be identified based on this analysis.

Discriminating functions were developed, using type of program as a classification variable, and IR, score per student, accidents/student and convictions/student for the year 1988 as the four predictor variables . Based on discriminant functions, the classification of schools into different programs was predicted as shown in table 4.25. The same table shows that predictions of schools under the range program are correct in 33 out of 124 schools (26.6%); predictions of commercial schools using the competency program are correct in 28 out of 35 schools

(80%). The higher correct classification for competency (comm.) program indicates that commercial schools were very successfully discriminated based on a set of predictor variables. The first discriminant function (which separates commmercial schools from the rest of the schools) was highly significant. Whereas the other two discriminant functions were not significant even at 80% level of confidence. This results in a high prediction error. In total, the correct classification of schools are 111 out of 279, for an overall percentage of 40% correct classification.

Based on the developed discriminating function and using another set of predictor variables (IR, accidents/ student, score/student and convictions/student) for the year 1989, the predicted classification of schools into the different programs is shown in table 4.26. It can be seen from table 4.26, that, except for schools under the competency programs, the percentage of correct classification for all other types of program decreased. For the commercial schools the percentage of correct classification is 82%, an increase of 2% from the 1988 set of data. The overall percentage of correct classification for all schools is 35%.

Using three categories of the classification variable - 1) range, 2) traditional and competency program combined and 3) competency program in commercial schools, a new discriminating function was developed. And the resulting

Table 4.25: Classification summary for year 1988 data.

From	Classified into Tradi-tional	Compe-tency (pub.)	Compe-tency (comm.)	Range	Total
Traditional	24 38.10%	18 28.57%	8 12.70%	13 20.63%	63 100.00%
Competency (pub.)	17 29.82	26 45.61	3 5.26	11 19.30	57 100.00
Competency (comm.)	1 2.86	1 2.86	28 80.00	5 14.29	35 100.00
Range	35 28.23	35 28.23	21 16.94	33 26.61	124 100.00
Total Percent	77 27.60	80 28.67	60 21.51	62 22.22	279 100.00

Table 4.26: Classification summary for year 1989 data.

From	Classified into Tradi-tional	Compe-tency (pub.)	Compe-tency (comm.)	Range	Total
Traditional	17 26.98%	22 34.92%	13 20.63%	11 17.45%	63 100.00%
Competency (pub.)	14 24.56	24 42.11	9 15.79	10 17.54	57 100.00
Competency (comm.)	2 5.71	1 2.86	29 82.86	3 8.57	35 100.00
Range	46 37.10	27 21.77	22 17.74	29 23.39	124 100.00
Total Percent	79 28.32	74 26.52	13 26.16	53 19.00	279 100.00

classification shows a 50% accuracy in overall classification as compared to 40% correct classification in the case of a classification variable having four categories. This indicates that there is more difference among these three types of program with respect to the predictor variables.

Classification of schools were also predicted using each of the four predictor variables separately as well as a combination of two and three predictor variables together. Discriminant functions were also developed using a stepwise procedure to select the predictor variables for the model. This caused only two variables (IR, accident rate) to enter the model. All these classifications show a higher percentage of error of classification as compared to the classification using all four predictor variables together.

The discriminant function analysis shows a 60 to 65 percent error of classification. Whereas, the high percentage of correct classification for commercial schools supports the earlier findings that the competency program in commercial schools had a significantly higher accident and conviction rate. The high percentage of error results from a small difference among types of program based on these predictor variables. This indicates that there is not a good relationship between types of program and these set of performance variables.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary:

Based on the fact that the frequency of accidents among young drivers remains high despite the wide spread use of driver education programs, such programs have come under attack. The critics charge driver education programs are inefficient and cost-ineffective.

Prior research on the effectiveness of various driver education programs was not conclusive. Many researchers cast doubt upon the earlier studies because they lacked a valid measure of accident exposure. In light of this concern, the present study was conducted utilizing an indirect accident exposure measure in the analysis of the effectiveness of different driver education programs. This indirect accident exposure method, called the quasi-induced accident exposure method, is based on the assumption that accident exposure by any group of drivers is proportional to the innocent victim involvements in multi-vehicle accident by that group of drivers. The criterion variable used in this method, is called the relative accident involvement ratio (IR). The IR is a measure of the relative frequency of accident involvement for drivers from different driver education programs.

A new data base was created by extracting information from three existing data files - The Highway Accident Master File, Driver Accident and Conviction Records File, and Driver Education Program and Information File.

In addition to the relative involvement ratio (IR), other traditional criterion variables such as accident frequency per student and conviction frequency per student were computed for each school and program. In order to take into account the difference in driver exposure from different geographical areas the IR value was also computed for various programs under three different geographical areas - Detroit metropolitan area, other urban areas and rural areas. To determine the performance of drivers from different schools or different programs under different driving conditions, the relative involvement ratio for a sample of higher and lower ranked schools (according to the IR criterion) under each program was determined for different weather and light conditions.

Hypotheses were constructed to determine if there were statistically significant differences in the mean relative involvement ratio, and the mean rate of accidents and convictions, among various driver education programs and schools. Analyses were also performed comparing the performance of various programs and schools under different weather and light conditions.

To determine the rating of different schools and programs, on the basis of both frequency and severity of accidents, a rating score was determined for all schools and programs. This score is a summation of the product of the frequency and weight of each type of accident, where the weight for each type of accident equaled the average dollar value of fatal, injury and property damage accidents. The consistency of schools in their performance on various criterion variables was also investigated over a period of two years.

Regression models were calibrated to predict the crash performance of individual schools under (i) four different programs (range, competency (public), competency (commercial), traditional) (ii) three different geographical locations of schools (Detroit metropolitan area, urban area, and rural area), and (iii) combinations of each program and geographical location. Finally, discriminant analysis was performed to determine how successfully schools can be discriminated into different programs based on a discriminant function derived from a set of predictor variables. This analysis would further determine whether a relationship between types of program and a set of predictor variables exists.

5.2 Conclusions:

Based on the analyses presented in the previous chapters, the following conclusions were drawn:

The 16, 17 and 18 year old drivers were about 11 and

12.5 percent more involved in accidents and convictions respectively than the drivers of all age group state-wide for the two year period (1988 and 1989). These numbers are based on the frequency of accidents and convictions, not adjusted for exposure.

The most common type of accident and conviction were rear-end accidents and speed related violations.

The competency program in commercial schools had significantly higher accident and conviction rates than the range, traditional and competency programs in public schools. There was no statistically significant difference in the mean accident rate between the range program (3-phase) and traditional and competency programs (2-phase) in public schools. However, the range program (3-phase) had a significantly higher conviction rate than 2-phase competency and traditional programs in public schools. The mean single-vehicle accident rate was significantly higher for students enrolled in the traditional program than the students enrolled in the range program.

The average IR value indicates that drivers from all programs were over-involved in multi-vehicle accidents. There was no statistically significant difference in the mean relative involvement ratio (IR) among the four programs including two-phase and three-phase program, when the induced exposure measure of accidents was utilized in the analysis. There was no difference in the performance of drivers from different driving education programs due to different geographical areas (i.e. different driving enviornment), as no statistically significant difference was found in the mean IR value (i) among all programs in each geographical area and (ii) for each program under three different geographical areas.

No statistically significant difference in the mean relative involvement ratio was found among different programs for samples of both higher and lower ranked schools under clear, rainy and snowy weather conditions. The traditional program results in the lowest and second lowest IR value for higher and lower ranked schools respectively under rainy and snowy conditions. However, the IR value was very high in snowy weather across all programs which indicates that none of the driver education program prepares students to drive under adverse weather conditions.

Under all three light conditions - day, night, and dawn/dusk, no significant differences were found in the mean IR value among all programs for both higher and lower ranked schools. The competency program in commercial schools results in the highest and lowest IR value for higher and lower ranked schools respectively under night time accidents. Moreover, the data indicates that young drivers are about 20% more likely to be over-involved in a night accident than a day accident (after correcting for exposure). The ratio is even higher among the lower ranked schools with high values of the IR shown by all public school programs. These ratios show that young drivers from these schools are involved in between 2 and 3 accidents as the guilty party for each accident in which they are the innocent victim.

No statistically significant difference was found in the mean IR value among the four programs for all four accident types - angle-straight, rear-end, angle turn and head-on-left turn accidents. However, an interesting finding was that the traditional program had a lower IR value for all four accident types than the range program. This indicates that at least for the four common accident types, the additional driving range experience did not result in a lower accident experience (after counting for exposure).

Based on a scoring system developed on the combined criterion of frequency and severity of accidents, the range program was found to have the best performance. The consistency analysis of school performance over a two year period indicates that schools in the higher ranked groups are more consistent than schools in the lower ranked groups. In the higher ranked group, schools were more consistent in their performance using the IR criterion variable than on any other criterion variable. Whereas in the lower ranked group, schools were most consistent based on the accident rate criterion variable.

All the regression models, except for the range and competency (comm.) programs in the Detroit metropolitan area, were either statistically not significant or had very poor explanatory power. This shows that there is more consistency in the performance of schools in the Detroit metropolitan area as compared to schools in other areas. The models for the range and competency (comm.) programs in the Detroit metropolitan area were statistically significant but still did not have a high explanatory power, so even these models can not be used for predicting school performance.

Using the discriminant analysis, it was found that only 40% of total schools can be correctly classified into their programs based on the four predictor variables - IR, accidents/student, score/student and convictions/student. This shows a small differences among the programs with respect to the predictor performance variables. Thus, it can be concluded that there was not a good relationship between types of program and their performances.

As an overall conclusion, there is no evidence of significant difference among public school driver education programs based on the performance predictor variables used in this study. The commercial school program did have a significantly higher accident and conviction frequency per student than the public school programs. However, when corrected for experience, this difference was no longer statistically significant.

5.3 Recommendations:

From the above conclusions, the following recommendations can be made:

First, the certification requirements which are imposed on commercial driving schools should be scrutinized to determine whether they are effective in ensuring quality driver education. Second, school districts which currently use the two-phase programs should not seek to enhance their programs by investing in simulators or driving ranges. Schools districts which currently use three-phase or four-phase programs should, in light of the maintenance costs, consider implementing a two-phase program instead. Third, public and commercial schools should enhance their curriculum in order to prepare students to drive under adverse weather conditions, and the public schools should provide better training for night driving.

The above conclusions were based on only a two year analysis period. This period is very short for a valid computation of driver performance. In order to draw a a more reliable conclusion, a longer evaluation period is recommended.

A follow-up-study is recommended with a longer evaluation period to verify the findings of this study.

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APPENDIX A

A Fortran Program for Changing the Layout of Accidents and Convictions Records File

APPENDIX A

A Fortran Program for Changing the Layout of Accidents and Convictions Records File

```
C     PROGRAM FOR CHANGING THE LAY OUT OF DRIVER'S
C     ACCIDENTS & CONVICTIONS RECORD FILE
      INTEGER COUN, BIRTH, ORIG, ACCDT, ACRN, VEH, INJ,
+     KILL, CONDAT, FRM
      CHARACTER*1 X, SEX
      CHARACTER*2 VETY
      CHARACTER*3 SCH, OFF
      CHARACTER*5 SPD, CODD
      CHARACTER*13 LIC
             N = 0
             J = 1
             K = 1
      OPEN (UNIT = 5)
      OPEN (UNIT = 7)
      OPEN (UNIT = 8)
10    DO 44 I = 1, 999999
      READ ( 5, 11, END = 99)
11    FORMAT (A1)
      IF (X.EQ.'B')THEN
             N = N+1
      IF (N.GE.2)THEN
      WRITE (7, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
31    FORMAT ( A13, I7, A1, I7, I2, A3)
      WRITE (8, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
      ENDIF
      IF (N.EQ.1)THEN
      IF (K.EQ.1)THEN
      WRITE (7, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
      ENDIF
      IF (J.EQ.0)THEN
      WRITE (8, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
      ENDIF
      ENDIF
      BACKSPACE (5)
      READ (5, 12) X, LIC, ORIG, SEX, BIRTH, COUN, SCH
12    FORMAT (A1, A13, 18X, I7, 1X, A1, I7, I2, A3)
             J = 0
             K = 0
             GO TO 10
      ENDIF
      IF (X. EQ. 'M') THEN
             K = K + 1
      BACKSPACE (5)
      READ (5, 13) X, CONDAT, OFF, SPD, VETY
13    FORMAT (A1, 13X, I7, 7X, A3, A5, 1X, A2)
      WRITE (7, 32) LIC, ORIG, SEX, BIRTH, COUN, SCH,
   +     CONDAT, OFF, SPD, VETY
```

```
32    FORMAT (A13, I7, A1, I7, I2, A3, 2X, I7, A3, A5, A2)
             N = 0
             GO TO 10
      ENDIF
      IF (X .EQ. 'S') THEN
              J = J + 1
      BACKSPACE (5)
      READ (5, 14) X, ACCDT, VEH, INJ, KILL, CODD, ACRN, FRM
14    FORMAT (A1, 13X, I7, 3I2, 3X, A5, I6, I7)
      WRITE (8, 33) LIC, ORIG, SEX, BIRTH, COUN, SCH, ACCD,
   +         VEH, INJ, KILL, CODD, ACRN, FRM
33    FORMAT (A13, I7, A1, I7, I2, A3, 2X, I7, 3I2, A5,
   +          I6, I7)
              N = 0
              GO TO 10
      ENDIF
44    CONTINUE
99    WRITE (7, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
      WRITE (8, 31) LIC, ORIG, SEX, BIRTH, COUN, SCH
      STOP
      END
```

APPENDIX B

List of variables used in the study

APPENDIX B

List of variables used in the study

The following list indicates various variables used in different chapters in the study.

PRG	Various driver education programs.
C	Competency program in public schools.
F	Four-phased program in public schools.
P	Competency program in commercial schools.
R	Range program.
S	Simulation program in public schools.
T	Traditional program.
C1 & C2	Competency (pub.) program in higher and lower ranked schools (according to IR criterion).
P1 & P2	Competency (comm.) program in higher and lower ranked schools (according to IR criterion).
R1 & R2	Range program in higher and lower ranked schools (according to IR criterion) respectively.
T1 & T2	Traditional program in higher and lower ranked schools (according to IR criterion) respectively.
GLC1	Detroit metropolitan area.
GLC2	Urban area.
GLC3	Rural area.
ACCRT	# of accidents per student.
CNVRT	# of convictions per student.

SNGRT	# of single-vehicle accidents per student.
IR	Relative accident involvement ratio. This ratio is defined as ratio of percentage of the at-fault drivers from a given driver education program scenario to the percentage of the innocent drivers from the same scenario.
IRCLR	IR value under clear weather conditions.
IRRAN	IR value under rainy weather conditions.
IRSNW	IR value under snowy weather conditions.
IRDAY	IR value under day time light conditions.
IRNGT	IR value under night time light conditions.
IRDWN	IR value under dwn/dusk time light conditions.
IRAST	IR value for angle-straight accidents.
IRRER	IR value for rear-end accidents.
IRATR	IR value for angle-turn accidents.
IRHLT	IR value for head-on-left turn accidents.

APPENDIX C

Values of various Criterion Variables for various Schools

APPENDIX C

Values of Various Criterion Variables

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
1	029	C	0.218	0.232	0.096
2	036	C	0.252	0.252	0.109
3	053	C	0.224	0.310	0.085
4	076	C	0.228	0.278	0.083
5	128	C	0.188	0.236	0.064
6	134	C	0.294	0.300	0.082
7	136	C	0.174	0.270	0.074
8	182	C	0.219	0.103	0.077
9	186	C	0.216	0.273	0.041
10	194	C	0.305	0.225	0.149
11	226	C	0.143	0.221	0.046
12	259	C	0.215	0.235	0.035
13	269	C	0.315	0.313	0.125
14	392	C	0.217	0.249	0.075
15	393	C	0.259	0.240	0.057
16	410	C	0.217	0.213	0.049
17	412	C	0.270	0.282	0.056
18	413	C	0.325	0.341	0.072
19	415	C	0.213	0.167	0.051
20	417	C	0.262	0.333	0.052
21	422	C	0.194	0.226	0.032
22	425	C	0.188	0.261	0.043
23	429	C	0.169	0.212	0.014
24	431	C	0.287	0.295	0.060
25	441	C	0.223	0.278	0.065
26	442	C	0.185	0.144	0.090
27	444	C	0.196	0.170	0.061
28	469	C	0.198	0.315	0.091
29	478	C	0.257	0.311	0.098
30	495	C	0.267	0.282	0.124
31	507	C	0.273	0.323	0.051
32	525	C	0.247	0.332	0.041
33	531	C	0.222	0.241	0.042
34	537	C	0.238	0.246	0.064
35	538	C	0.314	0.385	0.091
36	539	C	0.189	0.185	0.046
37	546	C	0.260	0.387	0.069
38	554	C	0.206	0.309	0.050
39	570	C	0.181	0.243	0.083
40	615	C	0.229	0.222	0.078
41	618	C	0.175	0.188	0.048
42	629	C	0.299	0.203	0.056
43	633	C	0.290	0.302	0.078
44	638	C	0.245	0.263	0.064
45	641	C	0.204	0.175	0.102

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
46	650	C	0.247	0.364	0.079
47	669	C	0.238	0.213	0.098
48	670	C	0.187	0.184	0.050
49	687	C	0.192	0.201	0.089
50	714	C	0.246	0.229	0.055
51	769	C	0.184	0.213	0.027
52	777	C	0.171	0.236	0.021
53	778	C	0.215	0.327	0.034
54	780	C	0.201	0.328	0.026
55	781	C	0.201	0.265	0.045
56	784	C	0.207	0.302	0.033
57	790	C	0.135	0.224	0.004
58	049	F	0.218	0.282	0.075
59	075	F	0.251	0.340	0.077
60	334	F	0.302	0.459	0.074
61	355	F	0.223	0.302	0.044
62	527	F	0.266	0.454	0.038
63	528	F	0.201	0.277	0.027
64	A04	P	0.279	0.740	0.071
65	A05	P	0.246	0.410	0.066
66	A08	P	0.282	0.436	0.066
67	A09	P	0.293	0.504	0.057
68	A10	P	0.282	0.502	0.056
69	A21	P	0.275	0.382	0.059
70	A24	P	0.326	0.431	0.061
71	A35	P	0.238	0.352	0.058
72	A39	P	0.265	0.344	0.049
73	A45	P	0.302	0.304	0.078
74	A48	P	0.307	0.448	0.056
75	A56	P	0.226	0.308	0.068
76	A60	P	0.284	0.388	0.034
77	A62	P	0.341	0.590	0.098
78	A63	P	0.271	0.392	0.099
79	A65	P	0.308	0.396	0.063
80	A77	P	0.218	0.239	0.051
81	A82	P	0.310	0.477	0.069
82	A83	P	0.240	0.336	0.086
83	A86	P	0.260	0.448	0.065
84	A88	P	0.243	0.646	0.044
85	OSS	P	0.222	0.399	0.066
86	951	P	0.280	0.510	0.053
87	959	P	0.353	0.604	0.108
88	965	P	0.249	0.326	0.040
89	966	P	0.296	0.495	0.073
90	973	P	0.287	0.423	0.062

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
91	974	P	0.238	0.332	0.059
92	975	P	0.228	0.814	0.041
93	977	P	0.275	0.343	0.036
94	980	P	0.219	0.498	0.039
95	981	P	0.287	0.406	0.053
96	984	P	0.237	0.401	0.075
97	992	P	0.291	0.405	0.058
98	999	P	0.265	0.380	0.053
99	014	R	0.239	0.280	0.062
100	015	R	0.235	0.372	0.074
101	017	R	0.242	0.287	0.083
102	020	R	0.170	0.236	0.054
103	037	R	0.246	0.220	0.134
104	042	R	0.160	0.147	0.057
105	043	R	0.184	0.260	0.061
106	052	R	0.211	0.330	0.077
107	057	R	0.227	0.245	0.073
108	059	R	0.302	0.318	0.049
109	062	R	0.233	0.277	0.063
110	070	R	0.227	0.242	0.112
111	077	R	0.239	0.213	0.049
112	081	R	0.266	0.377	0.131
113	088	R	0.197	0.228	0.083
114	152	R	0.236	0.219	0.085
115	165	R	0.225	0.202	0.051
116	166	R	0.185	0.193	0.037
117	169	R	0.193	0.185	0.041
118	170	R	0.192	0.254	0.034
119	171	R	0.143	0.221	0.016
120	172	R	0.194	0.229	0.022
121	177	R	0.232	0.172	0.054
122	178	R	0.200	0.200	0.037
123	180	R	0.191	0.201	0.050
124	183	R	0.242	0.232	0.051
125	184	R	0.220	0.233	0.063
126	206	R	0.256	0.300	0.083
127	252	R	0.263	0.327	0.088
128	254	R	0.243	0.384	0.053
129	255	R	0.230	0.265	0.065
130	256	R	0.170	0.149	0.035
131	258	R	0.266	0.258	0.090
132	267	R	0.266	0.266	0.101
133	270	R	0.186	0.244	0.095
134	276	R	0.175	0.252	0.052
135	301	R	0.302	0.387	0.087

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
136	303	R	0.267	0.261	0.088
137	307	R	0.216	0.205	0.089
138	314	R	0.196	0.297	0.036
139	316	R	0.254	0.483	0.036
140	317	R	0.259	0.529	0.048
141	320	R	0.230	0.320	0.053
142	321	R	0.216	0.272	0.083
143	323	R	0.289	0.357	0.092
144	326	R	0.256	0.242	0.084
145	331	R	0.210	0.210	0.083
146	332	R	0.308	0.324	0.132
147	340	R	0.253	0.303	0.051
148	342	R	0.236	0.335	0.041
149	343	R	0.223	0.370	0.042
150	344	R	0.217	0.305	0.078
151	345	R	0.241	0.344	0.040
152	347	R	0.266	0.367	0.110
153	348	R	0.268	0.259	0.089
154	349	R	0.207	0.310	0.065
155	365	R	0.178	0.192	0.105
156	366	R	0.268	0.310	0.094
157	377	R	0.261	0.322	0.097
158	391	R	0.259	0.279	0.093
159	394	R	0.280	0.331	0.081
160	407	R	0.246	0.313	0.071
161	419	R	0.212	0.225	0.043
162	420	R	0.165	0.275	0.027
163	421	R	0.219	0.165	0.039
164	428	R	0.191	0.239	0.032
165	430	R	0.223	0.200	0.035
166	462	R	0.157	0.223	0.066
167	468	R	0.229	0.296	0.076
168	471	R	0.302	0.412	0.104
169	492	R	0.274	0.377	0.120
170	503	R	0.244	0.321	0.064
171	508	R	0.257	0.338	0.063
172	509	R	0.246	0.538	0.059
173	518	R	0.185	0.203	0.033
174	529	R	0.233	0.369	0.029
175	530	R	0.230	0.166	0.056
176	532	R	0.226	0.232	0.031
177	535	R	0.177	0.315	0.054
178	541	R	0.291	0.337	0.076
179	543	R	0.153	0.267	0.034
180	544	R	0.313	0.382	0.031

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
181	547	R	0.167	0.223	0.027
182	548	R	0.196	0.282	0.032
183	549	R	0.299	0.241	0.060
184	551	R	0.204	0.255	0.032
185	553	R	0.223	0.307	0.032
186	555	R	0.179	0.257	0.031
187	556	R	0.201	0.210	0.026
188	559	R	0.277	0.290	0.044
189	560	R	0.279	0.273	0.059
190	597	R	0.233	0.317	0.061
191	598	R	0.240	0.398	0.039
192	599	R	0.240	0.383	0.051
193	601	R	0.248	0.303	0.038
194	603	R	0.216	0.356	0.053
195	616	R	0.270	0.307	0.066
196	622	R	0.266	0.271	0.055
197	623	R	0.136	0.252	0.033
198	624	R	0.204	0.244	0.040
199	627	R	0.251	0.224	0.052
200	651	R	0.245	0.401	0.087
201	674	R	0.184	0.203	0.065
202	680	R	0.201	0.181	0.059
203	684	R	0.197	0.250	0.088
204	700	R	0.220	0.331	0.078
205	701	R	0.169	0.202	0.060
206	706	R	0.173	0.187	0.049
207	722	R	0.203	0.293	0.042
208	723	R	0.207	0.297	0.040
209	733	R	0.194	0.284	0.030
210	735	R	0.182	0.323	0.029
211	736	R	0.154	0.322	0.034
212	738	R	0.177	0.306	0.024
213	740	R	0.131	0.324	0.021
214	741	R	0.160	0.283	0.028
215	746	R	0.175	0.347	0.029
216	750	R	0.175	0.333	0.046
217	760	R	0.177	0.263	0.025
218	766	R	0.201	0.370	0.031
219	773	R	0.197	0.229	0.036
220	785	R	0.152	0.272	0.041
221	789	R	0.206	0.250	0.044
222	795	R	0.158	0.259	0.066
223	039	S	0.256	0.417	0.068
224	044	S	0.376	0.453	0.137
225	253	S	0.201	0.383	0.042

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
226	710	S	0.262	0.329	0.083
227	754	S	0.213	0.236	0.031
228	009	T	0.156	0.174	0.080
229	035	T	0.197	0.243	0.126
230	041	T	0.237	0.278	0.053
231	103	T	0.180	0.373	0.082
232	114	T	0.278	0.295	0.080
233	147	T	0.215	0.360	0.066
234	153	T	0.282	0.369	0.141
235	154	T	0.216	0.318	0.056
236	163	T	0.273	0.257	0.114
237	167	T	0.210	0.231	0.075
238	187	T	0.214	0.185	0.078
239	188	T	0.179	0.171	0.042
240	198	T	0.162	0.188	0.042
241	208	T	0.231	0.317	0.078
242	217	T	0.238	0.321	0.101
243	260	T	0.156	0.227	0.084
244	289	T	0.261	0.272	0.075
245	295	T	0.232	0.258	0.090
246	339	T	0.266	0.254	0.078
247	350	T	0.309	0.373	0.089
248	367	T	0.193	0.159	0.070
249	385	T	0.221	0.292	0.080
250	387	T	0.265	0.398	0.075
251	395	T	0.255	0.293	0.089
252	406	T	0.189	0.207	0.037
253	408	T	0.239	0.278	0.034
254	409	T	0.195	0.248	0.053
255	411	T	0.243	0.189	0.038
256	416	T	0.305	0.342	0.093
257	434	T	0.234	0.266	0.069
258	439	T	0.173	0.246	0.056
259	450	T	0.314	0.364	0.119
260	455	T	0.332	0.254	0.098
261	457	T	0.224	0.157	0.134
262	482	T	0.266	0.293	0.074
263	483	T	0.279	0.333	0.072
264	486	T	0.189	0.223	0.054
265	490	T	0.235	0.294	0.105

OBS	SCH	PRG	ACCRT	CNVRT	SNGRT
266	494	T	0.244	0.299	0.122
267	506	T	0.283	0.323	0.051
268	526	T	0.243	0.263	0.040
269	536	T	0.197	0.315	0.050
270	545	T	0.283	0.233	0.087
271	583	T	0.232	0.253	0.124
272	591	T	0.208	0.279	0.068
273	600	T	0.234	0.330	0.064
274	617	T	0.209	0.180	0.108
275	635	T	0.166	0.178	0.057
276	675	T	0.154	0.167	0.066
277	705	T	0.227	0.354	0.042
278	707	T	0.288	0.222	0.082
279	712	T	0.196	0.235	0.051
280	715	T	0.218	0.288	0.056
281	719	T	0.215	0.330	0.057
282	720	T	0.235	0.312	0.060
283	725	T	0.214	0.245	0.034
284	753	T	0.205	0.226	0.018
285	757	T	0.218	0.319	0.062
286	763	T	0.120	0.287	0.022
287	770	T	0.177	0.314	0.031
288	772	T	0.187	0.255	0.058
289	776	T	0.194	0.261	0.041
290	782	T	0.197	0.217	0.043

OBS	SCH	PRG	IR
1	029	C	1.190
2	036	C	1.300
3	053	C	0.800
4	076	C	1.750
5	128	C	2.824
6	134	C	1.617
7	136	C	2.700
8	182	C	1.294
9	186	C	4.091
10	194	C	1.824
11	226	C	4.250
12	259	C	1.818
13	269	C	1.400
14	392	C	1.867
15	393	C	1.486
16	410	C	1.743
17	412	C	1.529
18	413	C	1.569
19	415	C	1.368
20	417	C	1.649
21	422	C	1.675
22	425	C	1.300
23	429	C	1.545
24	431	C	1.462
25	441	C	1.619
26	442	C	1.364
27	444	C	1.375
28	469	C	3.500
29	478	C	1.111
30	495	C	1.400
31	507	C	1.333
32	525	C	1.583
33	531	C	1.316
34	537	C	1.667
35	538	C	1.585
36	539	C	1.429
37	546	C	1.371
38	554	C	2.136
39	570	C	2.100
40	615	C	1.160
41	618	C	4.167
42	629	C	1.156
43	633	C	1.680
44	638	C	1.500
45	641	C	1.000

OBS	SCH	PRG	IR
46	650	C	1.094
47	669	C	2.000
48	670	C	1.120
49	687	C	1.455
50	714	C	1.765
51	769	C	1.895
52	777	C	1.423
53	778	C	2.565
54	780	C	1.750
55	781	C	1.938
56	784	C	1.716
57	790	C	1.563
58	049	F	1.500
59	075	F	1.840
60	334	F	1.688
61	355	F	1.257
62	527	F	1.467
63	528	F	1.870
64	A04	P	1.147
65	A05	P	1.222
66	A08	P	1.912
67	A09	P	1.498
68	A10	P	1.820
69	A21	P	1.698
70	A24	P	1.697
71	A35	P	2.077
72	A39	P	1.580
73	A45	P	1.362
74	A48	P	1.653
75	A56	P	1.933
76	A60	P	1.469
77	A62	P	1.553
78	A63	P	1.560
79	A65	P	1.652
80	A77	P	1.625
81	A82	P	1.604
82	A83	P	2.400
83	A86	P	1.889
84	A88	P	1.600
85	OSS	P	1.525
86	951	P	1.667
87	959	P	1.639
88	965	P	1.500
89	966	P	1.477
90	973	P	1.674

OBS	SCH	PRG	IR
91	974	P	1.606
92	975	P	1.179
93	977	P	1.875
94	980	P	1.330
95	981	P	1.797
96	984	P	1.263
97	992	P	1.721
98	999	P	1.384
99	014	R	1.423
100	015	R	1.900
101	017	R	1.773
102	020	R	1.714
103	037	R	1.286
104	042	R	1.824
105	043	R	3.700
106	052	R	1.357
107	057	R	1.879
108	059	R	1.931
109	062	R	1.000
110	070	R	1.488
111	077	R	1.343
112	081	R	2.308
113	088	R	1.500
114	152	R	1.346
115	165	R	2.321
116	166	R	2.348
117	169	R	1.370
118	170	R	1.023
119	171	R	1.545
120	172	R	1.424
121	177	R	1.891
122	178	R	1.722
123	180	R	1.774
124	183	R	2.149
125	184	R	1.320
126	206	R	1.889
127	252	R	1.375
128	254	R	1.552
129	255	R	1.278
130	256	R	3.091
131	258	R	1.667
132	267	R	1.350
133	270	R	2.318
134	276	R	1.353
135	301	R	1.441

OBS	SCH	PRG	IR
136	303	R	1.741
137	307	R	2.000
138	314	R	1.938
139	316	R	1.554
140	317	R	1.667
141	320	R	1.647
142	321	R	1.706
143	323	R	2.000
144	326	R	1.762
145	331	R	2.556
146	332	R	1.500
147	340	R	1.889
148	342	R	1.481
149	343	R	1.750
150	344	R	1.316
151	345	R	1.580
152	347	R	1.458
153	348	R	1.909
154	349	R	2.308
155	365	R	0.889
156	366	R	1.373
157	377	R	1.538
158	391	R	2.667
159	394	R	1.800
160	407	R	1.444
161	419	R	1.444
162	420	R	2.250
163	421	R	1.922
164	428	R	1.923
165	430	R	1.231
166	462	R	1.333
167	468	R	1.438
168	471	R	1.923
169	492	R	2.045
170	503	R	1.520
171	508	R	1.273
172	509	R	1.684
173	518	R	1.450
174	529	R	1.968
175	530	R	1.419
176	532	R	1.885
177	535	R	1.250
178	541	R	1.590
179	543	R	1.778
180	544	R	1.600

OBS	SCH	PRG	IR
181	547	R	1.054
182	548	R	1.042
183	549	R	1.254
184	551	R	1.681
185	553	R	1.218
186	555	R	1.320
187	556	R	2.159
188	559	R	1.340
189	560	R	1.823
190	597	R	1.125
191	598	R	1.644
192	599	R	1.548
193	601	R	1.386
194	603	R	1.905
195	616	R	1.844
196	622	R	1.848
197	623	R	0.700
198	624	R	1.196
199	627	R	1.833
200	651	R	2.000
201	674	R	1.156
202	680	R	1.300
203	684	R	1.235
204	700	R	1.313
205	701	R	2.000
206	706	R	2.333
207	722	R	1.314
208	723	R	1.524
209	733	R	1.159
210	735	R	1.917
211	736	R	1.286
212	738	R	1.191
213	740	R	1.424
214	741	R	1.458
215	746	R	1.585
216	750	R	1.184
217	760	R	1.219
218	766	R	1.600
219	773	R	1.691
220	785	R	2.000
221	789	R	1.647
222	795	R	2.538
223	039	S	1.500
224	044	S	1.789
225	253	S	1.440

OBS	SCH	PRG	IR
226	710	S	3.000
227	754	S	1.684
228	009	T	2.286
229	035	T	3.000
230	041	T	1.511
231	103	T	2.000
232	114	T	0.976
233	147	T	2.000
234	153	T	2.111
235	154	T	1.516
236	163	T	1.261
237	167	T	1.238
238	187	T	2.118
239	188	T	1.515
240	198	T	0.941
241	208	T	1.579
242	217	T	2.214
243	260	T	1.222
244	289	T	1.293
245	295	T	1.158
246	339	T	1.391
247	350	T	1.907
248	367	T	1.667
249	385	T	1.000
250	387	T	1.500
251	395	T	1.174
252	406	T	1.571
253	408	T	1.600
254	409	T	1.538
255	411	T	1.441
256	416	T	1.769
257	434	T	1.360
258	439	T	1.929
259	450	T	0.935
260	455	T	1.407
261	457	T	1.107
262	482	T	1.053
263	483	T	1.125
264	486	T	1.137
265	490	T	1.375

OBS	SCH	PRG	IR
266	494	T	1.833
267	506	T	1.015
268	526	T	1.810
269	536	T	1.367
270	545	T	1.292
271	583	T	1.455
272	591	T	1.615
273	600	T	1.444
274	617	T	1.750
275	635	T	1.121
276	675	T	3.800
277	705	T	2.109
278	707	T	1.714
279	712	T	1.727
280	715	T	1.574
281	719	T	1.333
282	720	T	1.492
283	725	T	1.034
284	753	T	1.147
285	757	T	1.824
286	763	T	2.375
287	770	T	1.313
288	772	T	2.545
289	776	T	2.150
290	782	T	1.684

OBS	SCH	PRG	IRCLR	IRRAN	IRSNW	IRDAY
1	029	C1	1.105	1.333	1.500	1.750
2	036	C1	1.071	1.000	N.A.	1.000
3	053	C1	1.250	1.333	0.667	1.250
4	182	C1	1.333	1.000	0.833	0.913
5	425	C1	0.950	1.286	1.400	1.222
6	478	C1	1.500	1.167	0.500	1.455
7	615	C1	1.364	1.000	3.000	1.455
8	629	C1	1.385	1.200	2.000	1.417
9	641	C1	0.733	0.800	1.000	0.800
10	650	C1	1.300	2.000	0.750	1.375
11	670	C1	1.143	1.000	N.A.	1.167
12	128	C2	3.250	1.500	4.000	3.500
13	136	C2	1.571	2.600	2.500	1.750
14	186	C2	2.333	1.500	1.500	2.400
15	226	C2	1.786	2.429	1.667	2.087
16	469	C2	2.083	1.875	6.000	1.722
17	554	C2	1.500	2.000	5.000	2.200
18	570	C2	3.000	3.667	6.500	3.222
19	618	C2	4.250	6.000	2.000	5.750
20	669	C2	2.200	2.500	3.333	2.429
21	778	C2	8.000	2.000	3.500	2.500
22	781	C2	2.118	2.250	3.000	2.643
23	A04	P1	1.000	1.180	1.500	0.960
24	A05	P1	1.536	1.154	0.833	1.407
25	A45	P1	1.000	1.428	1.000	1.000
26	975	P1	1.077	1.375	1.000	1.545
27	980	P1	1.220	1.582	1.363	1.390
28	984	P1	0.984	1.263	1.500	1.651
29	999	P1	1.204	1.615	1.625	1.447
30	A08	P2	1.909	3.667	4.000	3.375
31	A10	P2	2.091	1.400	1.714	2.042
32	A35	P2	2.013	1.667	1.636	2.047
33	A56	P2	1.875	1.667	2.200	2.125
34	A83	P2	1.886	1.545	2.333	1.851
35	A86	P2	1.583	2.000	N.A.	1.923
36	977	P2	1.900	1.800	7.000	1.842

OBS	IRNGT	IRDWN	IRAST	IRRER	IRATR	IRHLT
1	0.769	N.A.	2.000	1.800	1.500	0.500
2	1.667	1.000	1.000	1.200	1.500	N.A.
3	0.750	2.000	0.800	1.833	1.000	2.000
4	1.333	2.000	1.285	1.500	0.600	1.500
5	1.714	1.500	1.667	0.533	2.000	N.A.
6	1.429	1.000	0.714	1.333	1.000	3.000
7	1.286	0.500	1.200	1.200	1.333	0.500
8	1.444	2.000	1.333	1.571	1.000	1.000
9	1.600	0.667	1.143	1.000	0.250	N.A.
10	1.286	1.000	1.667	1.167	0.500	1.000
11	0.750	2.000	1.334	1.857	2.500	2.000
12	3.000	0.500	3.000	N.A.	N.A.	N.A.
13	3.000	3.000	4.000	1.700	4.000	3.000
14	1.667	2.000	3.000	1.000	N.A.	N.A.
15	2.083	5.000	3.000	2.333	1.750	2.000
16	3.750	3.500	1.667	1.750	5.000	6.000
17	3.000	1.000	4.000	2.000	2.000	.
18	4.667	2.000	5.000	2.429	.	.
19	1.667	2.000	2.500	6.000	.	1.500
20	3.000	0.500	2.750	1.333	.	.
21	3.000	1.000	1.667	.	.	1.000
22	2.667	3.000	2.000	1.889	.	2.000
23	1.750	1.000	1.000	1.500	1.000	0.600
24	1.176	2.000	2.167	1.235	1.600	2.000
25	2.600	1.333	1.333	0.778	.	1.500
26	1.333	1.000	1.222	1.667	0.667	1.500
27	1.273	1.083	1.239	1.519	0.957	1.393
28	0.625	0.667	1.278	1.148	2.250	0.692
29	1.273	1.500	0.923	1.720	2.000	1.333
30	2.400	4.000	2.333	2.800	.	1.000
31	2.143	0.500	2.500	2.077	2.000	2.000
32	1.824	5.333	1.800	1.847	2.308	2.333
33	1.364	2.000	2.000	2.364	2.000	4.000
34	1.600	5.000	1.583	1.645	2.000	5.500
35	4.000	2.000	2.000	2.750	2.330	0.750
36	3.600	2.500	2.250	1.909	1.250	1.000

OBS	SCH	PRG	IRCLR	IRRAN	IRSNW	IRDAY
37	037	R1	1.000	1.333	3.000	1.500
38	062	R1	1.406	1.455	1.000	1.342
39	170	R1	1.222	1.333	1.333	1.500
40	255	R1	1.545	0.333	1.000	1.250
41	365	R1	1.000	1.333	0.750	0.912
42	430	R1	0.571	0.800	2.000	0.900
43	508	R1	1.071	1.500	2.500	1.333
44	535	R1	1.073	1.875	1.000	1.262
45	547	R1	1.500	0.667	.	0.714
46	548	R1	1.214	.	0.800	1.308
47	549	R1	0.905	1.500	1.667	0.957
48	553	R1	1.333	1.333	0.333	1.113
49	597	R1	1.412	0.857	1.000	1.188
50	623	R1	1.158	1.100	0.444	1.083
51	624	R1	1.515	0.950	1.000	1.405
52	674	R1	1.333	1.000	2.667	1.563
53	680	R1	1.500	0.800	1.333	1.000
54	733	R1	1.889	0.667	1.000	1.308
55	736	R1	1.129	1.444	0.500	1.200
56	738	R1	0.886	1.545	1.000	1.061
57	750	R1	0.960	1.100	2.000	1.294
58	760	R1	1.032	1.214	1.333	1.158
59	043	R2	2.167	1.200	.	1.700
60	059	R2	2.375	0.013	.	7.500
61	081	R2	2.333	3.000	1.500	2.000
62	165	R2	1.853	2.438	1.429	2.190
63	166	R2	2.077	2.600	1.250	2.700
64	183	R2	2.375	3.667	.	2.625
65	256	R2	2.077	2.200	1.333	1.947
66	270	R2	2.714	2.500	1.000	2.444
67	307	R2	2.316	1.333	.	2.091
68	314	R2	1.889	4.000	1.125	1.760
69	323	R2	2.000	2.200	7.000	2.375
70	331	R2	1.941	1.667	2.000	1.600
71	349	R2	2.211	7.000	2.333	3.000
72	391	R2	2.115	1.857	2.750	2.577

OBS	IRNGT	IRDWN	IRAST	IRRER	IRATR	IRHLT
37	0.500	0.500	2.000	0.857	2.000	1.500
38	1.375	2.000	1.750	1.824	2.000	0.750
39	0.833	2.000	1.000	1.091	.	2.000
40	1.000	2.000	5.000	1.000	1.000	1.000
41	1.429	3.000	0.692	1.100	1.000	1.000
42	0.625	0.500	0.556	0.800	0.500	0.500
43	1.500	0.500	2.500	1.125	.	0.667
44	1.000	1.000	1.786	1.050	1.000	1.333
45	3.000	2.000	1.000	1.000	.	2.000
46	1.167	1.000	2.667	1.167	1.000	.
47	1.571	2.000	1.200	1.556	1.200	0.800
48	1.778	0.800	0.900	2.250	0.692	1.000
49	1.429	3.000	3.000	0.818	6.000	1.333
50	1.375	1.000	1.000	0.857	0.250	.
51	0.667	2.500	0.000	1.269	1.667	1.200
52	1.333	1.000	2.000	1.000	1.000	.
53	2.167	1.500	1.250	0.900	1.750	5.000
54	1.167	1.000	0.500	1.571	0.750	1.667
55	1.750	1.000	1.333	1.364	0.250	2.750
56	1.444	0.667	0.714	1.313	1.800	0.833
57	0.941	1.000	1.000	1.200	0.500	1.667
58	0.857	1.333	0.667	1.056	1.333	1.500
59	4.000	.	2.000	1.333	1.000	.
60	2.333	2.000	2.000	5.500	.	1.200
61	9.000	1.000	.	2.000	.	.
62	1.708	0.778	2.375	1.800	1.500	1.200
63	1.273	4.000	1.333	1.500	.	5.000
64	5.000	3.000	.	2.400	.	2.000
65	4.000	1.000	3.500	1.714	2.000	2.000
66	1.333	.	1.000	5.000	4.000	2.000
67	3.000	4.000	6.000	2.500	1.167	1.667
68	1.375	0.667	3.500	2.000	5.000	.
69	1.833	5.000	7.000	2.333	9.000	1.000
70	2.833	.	2.000	2.833	3.500	2.000
71	2.286	1.500	6.000	1.500	5.000	3.000
72	1.500	1.750	5.000	2.000	2.167	1.750

OBS	SCH	PRG	IRCLR	IRRAN	IRSNW	IRDAY
73	420	R2	2.143	2.500	.	4.000
74	492	R2	1.705	2.087	2.143	1.803
75	529	R2	2.556	2.000	1.500	2.556
76	556	R2	1.941	3.667	3.500	2.000
77	651	R2	1.618	2.273	7.000	2.296
78	701	R2	1.682	3.000	1.200	1.727
79	706	R2	1.733	2.833	2.000	2.043
80	785	R2	2.000	3.000	1.500	2.654
81	795	R2	1.826	1.500	.	1.905
82	114	T1	1.200	1.500	1.000	1.250
83	198	T1	1.222	1.000	0.714	1.222
84	295	T1	1.150	0.667	1.500	0.947
85	385	T1	1.231	1.000	1.667	1.000
86	450	T1	0.783	1.429	1.444	1.074
87	457	T1	1.211	0.875	1.000	1.167
88	482	T1	0.981	1.000	2.000	1.038
89	483	T1	1.094	0.944	0.929	0.932
90	486	T1	1.222	1.000	1.500	1.000
91	506	T1	1.235	0.333	0.750	0.957
92	635	T1	0.951	1.667	1.333	1.024
93	725	T1	1.083	2.000	1.000	1.286
94	753	T1	1.167	1.600	1.000	1.500
95	009	T2	5.333	2.000	1.500	3.250
96	035	T2	2.571	3.500	1.000	2.714
97	103	T2	3.500	.	1.500	3.667
98	147	T2	1.300	4.500	1.500	1.600
99	153	T2	1.636	2.750	3.500	2.000
100	187	T2	2.000	2.000	5.000	2.750
101	217	T2	1.875	1.500	2.000	1.778
102	439	T2	4.333	1.000	2.000	2.600
103	675	T2	2.143	2.250	2.000	1.938
104	705	T2	1.933	3.500	2.000	2.700
105	763	T2	1.968	2.273	2.500	2.483
106	772	T2	1.467	1.500	6.000	1.615
107	776	T2	1.250	2.500	4.000	2.100

OBS	IRNGT	IRDWN	IRAST	IRRER	IRATR	IRHLT
73	0.750	.	.	2.500	1.000	.
74	2.188	2.000	1.900	2.103	1.556	2.250
75	1.667	2.000	3.000	1.800	2.000	4.000
76	4.333	2.000	1.500	2.333	1.500	.
77	1.235	2.000	0.000	2.235	1.333	0.714
78	2.000	1.667	1.800	1.643	2.000	2.000
79	1.615	2.333	1.500	2.000	1.500	1.400
80	1.571	1.429	3.667	2.000	2.000	5.500
81	2.250	1.500	4.000	2.778	2.667	2.333
82	1.400	.	0.667	1.000	0.500	1.000
83	0.833	.	0.250	1.250	1.000	.
84	1.200	.	1.500	1.125	1.000	0.600
85	1.333	.	1.000	1.167	2.000	.
86	0.833	.	1.143	1.385	0.500	0.666
87	1.700	0.400	1.250	1.000	2.000	2.000
88	1.471	0.833	0.866	1.143	0.250	1.111
89	1.059	1.750	1.250	1.462	0.429	1.000
90	1.667	1.000	0.500	1.333	1.000	1.000
91	1.000	0.667	1.400	0.800	1.000	1.500
92	1.556	0.500	1.000	1.182	0.714	0.625
93	1.125	.	1.333	0.800	.	.
94	1.400	0.667	1.000	1.428	1.000	0.750
95	3.000	.	1.833	2.250	2.600	2.500
96	3.500	1.000	2.000	1.625	1.500	2.000
97	3.000	.	1.500	.	.	.
98	3.000	.	3.000	1.833	.	1.333
99	2.500	3.000	1.667	2.000	.	.
100	2.500	1.333	3.000	1.200	2.500	.
101	3.000	1.500	2.500	.	.	3.000
102	2.000	.	2.000	3.000	.	.
103	3.250	.	2.334	2.428	2.500	3.000
104	2.800	1.000	4.000	1.400	4.000	1.500
105	2.667	3.000	4.000	1.714	2.000	1.250
106	2.143	.	1.500	1.833	.	2.500
107	2.667	.	2.000	2.500	2.000	.

APPENDIX D

Histograms of IR and ACCRT Variables for various Programs

APPENDIX D

<u>Histograms of IR and ACCRT Variables for various Programs</u>

RANGE PROGRAM

FREQUENCY BAR CHART

```
FREQUENCY

    |            **
 30 +            **
    |            **   **
    |            **   **
    |            **   **   **
    |            **   **   **   **
 20 +            **   **   **   **
    |            **   **   **   **
    |            **   **   **   **
    |            **   **   **   **
    |            **   **   **   **
 10 +            **   **   **   **   **
    |            **   **   **   **   **
    |       **   **   **   **   **   **
    |       **   **   **   **   **   **
    |  **   **   **   **   **   **   **   **   **   **   **
    -----------------------------------------------------------
       0    1    1    1    1    2    2    2    2    3    3    4
       .    .    .    .    .    .    .    .    .    .    .    .
       8    0    2    5    7    0    2    5    7    0    5    0
       0    0    5    0    5    0    5    0    5    0    0    0

                              IR
```

TRADITIONAL PROGRAM

FREQUENCY BAR CHART

```
FREQUENCY

    |                 ***
 15 +                 ***
    |            ***  ***
    |            ***  ***
    |            ***  ***
    |            ***  ***
 10 +            ***  ***
    |            ***  ***  ***
    |       ***  ***  ***  ***
    |       ***  ***  ***  ***  ***
    |       ***  ***  ***  ***  ***
  5 +       ***  ***  ***  ***  ***
    |       ***  ***  ***  ***  ***  ***
    |       ***  ***  ***  ***  ***  ***
    |  ***  ***  ***  ***  ***  ***  ***
    |  ***  ***  ***  ***  ***  ***  ***  ***  ***  ***
    ---------------------------------------------------
      0.90 1.00 1.25 1.50 1.75 2.00 2.25 2.50 3.00 3.75

                            IR
```

COMPETENCY (COMM.) PROGRAM

FREQUENCY BAR CHART

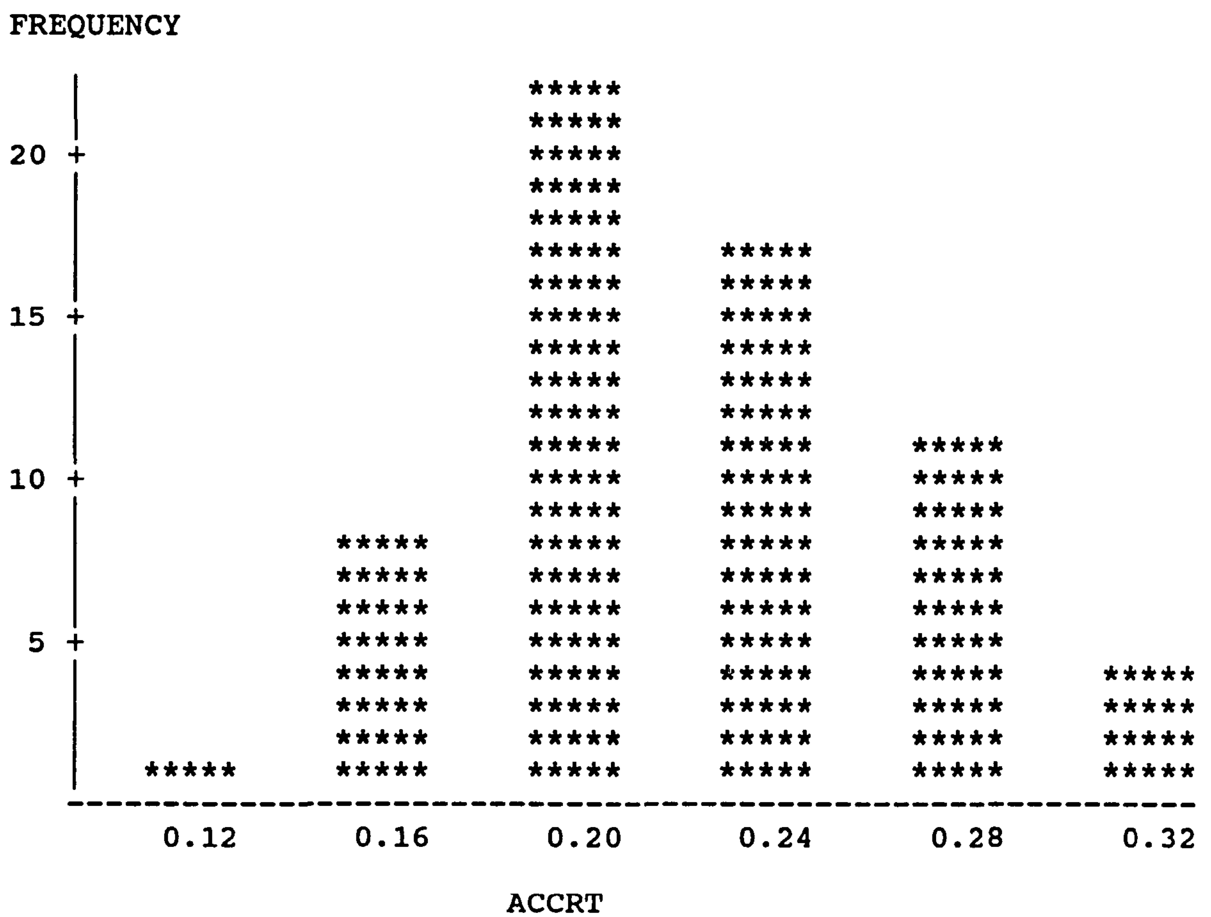
```
REQUENCY

13 +              *****
   |              *****
12 +              *****
   |              *****
11 +              *****     *****
   |              *****     *****
10 +              *****     *****
   |              *****     *****
 9 +              *****     *****
   |              *****     *****
 8 +              *****     *****
   |              *****     *****
 7 +              *****     *****
   |              *****     *****
 6 +    *****     *****     *****
   |    *****     *****     *****
 5 +    *****     *****     *****
   |    *****     *****     *****
 4 +    *****     *****     *****     *****
   |    *****     *****     *****     *****
 3 +    *****     *****     *****     *****
   |    *****     *****     *****     *****
 2 +    *****     *****     *****     *****
   |    *****     *****     *****     *****
 1 +    *****     *****     *****     *****                         *****
   |    *****     *****     *****     *****                         *****
   -----------------------------------------------------------------------
         1.25      1.50      1.75      2.00      2.25      2.50

                                IR
```

TRADITIONAL PROGRAM

FREQUENCY BAR CHART



COMPETENCY (PUB.) PROGRAM

FREQUENCY BAR CHART

```
FREQUENCY

   |                        *****
   |                        *****
   |                        *****
15 +                        *****
   |                        *****
   |              *****     *****
   |              *****     *****
   |              *****     *****
10 +              *****     *****
   |              *****     *****     *****
   |              *****     *****     *****               *****
   |              *****     *****     *****     *****     *****
   |              *****     *****     *****     *****     *****
 5 +              *****     *****     *****     *****     *****
   |              *****     *****     *****     *****     *****
   |              *****     *****     *****     *****     *****
   |    *****     *****     *****     *****     *****     *****
   |    *****     *****     *****     *****     *****     *****
  -----------------------------------------------------------
         0.15      0.18      0.21      0.24      0.27      0.30

                              ACCRT
```

COMPETENCY (COMM.) PROGRAM

FREQUENCY BAR CHART

```
FREQUENCY

12 +                    *****
   |                    *****
11 +                    *****
   |                    *****
10 +                    *****
   |                    *****
 9 +                    *****
   |                    *****
 8 +                    *****
   |                    *****
 7 +            *****   *****   *****
   |            *****   *****   *****
 6 +    *****   *****   *****   *****
   |    *****   *****   *****   *****
 5 +    *****   *****   *****   *****
   |    *****   *****   *****   *****
 4 +    *****   *****   *****   *****
   |    *****   *****   *****   *****
 3 +    *****   *****   *****   *****
   |    *****   *****   *****   *****
 2 +    *****   *****   *****   *****           *****
   |    *****   *****   *****   *****           *****
 1 +    *****   *****   *****   *****   *****   *****
   |    *****   *****   *****   *****   *****   *****
   -----------------------------------------------------
        0.225   0.250   0.275   0.300   0.325   0.350

                            ACCRT
```

APPENDIX E

ANOVA Tables used in Hypotheses Testing

APPENDIX E

ANOVA Tables Used in Hypotheses Testing

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 279

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: ACCRT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.07440236	0.02480079
ERROR	275	0.47316988	0.00172062
CORRECTED TOTAL	278	0.54757224	

MODEL F = 14.41 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	ACCRT MEAN
0.135877	18.0800	0.04148033	0.22942652

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.07440236	14.41	0.0001

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 279

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: CNVRT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.88006532	0.29335511
ERROR	275	1.54801961	0.00562916
CORRECTED TOTAL	278	2.42808493	

MODEL F = 52.11 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	CNVRT MEAN
0.362452	25.5032	0.07502774	0.29418996

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.88006532	52.11	0.0001

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	3	C R T

NUMBER OF OBSERVATIONS IN DATA SET = 244

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: ACCRT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.00157281	0.00078641
ERROR	241	0.43263714	0.00179517
CORRECTED TOTAL	243	0.43420995	

MODEL F = 0.44 PR > F = 0.6458

R-SQUARE	C.V.	ROOT MSE	ACCRT MEAN
0.003622	18.9736	0.04236950	0.22330738

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	2	0.00157281	0.44	0.6458

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	3	C R T

NUMBER OF OBSERVATIONS IN DATA SET = 244

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: CNVRT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.02620329	0.01310164
ERROR	241	1.04664492	0.00434292
CORRECTED TOTAL	243	1.07284821	

MODEL F = 1.02 PR > F = 0.1508

R-SQUARE	C.V.	ROOT MSE	CNVRT MEAN
0.024424	24.1185	0.06590087	0.27323770

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	2	0.02620329	1.02	0.1508

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 279

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.82825570	0.27608523
ERROR	275	71.40220301	0.25964437
CORRECTED TOTAL	278	72.23045871	

MODEL F = 1.06 PR > F = 0.3651

R-SQUARE	C.V.	ROOT MSE	IR MEAN
0.011467	30.8191	0.50955311	1.65336559

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.82825570	1.06	0.3651

2 PHASE VS 3 PHASE

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	2	2PH 3PH

NUMBER OF OBSERVATIONS IN DATA SET = 244

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	1	0.02778580	0.02778580
ERROR	242	69.90796421	0.28887589
CORRECTED TOTAL	243	69.93575001	

MODEL F = 0.10 PR > F = 0.7567

R-SQUARE	C.V.	ROOT MSE	IR MEAN
0.000397	32.4049	0.53747175	1.65861066

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	1	0.02778580	0.10	0.7567

DETROIT

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 94

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.21040042	0.07013347
ERROR	90	8.94699941	0.09941110
CORRECTED TOTAL	93	9.15739983	

MODEL F = 0.71 PR > F = 0.5512

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.022976	19.9170	0.31529527	1.58304255

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.21040042	0.71	0.5512

URBAN

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 96

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.35358119	0.45119373
ERROR	92	26.97341005	0.29318924
CORRECTED TOTAL	95	28.32699124	

MODEL F = 1.54 PR > F = 0.2097

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.047784	31.5016	0.54146952	1.71886458

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.35358119	1.54	0.2097

RURAL

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 89

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: TRI

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.56651798	0.18883933
ERROR	85	33.30166901	0.39178434
CORRECTED TOTAL	88	33.86818699	

MODEL F = 0.48 PR > F = 0.6957

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.016727	37.7750	0.62592679	1.65698876

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.56651798	0.48	0.6957

Conpetency program (public)

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
GLC	3	1 2 3

NUMBER OF OBSERVATIONS IN DATA SET = 57

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.90186847	0.45093424
ERROR	54	29.17102725	0.54020421
CORRECTED TOTAL	56	30.07289572	
MODEL F =	0.83		PR > F = 0.4395

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.029989	41.9416	0.73498586	1.75240351

SOURCE	DF	ANOVA SS	F VALUE	PR > F
GLC	2	0.90186847	0.83	0.4395

Range

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
GLC	3	1 2 3

NUMBER OF OBSERVATIONS IN DATA SET = 124

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.88049027	0.44024514
ERROR	121	22.03672615	0.18212170
CORRECTED TOTAL	123	22.91721642	

MODEL F = 2.42 PR > F = 0.0935

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.038420	25.8937	0.42675720	1.64811290

SOURCE	DF	ANOVA SS	F VALUE	PR > F
GLC	2	0.88049027	2.42	0.0935

Traditional Program

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
GLC	3	1 2 3

NUMBER OF OBSERVATIONS IN DATA SET = 63

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.02705935	0.01352968
ERROR	60	16.14383192	0.26906387
CORRECTED TOTAL	62	16.17089127	

MODEL F = 0.05 PR > F = 0.9510

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.001673	32.5332	0.51871366	1.59441270

SOURCE	DF	ANOVA SS	F VALUE	PR > F
GLC	2	0.02705935	0.05	0.9510

Competency Program (comm.)

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
GLC	3	1 2 3

NUMBER OF OBSERVATIONS IN DATA SET = 35

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	2	0.37070645	0.18535323
ERROR	32	1.87049315	0.05845291
CORRECTED TOTAL	34	2.24119960	

MODEL F = 3.17 PR > F = 0.0654

R-SQUARE	C.V.	ROOT MSE	TRI MEAN
0.165405	14.9536	0.24177037	1.61680000

SOURCE	DF	ANOVA SS	F VALUE	PR > F
GLC	2	0.37070645	3.17	0.0654

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRCLR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.08191564	0.02730521
ERROR	49	2.73270308	0.05576945
CORRECTED TOTAL	52	2.81461872	

MODEL F = 0.49 PR > F = 0.6911

R-SQUARE	C.V.	ROOT MSE	IRCLR MEAN
0.029104	20.0777	0.23615556	1.17620755

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.08191564	0.49	0.6911

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRRAN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.27981229	0.09327076
ERROR	48	6.48353978	0.13507375
CORRECTED TOTAL	51	6.76335208	

MODEL F = 0.69 PR > F = 0.5623

R-SQUARE	C.V.	ROOT MSE	IRRAN MEAN
0.041372	30.8893	0.36752380	1.18980769

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.27981229	0.69	0.5623

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRSNW

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.08104876	0.02701625
ERROR	45	18.19395724	0.40431016
CORRECTED TOTAL	48	18.27500600	

MODEL F = 0.07 PR > F = 0.9772

R-SQUARE	C.V.	ROOT MSE	IRSNW MEAN
0.004435	49.8765	0.63585388	1.27485714

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.08104876	0.07	0.9772

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRDAY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.28511733	0.09503911
ERROR	49	2.49951286	0.05101047
CORRECTED TOTAL	52	2.78463019	

MODEL F = 1.86 PR > F = 0.1481

R-SQUARE	C.V.	ROOT MSE	IRDAY MEAN
0.102390	18.7177	0.22585497	1.20664151

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.28511733	1.86	0.1481

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRDWN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.94968783	0.64989594
ERROR	42	18.18953732	0.43308422
CORRECTED TOTAL	45	20.13922515	
MODEL F =	1.50		PR > F = 0.2283

R-SQUARE	C.V.	ROOT MSE	IRDWN MEAN
0.096810	50.9916	0.65809135	1.29058696

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.94968783	1.50	0.2283

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRNGT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.13481934	0.04493978
ERROR	49	11.08815273	0.22628883
CORRECTED TOTAL	52	11.22297208	

MODEL F = 0.20 PR > F = 0.8968

R-SQUARE	C.V.	ROOT MSE	IRNGT MEAN
0.012013	36.2538	0.47569826	1.31213208

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.13481934	0.20	0.8968

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRAST

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.77590894	0.59196965
ERROR	49	29.21960430	0.59631846
CORRECTED TOTAL	52	30.99551325	
MODEL F =	0.99		PR > F = 0.4041

R-SQUARE	C.V.	ROOT MSE	IRAST MEAN
0.057296	59.3332	0.77221659	1.30149057

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.77590894	0.99	0.4041

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRRER

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.41913600	0.13971200
ERROR	49	5.48418087	0.11192206
CORRECTED TOTAL	52	5.90331687	

MODEL F = 1.25 PR > F = 0.3024

R-SQUARE	C.V.	ROOT MSE	IRRER MEAN
0.071000	26.9452	0.33454754	1.24158491

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.41913600	1.25	0.3024

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRATR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.43706578	0.47902193
ERROR	44	38.07857014	0.86542205
CORRECTED TOTAL	47	39.51563592	

MODEL F = 0.55 PR > F = 0.6485

R-SQUARE	C.V.	ROOT MSE	IRATR MEAN
0.036367	76.0163	0.93028063	1.22379167

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.43706578	0.55	0.6485

Higher Ranked schools

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 53

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRHLT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.56997688	0.52332563
ERROR	40	26.84317703	0.67107943
CORRECTED TOTAL	43	28.41315391	

MODEL F = 0.78 PR > F = 0.5122

R-SQUARE	C.V.	ROOT MSE	IRHLT MEAN
0.055255	60.8142	0.81919438	1.34704545

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.56997688	0.78	0.5122

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRCLR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	6.69943375	2.23314458
ERROR	50	55.42763596	1.10855272
CORRECTED TOTAL	53	62.12706970	

MODEL F = 2.01 PR > F = 0.1238

R-SQUARE	C.V.	ROOT MSE	IRCLR MEAN
0.107834	45.7390	1.05287830	2.30192593

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	6.69943375	2.01	0.1238

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRRAN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	2.03510032	0.67836677
ERROR	49	69.04816889	1.40914630
CORRECTED TOTAL	52	71.08326921	
MODEL F =	0.48		PR > F = 0.6967

R-SQUARE	C.V.	ROOT MSE	IRRAN MEAN
0.028630	48.4427	1.18707468	2.45047170

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	2.03510032	0.48	0.6967

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRSNW

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	9.98792466	3.32930822
ERROR	43	132.67578019	3.08548326
CORRECTED TOTAL	46	142.66370485	

MODEL F = 1.08 PR > F = 0.3681

R-SQUARE	C.V.	ROOT MSE	IRSNW MEAN
0.070010	62.0989	1.75655437	2.82863830

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	9.98792466	1.08	0.3681

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRDAY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.53250338	0.51083446
ERROR	50	51.79341899	1.03586838
CORRECTED TOTAL	53	53.32592237	

MODEL F = 0.49 PR > F = 0.6887

R-SQUARE	C.V.	ROOT MSE	IRDAY MEAN
0.028738	40.9855	1.01777619	2.48325926

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.53250338	0.49	0.6887

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRDWN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	6.24510541	2.08170180
ERROR	39	67.18209250	1.72261776
CORRECTED TOTAL	42	73.42719791	

MODEL F = 1.21 PR > F = 0.3194

R-SQUARE	C.V.	ROOT MSE	IRDWN MEAN
0.085052	59.2264	1.31248534	2.21604651

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	6.24510541	1.21	0.3194

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRNGT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	1.21616046	0.40538682
ERROR	50	86.18359768	1.72367195
CORRECTED TOTAL	53	87.39975815	

MODEL F = 0.24 PR > F = 0.8714

R-SQUARE	C.V.	ROOT MSE	IRNGT MEAN
0.013915	49.3903	1.31288688	2.65818519

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	1.21616046	0.24	0.8714

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRAST

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	5.94237829	1.98079276
ERROR	47	86.49017587	1.84021651
CORRECTED TOTAL	50	92.43255416	

MODEL F = 1.08   PR > F = 0.3682

R-SQUARE	C.V.	ROOT MSE	IRAST MEAN
0.064289	50.3305	1.35654580	2.69527451

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	5.94237829	1.08	0.3682

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRRER

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.98237360	0.32745787
ERROR	46	43.32012048	0.94174175
CORRECTED TOTAL	49	44.30249408	

MODEL F = 0.35   PR > F = 0.7909

R-SQUARE	C.V.	ROOT MSE	IRRER MEAN
0.022174	43.5508	0.97043379	2.22828000

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.98237360	0.35	0.7909

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRATR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	3.75458787	1.25152929
ERROR	32	82.29124635	2.57160145
CORRECTED TOTAL	35	86.04583422	
MODEL F =	0.49		PR > F = 0.6939

R-SQUARE	C.V.	ROOT MSE	IRATR MEAN
0.043635	63.0052	1.60362135	2.54522222

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	3.75458787	0.49	0.6939

LOWER RANKED SCHOOLS

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PRG	4	C P R T

NUMBER OF OBSERVATIONS IN DATA SET = 54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: IRHLT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	0.73417465	0.24472488
ERROR	35	68.28326965	1.95095056
CORRECTED TOTAL	38	69.01744431	

MODEL F = 0.13 PR > F = 0.9444

R-SQUARE	C.V.	ROOT MSE	IRHLT MEAN
0.010638	60.4056	1.39676432	2.31230769

SOURCE	DF	ANOVA SS	F VALUE	PR > F
PRG	3	0.73417465	0.13	0.9444

APPENDIX F

1. Determination of Weights for Different Types of Accident.

2. List of Schools in Ranking Order.

3. List of Consistent Schools on various Criterion Variables.

APPENDIX F

Determination of Weight for Different Types of Accidents:

The weight for each type of accident is taken as equal to the average dollar value of each type of accident. To determine the average dollar value by type of accident, three steps were followed:

1. The percentage of fatal, injury and property damage (PDO) accidents in each type of accident were determined from the state-wide accident data for year 1988 as shown below:

Types of accidents	% of fatal accidents	% of injury accidents	% of PDO accidents
Pedestrian	4.91	91.33	3.76
Bicyle	0.94	84.50	14.56
Hit train	6.0	41.35	52.65
over-turned	1.13	56.82	42.05
Fixed object	0.62	30.33	69.05
Other object	0.05	11.98	87.97
Parking	0.05	8.3	91.65
Backing	0	5.79	94.21
Animal	0.008	2.34	97.65
Head-on	2.70	37.62	59.68
Angle	0.49	38.85	60.66
Rear-end	0.11	21.65	78.24
Side swipe (meeting)	0.0	20.65	79.35
Side swipe (passing)	0.0	12.46	87.54
Driveway	0.12	28.68	71.17

2. These percentages were multiplied by the respective average dollar value of fatal, injury and PDO accidents. The average dollar value taken for fatal, injury and PDO accidents are as follows (25):

   i) The cost of a fatal accident is $ 32,500.

ii) The cost of an injury accident is $ 6,100.

iii) The cost of a PDO accident taken is $ 1,150.

3. The weight of each accident type is equal to the summation of these three products.

Weight of an accident type = % of fatal * cost of fatal + % of injury * cost of injury + % of PDO * cost of PDO

The weight computed for each type of accident is as follows:

Types of accidents	Weight
Pedestrian	72,1012
Bicyle	56,2744
Hit train	50,7783
over-turned	43,1685
Fixed object	28,4570
Other object	17.5540
Parking	15,6200
Backing	14,3700
Animal	12,6800
Head-on	38,6000
Angle	32,4560
Rear-end	23,5660
Side swipe (meeting)	21,7300
Side swipe (passing)	17,6182
Driveway	20,5880

List of Schools in Ranking Order

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
1	763	1	T	6.20
2	790	2	C	6.67
3	740	4	R	7.07
4	623	4	R	7.10
5	785	4	R	7.46
6	795	4	R	7.56
7	462	4	R	7.76
8	226	2	C	7.84
9	260	1	T	7.98
10	736	4	R	7.98
11	042	4	R	8.22
12	420	4	R	8.22
13	198	1	T	8.38
14	020	4	R	8.42
15	635	1	T	8.71
16	256	4	R	8.72
17	171	4	R	8.74
18	543	4	R	8.75
19	675	1	T	8.79
20	009	1	T	8.80
21	442	2	C	8.89
22	701	4	R	9.03
23	741	4	R	9.03
24	276	4	R	9.06
25	770	1	T	9.06
26	555	4	R	9.11
27	429	2	C	9.14
28	188	1	T	9.15
29	746	4	R	9.17
30	769	2	C	9.19
31	518	4	R	9.24
32	777	2	C	9.25
33	738	4	R	9.30
34	535	4	R	9.35
35	547	4	R	9.37
36	760	4	R	9.38
37	570	2	C	9.40
38	439	1	T	9.40
39	365	4	R	9.50
40	103	1	T	9.57
41	539	2	C	9.58
42	169	4	R	9.66
43	781	2	C	9.67
44	618	2	C	9.67
45	422	2	C	9.73

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
46	772	1	T	9.74
47	712	1	T	9.78
48	270	4	R	9.81
49	735	4	R	9.86
50	409	1	T	9.92
51	706	4	R	9.95
52	674	4	R	9.99
53	750	4	R	10.01
54	180	4	R	10.02
55	088	4	R	10.03
56	444	2	C	10.04
57	166	4	R	10.05
58	128	2	C	10.08
59	136	2	C	10.19
60	556	4	R	10.28
61	406	1	T	10.33
62	035	1	T	10.34
63	259	2	C	10.35
64	253	5	S	10.39
65	687	2	C	10.40
66	528	6	F	10.41
67	722	4	R	10.42
68	349	4	R	10.44
69	548	4	R	10.47
70	773	4	R	10.47
71	428	4	R	10.48
72	367	1	T	10.49
73	469	2	C	10.49
74	A77	3	P	10.50
75	776	1	T	10.51
76	766	4	R	10.52
77	425	2	C	10.54
78	723	4	R	10.55
79	314	4	R	10.59
80	172	4	R	10.63
81	782	1	T	10.69
82	670	2	C	10.70
83	733	4	R	10.71
84	684	4	R	10.73
85	186	2	C	10.76
86	617	1	T	10.76
87	551	4	R	10.83
88	486	1	T	10.86
89	043	4	R	10.87
90	624	4	R	10.94

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
91	052	4	R	10.95
92	980	3	P	10.95
93	415	2	C	10.99
94	680	4	R	11.11
95	029	2	C	11.14
96	154	1	T	11.15
97	536	1	T	11.15
98	187	1	T	11.16
99	778	2	C	11.16
100	392	2	C	11.19
101	182	2	C	11.23
102	715	1	T	11.27
103	753	1	T	11.31
104	789	4	R	11.34
105	049	6	F	11.35
106	784	2	C	11.38
107	757	1	T	11.43
108	A83	3	P	11.45
109	147	1	T	11.49
110	217	1	T	11.51
111	385	1	T	11.52
112	167	1	T	11.56
113	441	2	C	11.59
114	457	1	T	11.63
115	419	4	R	11.64
116	307	4	R	11.64
117	591	1	T	11.66
118	603	4	R	11.67
119	178	4	R	11.69
120	331	4	R	11.69
121	725	1	T	11.72
122	170	4	R	11.73
123	A56	3	P	11.87
124	532	4	R	11.88
125	430	4	R	11.88
126	355	6	F	11.91
127	410	2	C	11.91
128	975	3	P	11.94
129	295	1	T	11.96
130	343	4	R	11.96
131	421	4	R	11.99
132	OSS	3	P	12.01
133	057	4	R	12.03
134	342	4	R	12.03
135	780	2	C	12.04

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
136	070	4	R	12.09
137	344	4	R	12.12
138	184	4	R	12.14
139	053	2	C	12.18
140	530	4	R	12.21
141	597	4	R	12.21
142	490	1	T	12.29
143	705	1	T	12.30
144	641	2	C	12.37
145	754	5	S	12.37
146	700	4	R	12.39
147	720	1	T	12.39
148	320	4	R	12.40
149	554	2	C	12.42
150	531	2	C	12.42
151	468	4	R	12.44
152	177	4	R	12.45
153	255	4	R	12.55
154	525	2	C	12.59
155	434	1	T	12.61
156	077	4	R	12.65
157	076	2	C	12.66
158	321	4	R	12.67
159	017	4	R	12.70
160	719	1	T	12.73
161	345	4	R	12.76
162	529	4	R	12.77
163	553	4	R	12.79
164	075	6	F	12.79
165	503	4	R	12.79
166	537	2	C	12.80
167	A05	3	P	12.82
168	615	2	C	12.83
169	599	4	R	12.87
170	408	1	T	12.89
171	062	4	R	12.93
172	165	4	R	12.94
173	509	4	R	13.01
174	984	3	P	13.02
175	A35	3	P	13.04
176	650	2	C	13.04
177	208	1	T	13.05
178	152	4	R	13.09
179	015	4	R	13.11
180	583	1	T	13.11

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
181	377	4	R	13.14
182	041	1	T	13.20
183	494	1	T	13.20
184	526	1	T	13.24
185	974	3	P	13.25
186	627	4	R	13.27
187	183	4	R	13.29
188	714	2	C	13.33
189	965	3	P	13.35
190	014	4	R	13.39
191	598	4	R	13.43
192	638	2	C	13.46
193	600	1	T	13.47
194	669	2	C	13.47
195	A88	3	P	13.49
196	393	2	C	13.49
197	081	4	R	13.53
198	206	4	R	13.58
199	037	4	R	13.61
200	417	2	C	13.66
201	387	1	T	13.66
202	391	4	R	13.83
203	999	3	P	13.84
204	254	4	R	13.89
205	407	4	R	13.92
206	348	4	R	13.93
207	395	1	T	13.96
208	A86	3	P	14.00
209	411	1	T	14.02
210	A63	3	P	14.03
211	651	4	R	14.03
212	114	1	T	14.15
213	495	2	C	14.15
214	316	4	R	14.19
215	977	3	P	14.20
216	527	6	F	14.31
217	601	4	R	14.33
218	508	4	R	14.34
219	323	4	R	14.40
220	252	4	R	14.44
221	317	4	R	14.50
222	622	4	R	14.51
223	710	5	S	14.57
224	366	4	R	14.60
225	A39	3	P	14.61

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
226	052	4	R	14.67
227	680	4	R	14.70
228	981	3	P	14.70
229	153	1	T	14.72
230	A56	3	P	14.73
231	525	2	C	14.75
232	036	2	C	14.75
233	326	4	R	14.79
234	340	4	R	14.80
235	039	5	S	14.81
236	546	2	C	14.82
237	478	2	C	14.84
238	347	4	R	14.85
239	289	1	T	14.87
240	258	4	R	14.88
241	267	4	R	14.90
242	482	1	T	14.92
243	992	3	P	14.93
244	303	4	R	14.95
245	339	1	T	14.96
246	492	4	R	14.99
247	163	1	T	15.01
248	559	4	R	15.05
249	560	4	R	15.09
250	483	1	T	15.11
251	412	2	C	15.14
252	507	2	C	15.17
253	A04	3	P	15.36
254	A21	3	P	15.41
255	394	4	R	15.54
256	431	2	C	15.57
257	707	1	T	15.61
258	301	4	R	15.66
259	334	6	F	15.70
260	541	4	R	15.74
261	194	2	C	15.84
262	A10	3	P	15.90
263	A08	3	P	15.96
264	633	2	C	16.05
265	951	3	P	16.11

ACCIDENT RATING SCORE

RANK	SCH	TYP	PRG	SCR/STU
266	A45	3	P	16.17
267	332	4	R	16.22
268	A65	3	P	16.42
269	629	2	C	16.46
270	A82	3	P	16.48
271	549	4	R	16.55
272	134	2	C	16.85
273	455	1	T	16.85
274	350	1	T	16.89
275	269	2	C	16.93
276	A62	3	P	16.94
277	471	4	R	16.97
278	059	4	R	17.00
279	545	1	T	17.02
280	616	4	R	17.13
281	506	1	T	17.14
282	450	1	T	17.32
283	A48	3	P	17.36
284	416	1	T	17.74
285	538	2	C	17.76
286	A24	3	P	17.79
287	544	4	R	18.50
288	413	2	C	18.70
289	959	3	P	21.41
290	044	5	S	33.01

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
1	182	C	0.2165
2	256	R	0.2870
3	457	T	0.3075
4	442	C	0.3170
5	187	T	0.3175
6	530	R	0.3285
7	411	T	0.3340
8	367	T	0.3355
9	421	R	0.3355
10	444	C	0.3380
11	042	R	0.3380
12	169	R	0.3470
13	177	R	0.3475
14	675	T	0.3700
15	188	T	0.3770
16	365	R	0.3805
17	539	C	0.3815
18	415	C	0.3845
19	680	R	0.3855
20	618	C	0.3930
21	629	C	0.3935
22	429	C	0.3960
23	623	R	0.3970
24	670	C	0.3990
25	635	T	0.4020
26	166	R	0.4020
27	152	R	0.4025
28	687	C	0.4030
29	556	R	0.4030
30	706	R	0.4035
31	009	T	0.4060
32	641	C	0.4075
33	617	T	0.4120
34	307	R	0.4140
35	178	R	0.4175
36	518	R	0.4180
37	790	C	0.4185
38	422	C	0.4195
39	180	R	0.4210
40	410	C	0.4310
41	165	R	0.4315
42	077	R	0.4315
43	198	T	0.4395
44	769	C	0.4400
45	419	R	0.4410

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
46	430	R	0.4410
47	547	R	0.4415
48	615	C	0.4435
49	167	T	0.4440
50	406	T	0.4440
51	782	T	0.4455
52	029	C	0.4460
53	020	R	0.4465
54	669	C	0.4465
55	674	R	0.4475
56	260	T	0.4500
57	773	R	0.4515
58	194	C	0.4530
59	627	R	0.4535
60	701	R	0.4545
61	331	R	0.4550
62	462	R	0.4550
63	088	R	0.4565
64	707	T	0.4620
65	184	R	0.4630
66	763	T	0.4640
67	171	R	0.4645
68	037	R	0.4650
69	555	R	0.4655
70	035	T	0.4655
71	549	R	0.4725
72	226	C	0.4735
73	684	R	0.4735
74	777	C	0.4740
75	551	R	0.4750
76	276	R	0.4765
77	128	C	0.4775
78	712	T	0.4775
79	393	C	0.4805
80	409	T	0.4815
81	172	R	0.4820
82	532	R	0.4825
83	259	C	0.4830
84	545	T	0.4835
85	624	R	0.4850
86	570	C	0.4855
87	486	T	0.4870
88	070	R	0.4875
89	439	T	0.4875
90	537	C	0.4905

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
91	753	T	0.4915
92	A77	P	0.4935
93	785	R	0.4935
94	714	C	0.4985
95	057	R	0.4990
96	183	R	0.4995
97	420	R	0.5010
98	425	C	0.5020
99	428	R	0.5050
100	776	T	0.5060
101	560	R	0.5065
102	270	R	0.5115
103	754	S	0.5165
104	295	T	0.5170
105	391	R	0.5170
106	543	R	0.5235
107	795	R	0.5240
108	526	T	0.5250
109	255	R	0.5255
110	326	R	0.5280
111	741	R	0.5290
112	789	R	0.5315
113	043	R	0.5340
114	559	R	0.5375
115	772	T	0.5400
116	348	R	0.5425
117	455	T	0.5425
118	733	R	0.5435
119	781	C	0.5455
120	760	R	0.5475
121	076	C	0.5520
122	736	R	0.5520
123	062	R	0.5525
124	738	R	0.5535
125	548	R	0.5555
126	725	T	0.5580
127	715	T	0.5585
128	638	C	0.5600
129	392	C	0.5645
130	740	R	0.5645
131	525	C	0.5650
132	408	T	0.5670
133	186	C	0.5695
134	531	C	0.5710
135	267	R	0.5740

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
136	441	C	0.5740
137	014	R	0.5750
138	258	R	0.5765
139	163	T	0.5785
140	339	T	0.5795
141	049	F	0.5810
142	591	T	0.5840
143	036	C	0.5845
144	633	C	0.5850
145	303	R	0.5865
146	528	F	0.5905
147	321	R	0.5930
148	349	R	0.5970
149	746	R	0.5980
150	583	T	0.6015
151	494	T	0.6020
152	314	R	0.6025
153	622	R	0.6035
154	385	T	0.6070
155	114	T	0.6085
156	723	R	0.6085
157	735	R	0.6100
158	412	C	0.6105
159	535	R	0.6115
160	355	F	0.6140
161	041	T	0.6145
162	017	R	0.6150
163	434	T	0.6150
164	541	R	0.6160
165	154	T	0.6165
166	482	T	0.6245
167	289	T	0.6285
168	344	R	0.6295
169	597	R	0.6295
170	490	T	0.6305
171	A56	P	0.6310
172	784	C	0.6310
173	170	R	0.6315
174	395	T	0.6325
175	332	R	0.6345
176	720	T	0.6350
177	553	R	0.6370
178	965	P	0.6370
179	974	P	0.6375
180	770	T	0.6380

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
181	503	R	0.6385
182	075	F	0.6390
183	366	R	0.6390
184	601	R	0.6395
185	136	C	0.6405
186	431	C	0.6420
187	206	R	0.6425
188	340	R	0.6435
189	554	C	0.6495
190	A83	P	0.6510
191	778	C	0.6515
192	345	R	0.6525
193	468	R	0.6540
194	700	R	0.6540
195	766	R	0.6545
196	536	T	0.6580
197	977	P	0.6615
198	A45	P	0.6635
199	342	R	0.6640
200	153	T	0.6675
201	417	C	0.6680
202	394	R	0.6710
203	722	R	0.6730
204	506	T	0.6745
205	053	C	0.6755
206	134	C	0.6770
207	600	T	0.6780
208	750	R	0.6785
209	495	C	0.6805
210	320	R	0.6835
211	469	C	0.6835
212	507	C	0.6880
213	413	C	0.6890
214	147	T	0.6900
215	A35	P	0.6930
216	603	R	0.6935
217	059	R	0.6955
218	407	R	0.6970
219	377	R	0.7025
220	208	T	0.7105
221	252	R	0.7120
222	705	T	0.7130
223	508	R	0.7145
224	538	C	0.7155
225	217	T	0.7175

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
226	052	R	0.7185
227	710	S	0.7190
228	269	C	0.7195
229	416	T	0.7215
230	483	T	0.7290
231	253	S	0.7305
232	A39	P	0.7320
233	616	R	0.7325
234	323	R	0.7360
235	529	R	0.7385
236	015	R	0.7455
237	546	C	0.7460
238	780	C	0.7490
239	757	T	0.7530
240	599	R	0.7580
241	343	R	0.7590
242	999	P	0.7610
243	478	C	0.7615
244	A65	P	0.7670
245	081	R	0.7690
246	450	T	0.7755
247	301	R	0.7805
248	544	R	0.7810
249	A21	P	0.7835
250	387	T	0.7860
251	719	T	0.7865
252	992	P	0.7870
253	598	R	0.7880
254	350	T	0.7905
255	A63	P	0.7935
256	A60	P	0.7970
257	651	R	0.8045
258	347	R	0.8075
259	981	P	0.8095
260	254	R	0.8125
261	650	C	0.8140
262	A05	P	0.8180
263	OSS	P	0.8330
264	980	P	0.8370
265	103	T	0.8430

CONVICTION RATING SCORE

RANK	SCH	PRG	SCR/STU
266	492	R	0.8510
267	984	P	0.8615
268	A86	P	0.8715
269	A24	P	0.8770
270	A08	P	0.8795
271	527	F	0.9160
272	973	P	0.9245
273	471	R	0.9300
274	A82	P	0.9315
275	334	F	0.9410
276	966	P	0.9430
277	039	S	0.9690
278	A48	P	0.9830
279	316	R	0.9905
280	951	P	1.0280
281	A10	P	1.0395
282	A09	P	1.0515
283	A62	P	1.0840
284	509	R	1.1130
285	317	R	1.1340
286	A88	P	1.3745
287	975	P	1.4010
288	A04	P	1.4540
289	959	P	1.4785
290	044	S	1.6415

List of consistent schools on various criterion variables in higher ranked group over the two year period.

	Code of consistent schools in higher ranked group on criterion variable						
S.N.	IR	Acc/stu	Scr/stu	S.N.	IR	Acc/stu	Scr/stu
1.	A04	009	009	47.	355	509	439
2.	A05	020	020	48.	366	518	442
3.	A09	035	035	49.	385	525	462
4.	A21	042	042	50.	387	526	486
5.	A39	053	052	51.	393	529	508
6.	A62	077	053	52.	395	530	509
7.	A65	103	075	53.	406	532	518
8.	A82	128	077	54.	407	535	525
9.	A88	147	088	55.	415	543	526
10.	014	166	103	56.	417	547	529
11.	029	169	128	57.	419	553	530
12.	036	170	136	58.	429	554	532
13.	037	171	121	59.	430	555	535
14.	039	172	147	60.	431	556	539
15.	041	178	166	61.	434	570	547
16.	049	180	169	62.	441	617	554
17.	052	184	172	63.	442	618	570
18.	053	186	178	64.	450	625	618
19.	062	188	180	65.	455	624	623
20.	070	198	184	66.	462	635	624
21.	088	208	186	67.	478	670	635
22.	114	226	188	68.	482	674	674
23.	152	256	198	69.	483	675	675
24.	163	260	208	70.	486	701	701
25.	167	270	226	71.	490	712	706
26.	170	276	256	72.	495	722	712
27.	171	320	260	73.	506	723	719
28.	172	344	270	74.	508	725	733
29.	182	367	276	75.	518	733	736
30.	184	385	320	76.	527	735	738
31.	188	395	342	77.	530	736	740
32.	208	408	349	78.	531	738	741
33.	252	409	365	79.	536	740	750
34.	253	410	367	80.	539	741	760
35.	254	411	377	81.	545	746	763
36.	255	415	391	82.	546	750	770
37.	258	420	406	83.	547	754	772
38.	267	421	408	84.	548	757	778
39.	289	422	409	85.	549	760	780
40.	295	428	411	86.	553	763	781
41.	301	429	415	87.	555	766	784
42.	316	442	420	88.	559	769	785
43.	317	462	421	89.	591	772	790
44.	339	478	422	90.	597	773	795
45.	344	486	428	91.	598	776	
46.	347	508	429	92.	599	777	

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List of consistent schools on various criterion variables in higher ranked group over the two year period (continued).

	Code of consistent schools in higher ranked group on criterion variable					
S.N.	IR	Acc/stu	Scr/stu	S.N.	IR	Acc/stu	Scr/stu
93.	600	778					
94.	601	780					
95.	615	781					
96.	623	784					
97.	624	785					
98.	635	789					
99.	638	790					
100.	641	795					
101.	650						
102.	670						
103.	674						
104.	680						
105.	684						
106.	700						
107.	720						
108.	722						
109.	723						
110.	725						
111.	733						
112.	736						
113.	738						
114.	740						
115.	741						
116.	750						
117.	753						
118.	754						
119.	757						
120.	760						
121.	770						
122.	789						
123.	790						
124.	959						
125.	965						
126.	966						
127.	975						
128.	980						
129.	984						
130.	999						

List of consistent schools on various criterion variables in lower ranked group over the two year period.

	Code of consistent schools in lower ranked group on criterion variable						
S.N.	IR	Acc/stu	Scr/stu	S.N.	IR	Acc/stu	Scr/stu
1.	A83	A04	A04	47.		334	407
2.	A86	A05	A05	48.		339	412
3.	009	A09	A09	49.		340	413
4.	035	A10	A10	50.		345	416
5.	043	A21	A21	51.		349	417
6.	057	A24	A24	52.		350	434
7.	075	A39	A35	53.		366	455
8.	081	A45	A39	54.		387	471
9.	128	A48	A45	55.		394	482
10.	147	A62	A48	56.		407	483
11.	153	A63	A62	57.		412	492
12.	165	A65	A63	58.		413	527
13.	178	A82	A65	59.		416	538
14.	186	A86	A82	60.		417	541
15.	187	OSS	A86	61.		434	544
16.	226	015	OSS	62.		441	545
17.	270	029	015	63.		450	546
18.	307	044	044	64.		455	549
19.	349	049	057	65.		469	559
20.	391	057	059	66.		471	560
21.	392	059	062	67.		482	598
22.	410	062	134	68.		483	599
23.	420	081	152	69.		492	600
24.	428	114	154	70.		527	601
25.	469	134	163	71.		538	615
26.	471	152	183	72.		541	616
27.	532	154	194	73.		544	627
28.	543	163	206	74.		545	629
29.	556	182	252	75.		546	633
30.	616	183	253	76.		549	641
31.	622	194	258	77.		559	651
32.	675	206	289	78.		560	669
33.	701	217	301	79.		597	684
34.	706	252	314	80.		598	700
35.	707	253	316	81.		599	705
36.	710	254	317	82.		601	710
37.	763	258	321	83.		615	951
38.	778	267	326	84.		627	959
39.	781	289	332	85.		629	966
40.	785	301	334	86.		633	973
41.	977	314	339	87.		651	977
42.		316	340	88.		669	999
43.		317	350	89.		700	
44.		323	366	90.		705	
45.		326	387	91.		710	
46.		332	394	92.		951	

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List of consistent schools on various criterion variables in lower ranked group over the two year period (continued).

	Code of consistent schools in lower ranked group on criterion variable						
S.N.	IR	Acc/stu	Scr/stu	S.N.	IR	Acc/stu	Scr/stu
93.		959					
94.		966					
95.		973					
96.		977					
97.		981					
98.		992					
99.		999					