Research Report
KTC-89-42

1989 USAGE RATES AND EFFECTIVENESS OF SAFETY BELTS AND CHILD SAFETY SEATS IN KENTUCKY

by

Kenneth R. Agent
Transportation Research Engineer

Kentucky Transportation Center
College of Engineering
University of Kentucky
Lexington, Kentucky

in cooperation with
Kentucky State Police
Commonwealth of Kentucky

September 1989

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
KTC-89-42		

4. Title and Subtitle
1989 Usage Rates and Effectiveness of Safety Belts and Child Safety Seats in Kentucky

5. Report Date
September 1989

6. Performing Organization Code

7. Author(s)
K. R. Agent

8. Performing Organization Report No.
KTC-89-42

9. Performing Organization Name and Address
Kentucky Transportation Center
College of Engineering
University of Kentucky
Lexington, KY 40506-0043

10. Work Unit No. (TRAIS)

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
Kentucky State Police
Highway Safety Standards Branch
Frankfort, KY 40601

13. Type of Report and Period Covered
Final

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The objective of the survey summarized in this report is to establish 1989 safety belt and child safety seat usage rates in Kentucky to compare to those determined from previous surveys. Also included in this report is an analysis of accident records evaluating the effectiveness of safety belts.

Statewide usage rates in the 19 cities previously surveyed in 1982 through 1988 showed that driver safety belt usage increased substantially in 1989 while child safety seat usage stablized in 1989 at close to the 1988 level. The statewide usage rate of safety belts by drivers was 25.5 percent in 1989 compared to 20.5 in 1988, 13.0 percent in 1986, 9.2 percent in 1985, 6.9 percent in 1984, 5.8 percent in 1983, and 4.2 percent in 1982. The percentage of children in either a safety seat or belt was 48.8 percent in 1989 compared to 47.7 percent in 1988, 30.2 percent in 1986, 29.1 percent in 1985, 30.3 percent in 1984, 24.2 percent in 1983, and 15.4 percent in 1982.

Benefits in the reduction of injuries for occupants involved in police-reported accidents wearing a safety belt or in a safety seat were shown through the analysis of accident records. For example, a 42 percent reduction in fatal or incapacitating injuries was determined for drivers wearing a safety belt compared to those who were not restrained.

The data analysis resulted in the following recommendations: 1) a statewide mandatory safety belt law should be passed or, in lieu of a statewide law, cities should pass such a law, 2) enforcement of the existing child restraint law should be increased, and 3) the existing child restraint law should be strengthened.

17. Key Words	18. Distribution Statement
Safety Belt Child Safety Seat Accident Severity	Unlimited with Kentucky State Police Approval

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	38	

Table of Contents

INTRODUCTION

The use of safety belts and child safety seats is an effective means of reducing injuries to motor-vehicle occupants involved in a traffic accident. Included in this report is an analysis of accident records evaluating the effectiveness of safety belts in reducing injuries in traffic accidents in Kentucky. However, despite the evidence documenting the effectiveness of safety belts and safety seats, usage of these restraint systems has remained relatively low.

In an attempt to increase usage of child safety seats, a law was enacted by the 1982 Kentucky General Assembly requiring use of a "child restraint system" for children 40 inches or less in height. Surveys were conducted before and after the law became effective (1, 2). Those surveys revealed that the statewide usage of child safety seats or safety belts for children under 4 years of age increased from 15.4 percent in 1982 to 24.2 percent in 1983. Those same surveys indicated a statewide driver safety belt usage rate of 5.8 percent in 1983 compared to 4.2 percent in 1982. A survey conducted in 1984 indicated that the statewide usage of child safety seats and safety belts had increased to 30.3 percent while driver safety belt usage had increased to 6.9 percent (3). The 1985 survey revealed that the statewide usage of child safety seats and safety belts had stabilized at 29.1 percent while driver safety belt usage had increased to 9.2 percent (4). The 1986 survey revealed a very similar statewide usage of child safety seats and safety belts of 30.2 percent (compared to 1984 and 1985) while driver safety belt usage increased to 13.0 percent (5). There was no survey conducted in 1987. The increased usage of child safety seats during the period 1982 through 1986 may be attributed to both enactment of the mandatory usage law and to increased public information, which also may have contributed to the increase in driver safety belt usage.

The 1988 Kentucky General Assembly strengthened the child restraint law to include a $50 fine for violation of the law. A survey conducted in 1988 after the law became effective indicated that usage of child safety seats and safety belts had increased to 47.4 percent while driver safety belt usage increased to 20.5 percent (6). It was concluded that the substantial increase in the usage rate for children under the age of four could be directly related to the addition of a penalty to the law. An objective of the survey summarized in this report is to establish 1989 safety belt and child safety seat usage rates in Kentucky to compare to rates determined from previous surveys. The continuing effect of adding the penalty provision to the child restraint law could be evaluated. Another objective was to evaluate the effectiveness of safety belts in reducing injuries to occupants of motor vehicles involved in traffic accidents.

The National Highway Traffic Safety Administration has been conducting observational surveys to determine usage of safety belts by drivers and child safety seats by infants and toddlers. Data have been obtained in 19 cities across the nation. Safety belt usage by drivers in 1988 was observed to be approximately 30 percent in cities without mandatory belt laws and 50 percent in cities having belt laws (7). The use of child safety seats in these 19 cities in 1986 was reported as about 70 percent (8). All of these cities had laws requiring the use of child safety seats.

PROCEDURE

DATA COLLECTION PLAN

The basic data collection plan used in the previous surveys was used in the survey conducted as part of this study. The data collection form, shown in Figure 1, allowed for usage to be recorded for drivers and passengers. In the first surveys, usage was recorded only for children under 4 years old and for drivers. The data collection form was later organized to allow usage to be tabulated for both front- and rear-seat passengers. However, accurate data could not be easily obtained for rear-seat passengers since only a lap belt was available in the large majority of automobiles. Usage could easily be determined for the front-seat passengers since belt usage involves both the lap belt and shoulder harness. This would not include passengers riding in the middle, front-seat position. As shown in Figure 1, passengers were classified by age into four categories. The age categories used in the first surveys for the driver were not used in this survey. The procedure involved collecting data by observation only. This allowed data to be collected by one person.

An explanation of information collected is included in Figure 2. The data sheet was divided into three sections. General information (Section 1) described when and where data were collected. The section pertaining to cars containing children under 4 years of age (Section 2) included basic information concerning type of safety seat used and, when used, the brand and whether it was used properly. Information also was obtained for the driver of any vehicle containing a child under 4 years of age. That information consisted of the driver's age category, sex, and safety belt usage. Section 3 of the data sheet contained safety belt usage information for drivers of other vehicles (those without a child under 4 years of age) and for other front-seat passengers, classified by age.

Child safety seat usage was obtained for children under 4 years of age. Kentucky's law requires the use of child safety seats for children 40 inches in height or less. Since no interviews were conducted, a judgment concerning age or height had to be made, and the decision was made to use 4 years of age as the cutoff. Using this procedure, it also would be possible to relate survey results to traffic accident data, which report age of occupant. Children were further classified as being less than 1 year old or from 1 through 3 years old. In this report, children less than 1 year of age will be referred to as "infants", and children from 1 through 3 years of age will be termed "toddlers".

This was the seventh year of data collection for the statewide survey cities, and each year's data have been collected at the same sites in most cities. Sites were located either at traffic signals or four-way stops. Some general instructions were followed during data collection. Manuals providing suggestions for data collection procedures were reviewed when developing the data collection plan. A summary of some of the major instructions follows:

1. Data will be collected by observation.
2. Data will be obtained at intersections having either a traffic signal or four-way stop control. Observers will stand on the curb or at the edge of the roadway and observe stopped cars. Data also may be included for cars as they begin moving through a signalized intersection if the car is moving

sufficiently slow to allow accurate observations. Only passenger cars, station wagons, and mini-vans are to be included. Kentucky's law addresses only passenger vehicles, and specifically excludes recreational vehicles and trucks of more than 1 ton.

3. All data should be collected during daylight hours at various times throughout the day.

4. Priority will be given to any car containing a child under 4 years old. Driver and front-seat passenger safety belt information for other cars will be collected when time permits.

5. Observers shall use their best judgment in estimating age. However, they shall not guess on child safety seat usage. When the type of safety seat cannot be determined, it should be noted as unknown.

6. Proper or improper usage, along with the reason for improper usage, should be determined whenever possible, even when the type of child safety seat cannot be determined. (Note: The reasons for improper usage were those that could be identified quickly by observation. Such errors as improper routing of the belt through the seat could not be identified).

DATA COLLECTION LOCATIONS

Data were collected in the 19 cities used to estimate "statewide" usage in the previous surveys. The "statewide" survey cities and the child safety seat survey size in each city are given in Table 1. The sample had to be distributed across the state and be representative of a range of populations to account for social and economic factors. The sample distribution was based on county population categories. From the 1980 census, the number of children under 5 years of age in each county was used to distribute the sample. This was the youngest age category available in census data. The sample size was determined so that the confidence limits for the observed proportion (percent using child safety seats) would be within acceptable bounds for a given probability (9). This resulted in a statewide sample size of 5,000 for child safety seats. The sample of drivers' safety belt usage was much higher as was the sample of front-seat passengers.

IDENTIFICATION OF CHILD SAFETY SEATS

A list of various child safety seats reviewed while preparing for the survey is presented in Table 2. The manufacturer and seat name are shown as well as a description of the type of protection afforded and the age range for which the restraint is to be used. Usage requirements for each safety seat had to be known to determine whether the seat was used properly. For example, when a tether was required but not used, the safety seat would be classified as improperly used. As part of the training process, a notebook containing photographs and literature describing the various seats was prepared. That notebook was used for review before and during the data collection process. The number of models of safety seats has increased dramatically in the past few years which made identification more difficult. However, a relatively few types of safety seats comprised the majority of the safety seats which were observed.

SURVEY DATA ANALYSIS

The child safety seat data were entered into a computer file. That allowed summaries and cross tabulations to be performed rapidly for any of the recorded data. Safety belt usage data for drivers of vehicles not containing

children under 4 years of age and for front-seat passengers were summarized manually.

Statewide usage rates for drivers and front-seat passengers wearing safety belts and for children under 4 years of age in either a safety seat or belt were determined. To calculate these statewide rates, the percentages of the state population in various population categories were used. Data were obtained in cities having a wide range in population; this procedure allowed the effect of population on usage rates to be taken into account.

The 1989 usage rates for each city were tabulated as well as the change in usage compared to that determined in the 1982, 1983, 1984, 1985, 1986, and 1988 surveys. The usage determined for the various types of child safety seats was summarized along with the reasons for and extent of improper usage for the various seats. Also, various factors affecting child safety seat and driver safety belt usage were analyzed.

ACCIDENT ANALYSIS

The computer files containing all reported traffic accidents in Kentucky (for the years 1984 through 1988) were analyzed to determine the effectiveness of wearing safety belts or riding in a safety seat. The effectiveness of safety belts was related to several factors such as seating position, type of vehicle, and speed limit. The percent reductions in injuries were computed, and statistical tests were conducted to determine if the reductions were significant.

RESULTS

STATEWIDE USAGE RATES

Statewide usage rates determined for the 1989 survey for child safety seats and driver safety belt usage are listed in Tables 3 and 4, respectively. The rates were calculated using data from the 19 cities previously surveyed in 1982 through 1988. The statewide percentage was derived using the percentages of the state's population in the respective population categories.

Statewide, the 1989 survey indicated that 39.7 percent of children under 4 years of age were in child safety seats. That percentage was 14.4 percent in 1982 before implementation of the child restraint law and increased to 22.7 percent in 1983, 27.3 percent in 1984, 22.7 in 1985, and 23.7 percent in 1986. The percentage of children using a safety belt was 9.1 percent in 1989 compared to 10.6 percent in 1988, 6.5 percent in 1986, 6.4 percent in 1985, 3.0 percent in 1984, 1.5 percent in 1983, and 1.0 percent in 1982. The percentage of children in either a safety seat or belt was 48.8 percent in 1989 compared to 47.7 percent in 1988, 30.2 percent in 1986, 29.1 percent in 1985, 30.3 percent in 1984, 24.2 percent in 1983, and 15.4 percent in 1982. The change in usage over the past several years is shown graphically in Figure 3. These data show that, while the 1982 law resulted in an increase in usage, the usage rate (for children in either a safety seat or belt) stabilized at approximately 30 percent from 1984 through 1986. There was then a substantial increase in usage in 1988 which would be related, in part, to the addition of a penalty provision to the law. There was a statistically significant increase (probability of 0.99) from the 30.2 percent usage in 1986 to the 47.7 percent usage in 1988 (10). The usage then remained essentially the same

in 1989 as in 1988 with the slight increase not statistically significant (10).

The relationship between child safety seat and belt usage rates and population is shown in Figure 4. The usage rate in the highest population category was more than twice that for the smallest population category. This relationship is also shown in Figure 5 for driver safety belt usage rates.

For a sample size of 5,000, a probability of 0.99, and a proportion of 39.7 percent, the confidence limits of statewide child safety seat usage in 1989 were determined to be 37.9 to 41.6 percent (9). Using the same procedure, the confidence limits of the usage of either a safety seat or belt were 47.0 to 50.6 percent.

Statewide, the 1989 survey indicated that 25.5 percent of drivers were using a safety belt. The percentage has increased steadily from 4.2 percent in 1982, 5.8 percent in 1983, 6.9 percent in 1984, 9.2 percent in 1985, 13.0 percent in 1986, and 20.5 percent in 1988. The change in driver safety belt usage is shown graphically in Figure 6. For a sample size of 81,963, a probability of 0.99, and a proportion of 25.5 percent, the confidence limits of statewide driver safety belt usage were 25.1 to 25.9 percent (9). The increase in the usage rate in 1989 compared to 1988 was determined to be statistically significant (probability of 0.99) (10).

As noted previously, the 1989 data collection procedure included obtaining safety belt usage data for front-seat passengers (in addition to the children under 4 years of age). These data are summarized in Table 5 for the 19 cities used to determine statewide rates. It may be seen that there is a large reduction in usage for children in the 4 to 5 years of age category (27.8 percent) compared to the under 4 years of age category (48.8 percent) which is affected by the usage law. Usage decreased for the 6 to 12 years category (22.4 percent) compared to the 4 and 5 years of age category. Usage dropped substantially to 17.8 percent for teenage passengers but increased to 20.2 percent for passengers over 19 years of age. The usage rates determined for front-seat passengers in 1989 were higher than those determined in 1988 for teenage passengers and passengers over 19 years of age but were slightly less for the age categories of 4 to 5 years and 6 to 12 years of age.

GENERAL SUMMARY OF SURVEY

Following is a summary of data by city and by type of safety seat as well as an analysis of factors affecting usage.

1988 Usage Rates

Safety belt usage rates of drivers, by city, as determined from the 1989 survey are listed in Table 6. The total sample size for the 19 cities was 81,963. As noted in previous surveys, usage was greater in the larger cities. Usage rates varied from 41.8 percent in Lexington to 12.5 percent in Hazard. Cities having the next highest usage rates were Winchester (32.7 percent, Covington (32.3 percent), and Louisville (27.5 percent). The cities having the next lowest rates were Princeton (14.9 percent), Morehead (14.9 percent), Glasgow (15.1 percent), and Lawrenceburg (15.1 percent).

Usages of child safety seats and safety belts (children under 4 years of

age), by city, as determined from the 1989 survey are listed in Table 7. As with driver safety belt usage rates, those rates were higher in the larger cities. The "percent using any restraint" varied from 77.7 percent in Lexington to 20.4 percent in Hazard. The other cities having usage rates over 50 percent were Winchester (67.7 percent), Louisville (65.2 percent), Newport (60.3 percent), Covington (53.1 percent), and Madisonville (50.7 percent). The only other cities having a usage rate under 30 percent were Morehead (27.4 percent), Carrollton (28.4 percent), and Lawrenceburg (29.1 percent).

Many children who were not in a safety seat or belt were in especially dangerous positions. About 12 percent (593) of the children were observed to be sitting on adults' laps while approximately 7 percent (343) were observed standing on the seat.

A summary of usage rates (from the 1989 survey) of safety belts by front-seat passengers by city is shown in Table 8. While the sample sizes for some categories in some cities are low, the data generally confirm the statewide statistics presented previously. The largest sample sizes were for the "over 19 years of age" category and usage rates for this category varied from a high of 31.9 percent in Lexington to a low of 10.4 percent in Princeton.

Trends in Usage Rates by City

The changes in the usage of safety belts by drivers in the 19 statewide survey cities are summarized in Table 9. The usage rate was higher in 1989 than in 1988 in all 19 cities. Usage rates are listed for the 8-year period of 1982 through 1989. In 13 of the 19 cities, the rates have increased each year. From 1982 to 1989, the minimum increase was almost three times in Hazard to an increase of more than 10 times in Lawrenceburg, Maysville, Winchester, Madisonville, Somerset, and Elizabethtown.

The changes in usage of child safety seats or belts by children under 4 years of age in the survey cities are shown in Table 10. The usage rates in 1989 were higher than those determined in 1988 in 12 of the 19 cities. While the usage rate of safety belts for drivers was found to had increased each survey year in 13 cities, the usage rate of child safety seats or belts increased each year in only two cities (Henderson and Princeton). From 1982 to 1989, the usage rates had at least doubled in all 19 cities. The largest percentage increase over this time period was in Somerset while the lowest percentage increase was in Bardstown.

Summary by Type of Safety Seat

Usage of various types of child safety seats is summarized in Table 11. For each safety seat, the number observed as well as the percentage properly used are listed. Data are presented for all children, infants only, and toddlers only. Observers were trained to identify specific seats and their proper usage. The seat used was identified in most instances (about 85 percent). As the number of different types of safety seats increases, it becomes more difficult to identify the various seats. However, there remains several types of seats which are the most common types used.

The Fisher-Price safety seat was the single most frequently noted safety seat of all models observed as it was in the 1988 survey. The Evenflo One-Step was the second most frequently noted safety seat of all models observed

(it had been the most frequently observed safety seat in several of the past few surveys). The Strolee Wee Care had been the most frequently observed in the 1982 and 1983 surveys, and it was the third most frequently observed seat. However, most of the Strolee seats were of the type not requiring a tether while in the earlier surveys the model which required a tether was most common. Evenflo had the highest number of safety seats noted of any single manufacturer. Other commonly observed seats distributed by Evenflo, in addition to the One-Step, included the Bobby-Mac and the Dyn-O-Mite infant seat. A large number of safety seats manufactured by Century and Cosco/Peterson were also observed. The most common infant-only safety seats were the Kolcraft Rock-N-Ride, Evenflo Dyn-O-Mite, and Cosco/Peterson First Ride and TLC.

Proper usage was high for most of the various safety seats. Of the most common safety seats, the old Strolee had the lowest proper-usage percentage. This was related to the requirement to use a tether in the toddler position in the older models. The major reasons for improper usage are summarized in Table 12. The major reasons for improper usage included failure to harness the child into the seat and facing an infant forward rather than in the proper rear-facing position. Other reasons for improper usage included not using the shield, failure to tether the seat as required (this is related to the older Strolee safety seats), and not belting the restraint to the car (this was most commonly noted for infant-only safety seats).

As given in Table 3, the overall percent of child safety seats used properly in 1989 was 88 percent. This is substantially higher than that determined in the first surveys but similar to that determined for 1988. This increase in proper usage would be partially related to the decreased use of seats that have low proper-usage percentages. Specifically, more of the newer model Strolee seats, which do not require a tether, are being used. Also, fewer of older type seats, which were made by more than one manufacturer, in which the child was rarely harnessed are in use. Manufacturers have attempted to make the newer models of safety seats easier to use and to provide clear and concise instructions for proper usage. It also should be noted that improper usage identified in the survey was limited to the types that could be easily noted as a vehicle passed slowly by the observer. Other types of improper usage, such as improper routing of the safety belt, which could not be noted quickly by observation, were not included. Improper usage would be substantially higher if a detailed study of proper usage was conducted. While some of the increase in proper usage may be attributed to the data collection process, the results show that proper usage has increased from that determined from the first surveys.

Factors Affecting Usage

Several other factors, shown in Table 13, were noted as being related to child safety seat usage. Those relationships were similar to those observed in previous surveys. Usage was directly related to age of the child, with the usage rate for infants about 40 percent higher than for toddlers. Usage for children in the rear seat was 50 percent higher than for children in the front seat. Driver age and sex also were somewhat related, with usage higher when a female was driving and for drivers in the middle age category (31 to 51 years of age). The data also showed a reduction in usage when there were more than two small children in a car.

Usage also was much higher for children when the driver was wearing a safety belt. Almost all children (85 percent) riding in a vehicle in which the driver was wearing a safety belt were also either in a safety seat or belt.

ACCIDENT ANALYSIS

The number and percentage of all drivers involved in police-reported accidents sustaining a given injury as a function of safety belt usage is summarized in Table 14 (based on 1984 through 1988 accident data). By comparing the percentages, the percent reduction associated with safety belt usage could be calculated. The largest reduction was for a fatal injury (75 percent reduction) with the reduction decreasing for less severe injuries. The reductions in the percentage of fatal, incapacitating, and non-incapacitating injuries were determined to be statistically significant (probability of 0.99). In severe accidents, use of a safety belt would lessen, but not eliminate, the injury. This resulted in only a one percent decrease in the "possible injury" category (there was no statistically significant change in this injury category). There was a 42 percent reduction in a driver sustaining a fatal or severe injury in a traffic accident if a safety belt was worn compared to not wearing a safety belt. This agrees with other research studies which report that lap and shoulder safety belts, when used, reduce the risk of fatal or serious occupant injury by between 40 and 55 percent (7).

The effectiveness of safety belts in reducing driver injuries was related to several variables. In Table 15, the percentage of drivers sustaining either a fatal or severe injury who were wearing or not wearing a safety belt was related to type of vehicle, type of accident, and speed limit. There were reductions in percent fatal or severe injuries for drivers of passenger cars, single-unit trucks, and combination trucks. The reduction was higher for drivers of trucks. Safety belts also reduced the percentage fatally or severely injured in various types of accidents. The types of accidents were chosen to represent the extremes of accidents in terms of severity. The reductions were noted for the relatively low severity rear-end accidents as well as the more severe fixed object, head-on, and "overturned" accidents. Safety belts also were determined to be effective in reducing fatal or severe injuries for accidents occurring on either 35-mph local streets or 55-mph high speed roadways.

The number and percentage of children age 3 and under sustaining a given injury as a function of using a safety seat or safety belt are summarized in Table 16. There were substantial reductions, higher for the most severe injury types, associated with both safety seats and safety belts. The reductions were similar for use of either the safety belt or safety seat. The reductions for all injury categories except fatalities were statistically significant (probability of 0.99). The percent reductions were higher than that for drivers (as given in Table 14). There was a 68 percent reduction in the chance of a child less than age 4 sustaining a fatal or severe injury if a safety seat was used compared to not using any restraining device. Also, as shown in Table 17, the reductions in injuries applied to both the rear and front seating positions.

The number and percentage of occupants other than drivers sustaining a given injury as a function of safety belt usage are listed in Table 18.

Again, there was a large reduction in the percent injured (all reductions were statistically significant with a probability of 0.99). These percent reductions were generally higher than that for drivers. The chance of a vehicle occupant, other than the driver, sustaining a fatal or severe injury was reduced by 46 percent if a safety belt was worn compared to not wearing a safety belt.

The accident severities associated with using a lap belt and/or shoulder harness for occupants other than the driver (by seating position in the front or rear seat) are listed in Table 19. Only a lap belt is available in the rear seat in the large majority of vehicles. The use of a shoulder harness and/or lap belt in the front seat or a lap belt in the rear reduced injuries dramatically (all reductions were statistically significant with a probability of 0.99). Accident severity was less in the rear seat and the percent reduction in injuries was generally greater in the rear seat than the front seat. The use of a lap belt in the rear seat has been effective since its use was associated with a reduction in fatal or incapacitating injuries of 60 percent. This finding should not be interpreted to suggest that it would not be preferable to have a combination lap belt/shoulder harness in the rear seat.

The potential annual reductions in traffic accident fatalities and accident savings from an increase in driver safety belt usage are presented in Table 20. The reduction in fatalities and associated accident cost savings were calculated using the reduction factors listed in Table 14, accident data for the years of 1984 through 1988, the 25.5 percent usage rate determined from the 1989 observational survey, and accident cost estimates recommended by the Federal Highway Administration (10).

SUMMARY

Statewide usage rates in the 19 cities previously surveyed in 1982, 1983, 1984, 1985, 1986, and 1988 showed that driver safety belt usage increased substantially in 1989 while child safety seat usage stablized in 1989 at close to the 1988 level. The statewide usage rate of safety belts by drivers was 25.5 percent in 1989 compared to 20.5 percent in 1988, 13.0 percent in 1986, 9.2 percent in 1985, 6.9 percent in 1984, 5.8 percent in 1983, and 4.2 percent in 1982 (Figure 6). The percentage of children in either a safety seat or belt was 48.8 percent in 1989 compared to 47.7 percent in 1988, 30.2 percent in 1986, 29.1 percent in 1985, 30.3 percent in 1984, 24.2 percent in 1983, and 15.4 percent in 1982 (Figure 3). Usage rates for front-seat passengers in 1989 were higher than that in 1988 for teenage passengers and passengers over 19 years of age but were lower in 1989 for children in the 4 to 5 and 6 to 12 age categories. The safety belt usage rate for drivers varied from a low of 12.5 percent in Hazard to a high of 41.8 percent in Lexington. The percentage of children in either a safety seat or belt varied from a low of 20.4 percent in Hazard to a high of 77.7 percent in Lexington. Usage varied directly with population with higher usage in the largest cities. Current national driver usage rates for cities in states without a belt law has been found to be about 30 percent (7) which is in agreement with that determined for the highest populated locations in Kentucky (Table 4).

The significant benefits, based on the reduction of injuries, for occupants involved in a police-reported accident wearing a safety belt or in a safety seat were shown through the analyses of accident records. For example,

one finding was that there was a 42-percent reduction in fatal or incapacitating injuries for drivers wearing a safety belt compared to those who were not. The benefit in terms of the reduction in injuries in wearing a safety belt in either the front or rear seat was documented. The potential savings in fatalities, serious injuries, and accident costs which could be obtained from an increase in the use of safety belts was shown.

RECOMMENDATIONS

While driver safety belt usage has been increasing in the past few years, usage has remained low with a statewide rate of about 25 percent and rates as low as about 15 percent in some small cities. While public information has resulted in increases, a method which has been shown to result in a dramatic increase in safety belt usage is enactment of a mandatory safety belt law. National surveys have shown usage rates of 30 percent in cities without a belt law compared to 50 percent in cities having a law (7). Additionally, usage is higher in states having primary enforcement policies in which the officer may stop a motorist solely on the basis of a safety belt law violation (12). Belt use as high as 90 percent has been reported in other countries having belt laws and high levels of enforcement (12). It has been estimated that at the current usage level of about 50 percent in states having belt laws, safety belts would have saved 4,700 lives if all states had belt laws in 1987 (7). Similar laws have been enacted in numerous other states and such a law has been proposed in the Kentucky General Assembly but did not pass. An analysis of Kentucky accident records has shown the reduction in accident severity associated with safety belt usage. The potential annual reductions in traffic accident fatalities and accident savings from an increase in driver safety belt usage also have been estimated. For example, an increase in the driver usage rate up to 50 percent usage would result in a potential annual reduction of 91 fatalities and an annual accident savings from the reduction in fatalities and serious injuries of about 159 million dollars. Therefore, a recommendation is that a statewide mandatory safety belt law should be considered by the Kentucky General Assembly. In the event a statewide law is not enacted, cities should consider passing local mandatory safety belt laws.

The fact that use of child safety seats and safety belts for children under the age of four increased substantially in 1988 was related to the addition of a penalty to the law (6). As shown in Figure 3, the use of child safety seats and safety belts had stabilized at about 30 percent after the original safety seat law was enacted but then there was a dramatic increase in usage in 1988 after the addition of the penalty. However, this usage rate stabilized again in 1989 and is still not high in some cities. This points out the need to enforce the law. It has been shown that usage is directly related to the level of enforcement of any belt law (12). The existing law may be modified and strengthened additionally in accordance with recommendations presented in a previous report (2). An additional modification would include having the law apply to children under the age of 6 and allowing the substitution of safety belts for safety seats for older children. The low usage rate determined from this study for 4 and 5 year olds compared to the under 4 years of age category emphasises the need for the law to apply to children under 6 years of age. Of course, it would be preferable to enact a mandatory law which would apply to all ages.

REFERENCES

1. Agent, K. R. and Crabtree, J. D.; "Child Restraint Usage in Kentucky (Pre-Legislation)", University of Kentucky, Transportation Research Program Report UKTRP-82-15, September 1982.

2. Agent, K. R.; "Child Safety Seat Usage in Kentucky after Enactment of a Mandatory Usage Law", University of Kentucky, Transportation Research Program Report UKTRP-83-18, September 1983.

3. Agent, K. R. and Salsman, J. M.; "1984 Safety Belt and Child Safety Seat Usage Rates in Kentucky and Evaluation of a Public Information Campaign," University of Kentucky, Transportation Research Program Report UKTRP-84-27, September 1984.

4. Agent, K. R.; "1985 Safety Belt and Child Safety Seat Usage in Kentucky and Evaluation of a Public Information Campaign," University of Kentucky, Transportation Research Program Report UKTRP-85-21, September 1985.

5. Agent, K. R.; "1986 Safety Belt and Child Safety Seat Usage Rates in Kentucky", University of Kentucky, Transportation Research Program, Report UKTRP-86-20, September 1986.

6. Agent, K. R.;"1988 Usage Rates and Effectiveness of Safety Belts and Child Safety Seats in Kentucky", University of Kentucky, Transportation Center, Report KTC-88-6, October 1988.

7. Occupant Protection Facts, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, August 1988.

8. Ziegler, P. N.; "Use of Child Safety Seats", Research Notes, National Highway Traffic Safety Administration, March 1987.

9. Elementary Sampling for Traffic Engineers, The ENO Foundation for Highway Traffic Control, 1962.

10. Natrella, M. G.; Experimental Statistics, National Bureau of Standards Handbook 91, August 1963.

11. FHWA Technical Advisory T 7570.1, June 30, 1988.

12. Campbell, B. J.; "The Relationship of Seat Belt Law Enforcement to Level of Belt Use", University of North Carolina Highway Safety Research Center, June 1987.

TABLE 1. DISTRIBUTION OF SAMPLE USED TO ESTIMATE "STATEWIDE" USAGE OF CHILD SAFETY SEATS

POPULATION CATEGORY (NUMBER OF CHILDREN UNDER 5 YEARS OLD)	PERCENTAGE OF STATEWIDE TOTAL OF CHILDREN UNDER 5 YEARS OLD	SAMPLE SIZE	SURVEY COUNTIES	SURVEY CITIES
10,000 or more	26.6	1,330	Fayette	Lexington
			Jefferson	Louisville
			Kenton	Covington
5,000-9,999	14.0	700	Campbell	Newport
			Christian	Hopkinsville
			Hardin	Elizabethtown
2,500-4,999	23.3	1,165	Franklin	Frankfort
			Henderson	Henderson
			Hopkins	Madisonville
			Perry	Hazard
			Pulaski	Somerset
1,000-2,499	26.0	1,300	Barren	Glasgow
			Clark	Winchester
			Mason	Maysville
			Nelson	Bardstown
			Rowan	Morehead
Under 1,000	10.1	505	Anderson	Lawrenceburg
			Caldwell	Princeton
			Carroll	Carrollton

TABLE 2. LISTING OF AVAILABLE CHILD SAFETY SEATS*

MANUFACTURER	MODEL	DESCRIPTION
Cosco/Peterson	Safe-T-Shield	Convertible; three-point harness for infants; shield only for toddlers
	Safe-T-Seat	Convertible; five-point harness
	Safe and Easy	Convertible; five-point harness
	Safe and Snug	Convertible; combination shield and harness system
	Safe-T-Mate	Convertible; combination shield and harness system
	First Ride	Infants only; Y-harness
	TLC Infant Car Seat	Infants only, Y-harness
	Travel Hi-Lo	Children to 65 lbs; lap and shoulder belt in front seat, belt and tethered body harness in rear
	Deluxe Travel Hi-Lo	Children to 65 lbs; backrest and three-point harness
	Commuter	Convertible; combination shield and harness system
	Explorer	Toddlers and children; swing away shield
	Auto Trac	Convertible; combination shield and harness system
Century	Century 100	Convertible; five-point harness
	Century 200	Convertible; combination shield and harness system
	Century 300	Convertible; five-point harness with armrest
	Century 400XL	Convertible; combination shield and harness (modified inertial reel system)
	Century 1000 STE	Convertible; five-point harness
	Century 2000 STE	Convertible; combination shield and harness system
	Century 3000 STE	Convertible; combination shield and harness system
	Infant Love Seat	Infants only; Y-harness
	570 Infant Car Seat	Y-harness
	Child Love Seat	Toddlers only; five-point harness, tether required
	Safe-T-Rider	Toddlers and children to 10 years; lap and shoulder belt in front seat, lap belt and tethered body harness in rear seat
	Commander	Children to 65 lbs.; full shield
	CR-3	Booster seat; shield removes for use with lap-shoulder belt
	Trav-l-guard	Convertible; five-point harness with armrest
Strolee	Wee Care 597A	Convertible; five-point harness, tether required
	Wee Care 599	Convertible; five-point harness with armrest; tether required
	Wee Care 618	Convertible; five-point harness with armrest
	Wee Care 612	Convertible; five-point harness
	GT-2000	Convertible; five-point harness,
	Wee Care Booster Seat 602	Children to 70 lbs; auto lap and shoulder belt in front seat, auto lap belt with tethered harness in rear seat
	Quick Click	Children to 70 lbs; full shield

* Convertible restraints can be used by infants and toddlers, infants in a rear-facing position, and toddlers in a forward-facing position. Tethers, where required, are for toddler position only.

TABLE 2. LISTING OF AVAILABLE CHILD SAFETY SEATS* (continued)

MANUFACTURER	MODEL	DESCRIPTION
Evenflo (Questor)	Evenflo Infant Seat	Infants only; Y-harness
	Swinger	Infants only; Y-harness
	Evenflo Joy Ride	Infants only; Y-harness
	Model 410	Convertible; five-point harness
	Dyn-O-Mite	Infants only; Y-harness
	One-Step	Convertible; combination shield and harness system
	Care Seat	Convertible; five-point harness
	Safe Guard	Toddlers only; five-point harness
	Convertible	Convertible; five-point harness
	Evenflo 7	Convertible; combination shield and harness system
	Seven Year Car Seat	Convertible;combination harness-shield, converts to booster seat
	Ultara I and II	Convertible; harness-shield
	Britax Handicapped	Toddlers and children; five-point harness
	Bobby Mac Champion	Convertible; five-point harness for infant, add shield for toddler
	Bobby Mac Deluxe II	Convertible; three-point harness for infant, add swing-down shield for toddler
	Bobby Mac Super	Convertible; five-point harness, tether required
	Bobby Mac Wings	Toddler and children; full shield
	Bobby Mac Lite	Toddlers only; requires shield
	Evenflo Booster	Toddlers only; requires shield
	Evenflo Sightseer	Toddlers only; adjustable shield
International	Astroseat (9300A)	Convertible; five-point harness with armrest
	Astroseat (9100A)	Convertible; five-point harness
	Astroseat 6000	Children to 55 lbs; used with adult three-point belt system or adult lap belt with harness
Kolcraft	Hi-Rider	Convertible; five-point harness, optional shield
	Hi-Rider XL	Convertible; five-point harness with armrest
	Quikstep	Convertible; combination shield and harnessd system
	Dial-A-Fit	Convertible; harness-shield combination
	Ultra Ride	Convertible; five-point harness
	Tot-Rider	Toddlers and children to 10 yrs; lap and shoulder belt in front seat, lap belt and tethered body harness in rear
	Tot-Rider XL	Toddlers and children to 10 yrs; lap and shoulder belt in front seat, harness system in rear
	Tot-Rider Quikstep	Toddlers and children; full shield
	Redi-Rider	Convertible; combination shield and harness system
	Rock'n Ride	Infants only; Y-harness
	Flip 'n Go	Toddlers and children; full shield
Ford	Tot Guard	Toddlers only; shield only
	Infant Carrier	Infants only; three-point harness
General Motors	Infant Love Seat	Infants only; Y-harness
	Child Love Seat	Toddlers only; five-point harness, tether required

* Convertible restraints can be used by infants and toddlers, infants in a rear-facing position, and toddlers in a forward-facing position. Tethers, where required, are for toddler position only.

TABLE 2. LISTINGS OF AVAILABLE CHILD SAFETY SEATS* (Continued)

MANUFACTURER	MODEL	DESCRIPTION
Welsh	Travel Tot	Convertible five-point harness with shield
Collier-Keyworth	Safe and Sound	Convertible; combination shield and harness system
	Roundtripper	Convertible; combination shield and harness system
	Co-Pilot	Toddlers and children; full protective shield
	Cuddle Shuttle	Infants only; Y-harness
	Voyager	Toddlers and children; full shield
	CK Classic	Convertible; combination shield and harness system
Pride Trimble	Pride Ride (820)	Convertible; five-point harness
	Pride Ride (830)	Convertible; five-point harness with armrest
	Click'N'Go	Toddlers and children; lap and shoulder belt in front seat
Graco	Little Traveler (315)	Convertible; five-point harness with armrest
	Little Traveler (310)	Convertible; five-point harness
	Snug Seat	Infants only
	GT1000	Convertible
Nissan	Infant-Child Safety Seat	Convertible; combination shield and harness (inertial reel) system
E-Z-On Products	E-Z-On Vest	Toddlers and children; auto harness system, tether required
Fisher-Price	Fisher-Price	Convertible; combination shield (body pad) and harness (inertial reel) system
	Infant Car Seat	Infants only; harness-shield
Gerry	Guardian	Convertible; combination shield (body pad) and harness (inertial reel) system
	Voyager	Toddlers and children; full shield
	Doubleguard	Booster seat; full shield
Volvo	Child Cushion	Children; use only with lap/ shoulder belt
Babyhood	Wonda-Chair	Convertible; five-point harness
Ortho-Kinetics	Travel Chair	Two different models to fit infant and toddlers and children; adapted wheelchair requires additional lap belt to secure wheelchair
Tumble Forms	Carrie Car Seat	Handicapped child; harness system requires tether
Z.B. Sales	Bobob 2	Toddlers and children; five-point harness

*Convertible restraints can be used by infants and toddlers, infants in a rear-facing position, and toddlers in a forward-facing position. Tethers, where required, are for toddler position only.

TABLE 3. 1988 "STATEWIDE" CHILD SAFETY SEAT AND SAFETY BELT USAGE RATES

COUNTY POPULATION CATEGORY (NUMBER OF CHILDREN UNDER 4 YEARS OLD)	SAMPLE SIZE	NUMBER USING		PERCENT USING			PERCENT OF CHILD SAFETY SEATS USED PROPERLY
		CHILD SAFETY SEAT	SAFETY BELT	CHILD SAFETY SEAT	SAFETY BELT	ANY RESTRAINT	
10,000 or more	1,330	734	163	55.2	12.3	67.4	90
5,000-9,999	700	266	66	38.0	9.4	47.4	86
2,500-4,999	1,165	397	85	34.1	7.3	41.4	85
1,000-2,499	1,300	464	101	35.7	7.8	43.5	89
Under 1,000	505	125	41	24.8	8.1	32.9	82
All	5,000	1,986	456	39.7	9.1	48.8	88

TABLE 4. 1988 "STATEWIDE" DRIVER SAFETY BELT USAGE RATES

COUNTY POPULATION CATEGORY (NUMBER OF LICENSED DRIVERS)	NUMBER OF COUNTIES IN CATEGORY	PERCENTAGE OF STATEWIDE DRIVING POPULATION	SURVEY COUNTIES	SURVEY CITIES	SAMPLE SIZE	PERCENT DRIVERS USING SAFETY BELTS	PERCENT USAGE FOR CATEGORY
Over 75,000	3	30.0	Jefferson	Louisville	10,187	27.5	34.7
			Fayette	Lexington	11,457	41.8	
			Kenton	Covington	3,128	32.3	
30,001-75,000	9	17.0	Campbell	Newport	3,046	26.0	24.6
			Hardin	Elizabethtown	3,335	26.2	
			Christian	Hopkinsville	2,625	21.1	
20,001-30,000	13	14.6	Hopkins	Madisonville	3,778	22.3	22.6
			Henderson	Henderson	3,268	22.4	
			Franklin	Frankfort	5,833	23.9	
			Pulaski	Somerset	3,305	26.0	
			Barren	Glasgow	2,320	15.0	
10,001-20,000	32	20.0	Clark	Winchester	5,573	32.7	23.5
			Nelson	Bardstown	6,828	20.5	
			Perry	Hazard	3,148	12.5	
			Mason	Maysville	4,146	24.6	
10,000 or Under	63	18.4	Rowan	Morehead	3,542	14.9	15.7
			Caldwell	Princeton	2,345	14.9	
			Anderson	Lawrenceburg	2,278	15.1	
			Carroll	Carrollton	1,821	19.3	

TABLE 5. 1988 "STATEWIDE" FRONT SEAT PASSENGER SAFETY BELT USAGE RATES

COUNTY POPULATION CATEGORY (NUMBER OF LICENSED DRIVERS)	PASSENGER AGE CATEGORY							
	4-5 YEARS		6-12 YEARS		13-19 YEARS		OVER 19 YEARS	
	SAMPLE SIZE	PERCENT USAGE FOR CATEGORY	SAMPLE SIZE	PERCENT USAGE FOR CATEGORY	SAMPLE SIZE	PERCENT USAGE FOR CATEGORY	SAMPLE SIZE	PERCENT USAGE FOR CATEGORY
Over 75,000	491	35.6	486	26.1	1,913	20.4	4,189	26.0
30,001-75,000	190	28.9	166	18.1	646	16.7	1,638	18.3
20,001-30,000	317	24.3	461	22.1	1,279	15.9	2,896	17.0
10,001-20,000	434	23.3	361	24.4	1,153	20.0	2,578	21.4
10,000 or Under	178	21.9	234	18.4	624	13.9	1,533	13.6
All	1610	27.8	1708	22.4	5,615	17.8	12,834	20.2

TABLE 6. 1989 USAGE RATES OF SAFETY BELTS BY DRIVERS BY CITY

CITY	POPULATION	SAMPLE SIZE	NUMBER USING SAFETY BELT	PERCENT USING SAFETY BELT
Louisville	298,451	10,187	2,804	27.5
Lexington	204,165	11,457	4,787	41.8
Covington	49,585	3,128	1,011	32.3
Hopkinsville	27,318	2,625	553	21.1
Frankfort	25,973	5,833	1,392	23.9
Henderson	24,834	3,268	733	22.4
Newport	21,587	3,046	792	26.0
Madisonville	16,979	3,778	842	22.3
Elizabethtown	15,380	3,335	874	26.2
Winchester	15,216	5,573	1,821	32.7
Glasgow	12,958	2,320	348	15.0
Somerset	10,649	3,305	860	26.0
Maysville	7,983	4,146	1,021	24.6
Morehead	7,789	3,542	526	14.9
Princeton	7,073	2,345	350	14.9
Bardstown	6,155	6,828	1,403	20.5
Hazard	5,371	3,148	393	12.5
Lawrenceburg	5,167	2,278	343	15.1
Carrollton	3,967	1,821	351	19.3

TABLE 7. 1989 USAGE RATES, BY CITY, FOR CHILD SAFETY SEATS AND SAFETY BELTS (CHILDREN UNDER 4 YEARS OF AGE)

CITY	POPULATION	SAMPLE SIZE	NUMBER USING CHILD SAFETY SEAT	PERCENT USING CHILD SAFETY SEAT	PERCENT OF CHILD SAFETY SEATS USED PROPERLY	NUMBER CHILDREN USING SAFETY BELT	PERCENT CHILDREN USING SAFETY BELT	PERCENT CHILDREN USING ANY RESTRAINT
Louisville	298,451	546	311	57.0	91	45	8.2	65.2
Lexington	204,165	507	293	57.8	90	101	19.9	77.7
Covington	49,585	277	130	46.9	88	17	6.2	53.1
Hopkinsville	27,318	178	45	25.3	78	23	12.9	38.2
Frankfort	25,973	293	100	34.1	87	27	9.2	43.3
Henderson	24,834	200	71	35.5	87	14	7.0	42.5
Newport	21,587	237	124	52.3	79	19	8.0	60.3
Madisonville	16,979	201	89	44.3	85	13	6.5	50.7
Elizabethtown	15,380	285	97	34.0	87	24	8.4	42.4
Winchester	15,216	353	199	56.4	92	40	11.3	67.7
Glasgow	12,958	151	45	29.8	85	12	7.9	37.7
Somerset	10,649	270	104	38.5	79	23	8.5	47.0
Maysville	7,983	280	80	28.6	80	14	5.0	33.6
Morehead	7,789	226	55	24.3	86	7	3.1	27.4
Princeton	7,073	171	55	32.2	86	15	8.8	40.9
Bardstown	6,155	290	85	29.3	84	28	9.7	39.0
Hazard	5,371	201	33	16.4	87	8	4.0	20.4
Lawrenceburg	5,167	158	33	20.9	90	13	8.2	29.1
Carrollton	3,967	176	37	21.0	89	13	7.4	28.4

TABLE 8. 1989 USAGE RATES OF SAFETY BELTS BY FRONT SEAT PASSENGERS BY CITY

		AGE CATEGORY (YEARS)											
		4-5			6-12			13-19			OVER 19		
CITY	POPULATION	SAMPLE SIZE	NUMBER USING SAFETY BELT	PERCENT USING SAFETY BELT	SAMPLE SIZE	NUMBER USING SAFETY BELT	PERCENT USING SAFETY BELT	SAMPLE SIZE	NUMBER USING SAFETY BELT	PERCENT USING SAFETY BELT	SAMPLE SIZE	NUMBER USING SAFETY BELT	PERCENT USING SAFETY BELT
Louisville	298,451	186	44	23.7	185	34	18.4	679	95	14.0	1,387	282	20.3
Lexington	204,165	236	111	47.0	223	80	35.9	894	240	26.8	2,259	718	31.9
Covington	49,585	69	20	29.0	78	13	16.7	340	55	16.2	543	90	16.6
Hopkinsville	27,318	27	8	29.6	22	3	13.6	100	18	18.0	515	93	18.1
Frankfort	25,973	107	29	27.1	101	28	27.7	427	81	19.0	712	149	20.9
Henderson	24,834	60	14	23.3	112	27	24.1	183	30	16.4	670	141	21.0
Newport	21,587	78	23	29.5	75	18	24.0	200	37	18.5	483	91	18.8
Madisonville	16,979	57	22	38.6	148	33	22.3	257	31	12.1	717	104	14.5
Elizabethtown	15,380	85	24	28.2	69	9	13.0	346	53	15.3	640	116	18.1
Winchester	15,216	189	61	32.3	144	44	30.6	400	107	26.7	802	226	28.2
Glasgow	12,958	26	5	19.2	28	3	10.7	136	20	14.7	263	34	12.9
Somerset	10,649	67	7	10.4	72	11	15.3	276	42	15.2	534	65	12.2
Maysville	7,983	83	15	18.1	59	9	15.3	208	41	19.7	443	80	18.1
Morehead	7,789	55	10	18.2	57	8	14.0	214	29	13.6	547	85	15.5
Princeton	7,073	47	10	21.3	92	18	19.6	147	13	8.8	442	46	10.4
Bardstown	6,155	97	20	20.6	105	28	26.7	338	57	16.9	991	199	20.1
Hazard	5,371	65	5	7.7	53	7	13.2	207	26	12.6	342	46	13.5
Lawrenceburg	5,167	29	13	44.8	45	13	28.9	133	26	19.5	271	41	15.1
Carrollton	3,967	47	6	12.8	40	4	10.0	130	19	14.6	273	36	13.2

TABLE 9. CHANGE IN USAGE OF SAFETY BELTS BY DRIVERS IN STATEWIDE SURVEY CITIES

	PERCENT USING SAFETY BELTS						
CITY	1982	1983	1984	1985	1986	1988	1989
Louisville	6.2	11.9	13.1	13.5	16.0	24.6	27.5
Lexington	8.2	10.1	9.8	17.3	24.4	31.2	41.8
Covington	8.2	9.3	12.5	16.2	21.7	28.3	32.3
Hopkinsville	2.6	3.0	4.5	5.6	10.4	19.5	21.1
Frankfort	4.8	7.1	7.4	11.4	14.1	19.3	23.9
Henderson	3.1	4.6	7.0	9.0	11.1	19.6	22.4
Newport	4.7	6.4	5.4	5.8	8.9	20.1	26.0
Madisonville	1.9	2.8	4.8	7.5	11.9	20.0	22.3
Elizabethtown	2.6	3.5	5.0	8.3	14.0	19.8	26.2
Winchester	2.3	2.9	5.6	8.9	11.7	24.7	32.7
Glasgow	2.9	2.8	2.5	4.8	6.0	11.9	15.0
Somerset	2.4	3.6	5.6	6.8	9.0	19.1	26.0
Maysville	1.5	3.3	5.5	5.7	13.1	19.2	24.6
Morehead	2.9	3.2	3.1	5.1	7.2	12.0	14.9
Princeton	1.6	1.7	2.4	3.1	6.0	11.6	14.9
Bardstown	3.5	4.1	5.9	7.1	13.0	19.3	20.5
Hazard	4.4	2.7	4.2	5.9	5.3	9.5	12.5
Lawrenceburg	0.8	2.3	3.2	5.6	5.1	9.3	15.1
Carrollton	2.6	4.9	5.2	7.3	10.0	15.9	19.3

TABLE 10. CHANGE IN USAGE OF SAFETY SEATS OR BELTS BY CHILDREN UNDER 4 YEARS OF AGE IN SURVEY CITIES

CITY	PERCENT USING SAFETY SEATS OR BELTS						
	1982	1983	1984	1985	1986	1988	1989
Louisville	21.6	36.3	49.1	41.6	40.4	67.6	65.2
Lexington	32.1	45.8	50.0	44.4	46.2	78.3	77.7
Covington	22.4	38.6	49.1	46.9	49.5	58.8	53.1
Hopkinsville	11.8	19.1	19.1	20.2	21.3	32.6	38.2
Frankfort	15.4	25.9	30.0	27.3	30.0	43.0	43.3
Henderson	13.5	18.5	26.0	30.0	31.0	36.0	42.5
Newport	11.0	27.4	20.3	21.9	22.4	59.5	60.3
Madisonville	12.4	18.4	29.4	35.3	38.3	51.7	50.7
Elizabethtown	11.2	26.7	33.7	30.2	31.6	40.7	42.4
Winchester	12.5	13.9	33.4	28.6	26.1	56.4	67.7
Glasgow	13.9	16.6	20.5	18.5	21.2	36.4	37.7
Somerset	7.4	23.3	23.7	21.9	26.3	47.8	47.0
Maysville	11.8	18.2	17.1	18.6	24.6	31.4	33.6
Morehead	10.2	14.1	12.8	14.6	14.2	25.2	27.4
Princeton	9.9	11.7	12.3	16.4	20.5	33.3	40.9
Bardstown	19.7	21.0	31.0	30.7	31.0	40.7	39.0
Hazard	7.0	9.5	9.0	10.9	13.4	19.4	20.4
Lawrenceburg	7.0	6.3	22.2	23.4	19.6	32.3	29.1
Carrollton	6.3	10.2	15.9	21.6	18.8	26.1	28.4

TABLE 11. USAGE OF VARIOUS TYPES OF CHILD SAFETY SEATS

CHILD SAFETY SEAT	ALL CHILDREN		INFANTS ONLY		TODDLERS ONLY	
	NUMBER OBSERVED	PERCENT PROPERLY USED	NUMBER OBSERVED	PERCENT PROPERLY USED	NUMBER OBSERVED	PERCENT PROPERLY USED
Evenflo	387	86	77	75	310	88
One-Step	274	87	6	67	268	88
Dyn-O-Mite	61	79	61	79	0	DNA*
Bobby Mac	42	90	0	DNA	42	90
Joyride	10	80	10	80	0	DNA
Fisher-Price	341	94	27	89	314	94
Century	277	95	7	86	270	95
Cosco/Peterson	260	88	86	85	174	89
Commuter	93	88	1	100	92	88
First Ride	44	80	44	80	0	DNA
TLC	42	95	32	97	10	90
Unclassified	38	89	3	100	35	89
Safe and Snug	24	96	0	DNA	24	96
Safe-T-Seat	19	79	6	67	13	85
Strolee Wee Care	162	82	5	80	157	83
No Tether	134	93	4	50	130	95
Tether	28	29	1	100	27	26
Kolcraft	88	81	84	80	4	100
Rock N Ride	84	80	84	80	0	DNA
Unclassified	4	100	0	DNA	4	100
Booster Seat	50	94	5	60	45	98
Gerry Guardian	50	84	0	DNA	50	84
International Astroseat	23	52	20	60	3	0
Nissan	15	93	0	DNA	15	93
Child Love Seat	13	69	0	DNA	13	69
Collier Keyworth	6	100	1	100	5	100
Infant Love Seat	5	80	5	80	0	DNA
Pride Trimble	3	100	1	100	2	100

*DNA - Does Not Apply.

TABLE 12. MAJOR REASONS FOR IMPROPER USAGE

REASON	NUMBER WITH GIVEN REASON
Child Not Harnessed as Required	79
Infant Facing Forward	66
Shield Not Used as Required	29
Restraint Not Tethered as Required	28
Restraint Not Belted to Car	28

TABLE 13. VARIOUS FACTORS AFFECTING CHILD SAFETY SEAT USAGE

VARIABLE	CATEGORY	SAMPLE SIZE	PERCENT USING SAFETY SEATS OR BELTS
Age (Years)	Less Than 1	525	66
	1-3	4,475	47
Child's Location	Front	3,100	41
	Rear	1,867	63
Driver Sex	M	985	42
	F	3,985	56
Driver Age	Y*	2,520	46
	M	2,128	53
	O	321	43
Driver Restrained	Yes	2,463	85
	No	2,537	14
Number of Children Under 4 in Car	1	4,635	47
	2	356	67
	3 or More	9	22

*Y -- 16-30 years
M -- 31-50 years
O -- 51 years or older

TABLE 14. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE (ALL DRIVERS)*

TYPE OF INJURY	NOT WEARING SAFETY BELT NUMBER	NOT WEARING SAFETY BELT PERCENT	WEARING SAFETY BELT NUMBER	WEARING SAFETY BELT PERCENT	PERCENT REDUCTION
Fatal	2,009	0.24	132	0.06	75 **
Incapacitating	23,218	2.73	3,721	1.66	39 **
Non-Incapacitating	41,885	4.92	8,346	3.71	24 **
Possible Injury	44,501	5.23	11,603	5.16	1
Fatal or Incapacitating	25,227	2.96	3,853	1.72	42 **

* Based on 1984 through 1988 accident data. Total sample size for not wearing a safety belt was 851,599 compared to 224,661 for wearing a safety belt.

** Statistically significant reduction (probability of 0.99).

TABLE 15. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE BY TYPE OF VEHICLE, SPEED LIMIT, AND TYPE OF ACCIDENT (ALL DRIVERS)*

VARIABLE	CATEGORY	PERCENT SUSTAINING FATAL OR SEVERE INJURY: NOT WEARING SAFETY BELT	PERCENT SUSTAINING FATAL OR SEVERE INJURY: WEARING SAFETY BELT	PERCENT REDUCTION
Type of Vehicle	Passenger Car	3.03	1.77	41
	Single-Unit Truck	1.71	0.62	64
	Combination Truck	2.68	1.18	56
Type of Accident (Non-Intersection)	Rear End	1.37	0.85	38
	Fixed Object	11.65	5.17	56
	Head-On	13.94	8.87	36
	Overturned	16.98	8.27	51
Speed Limit (mph)	35	2.07	1.23	41
	45	2.88	1.70	41
	55	7.24	3.72	49

* Based on 1984 through 1988 accident data.

TABLE 16. ACCIDENT SEVERITY VERSUS SAFETY SEAT AND BELT USAGE (CHILDREN AGE THREE AND UNDER)*

TYPE OF INJURY	NOT USING SAFETY SEAT OR BELT		USING SAFETY SEAT		USING SAFETY BELT		PERCENT REDUCTION	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	SAFETY SEAT	SAFETY BELT
Fatal	34	0.14	7	0.06	4	0.05	58	60
Incapacitating	415	1.67	62	0.52	53	0.72	69 **	57 **
Non-Incapacitating	1,303	5.25	367	3.05	238	3.24	42 **	38 **
Possible Injury	1,628	6.56	505	4.20	318	4.33	36 **	34 **
Fatal or Incapacitating	449	1.81	69	0.57	57	0.78	68 **	57 **

* Based on 1984 through 1988 accident data. Total sample sizes were 24,802 for not using a safety seat or belt, 12,033 for using a safety seat, and 7,337 for using a safety belt.

** Statistically significant reduction (probability of 0.99).

TABLE 17. ACCIDENT SEVERITY VERSUS SAFETY SEAT AND BELT USAGE BY SEATING POSITION (CHILDREN AGE THREE AND UNDER)*

SEATING POSITION	TYPE OF INJURY	NOT USING SAFETY SEAT OR BELT		USING SAFETY SEAT OR BELT		PERCENT REDUCTION
		NUMBER	PERCENT	NUMBER	PERCENT	
Front	Fatal	26	0.15	5	0.06	64
	Incapacitating	315	1.86	66	0.73	61 **
	Non-Incapacitating	968	5.71	307	3.41	40 **
	Possible Injury	1,269	7.49	446	4.95	34 **
	Fatal or Incapacitating	341	2.01	71	0.79	61 **
Rear	Fatal	8	0.10	6	0.06	43
	Incapacitating	100	1.27	49	0.47	63 **
	Non-Incapacitating	335	4.27	298	2.88	33 **
	Possible Injury	359	4.57	377	3.64	20 **
	Fatal or Incapacitating	108	1.38	55	0.53	61 **

* Based on 1984 through 1988 accident data. Total sample sizes were 16,952 and 7,850 for not using a safety seat or belt in the front and rear seats, respectively, and 9,007 and 9,430 for using either a safety seat or belt in the front and rear seats, respectively.

** Statistically significant reduction (probability of 0.99).

TABLE 18. ACCIDENT SEVERITY VERSUS SAFETY BELT OR SEAT USAGE (OCCUPANTS OTHER THAN DRIVERS)*

TYPE OF INJURY	NOT USING LAP BELT OR SHOULDER HARNESS		USING LAP BELT AND/OR SHOULDER HARNESS		PERCENT REDUCTION
	NUMBER	PERCENT	NUMBER	PERCENT	
Fatal	531	0.23	40	0.07	70**
Incapacitating	8,148	3.54	1,134	1.97	44**
Non-Incapacitating	16,106	7.00	2,617	4.54	35**
Possible	17,280	7.51	3,895	6.76	10**
Fatal or Incapacitating	8,679	3.77	1,174	2.04	46**

* Based on 1985, 1987 and 1988 accident data. Total sample sizes were 230,132 not using a safety belt or seat compared to 41,187 using a safety belt.
** Statistically significant reduction (probability of 0.99).

TABLE 19. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE (OCCUPANTS OTHER THAN DRIVERS)*

SEATING POSITION	TYPE OF INJURY	NOT USING LAP BELT OR SHOULDER HARNESS		USING LAP BELT AND/OR SHOULDER HARNESS		PERCENT REDUCTION
		NUMBER	PERCENT	NUMBER	PERCENT	
Front	Fatal	416	0.24	30	0.07	70***
	Incapacitating	6,419	3.75	939	2.28	39***
	Non-Incapacitating	12,362	7.23	1,981	4.81	33***
	Possible	13,600	7.95	3,033	7.36	7***
	Fatal or Incapacitating	6,835	4.00	969	2.35	41***
Rear**	Fatal	115	0.19	10	0.06	69***
	Incapacitating	1,729	2.93	195	1.19	59***
	Non-Incapacitating	3,744	6.34	636	3.87	39***
	Possible	3,680	6.23	862	5.24	16***
	Fatal or Incapacitating	1,844	3.12	205	1.25	60***

* Based on 1985, 1987, and 1988 accident data. Total sample sizes were 171,071 and 59,061 for not using a safety belt in the front seat and rear seat, respectively and 41,187 and 16,440 for using a safety belt in the front and rear seat, respectively.
** Lap belts only primarily used in rear seat.
*** Statistically significant reduction (probability of 0.99).

TABLE 20. POTENTIAL ANNUAL REDUCTION IN TRAFFIC ACCIDENT FATALITIES AND ACCIDENT SAVINGS FROM INCREASE IN DRIVER SAFETY BELT USAGE*

DRIVER USAGE RATE (PERCENT)	POTENTIAL ANNUAL REDUCTION IN NUMBER OF		ANNUAL ACCIDENT SAVINGS (MILLION $) FROM REDUCTION IN		
	FATALITIES	SERIOUS INJURIES**	FATALITIES	SERIOUS INJURIES	TOTAL
30	17	179	25.5	7.0	32.5
40	54	377	81.0	14.7	95.7
50	91	574	136.5	22.4	158.9
60	129	771	193.5	30.1	223.6
70	166	968	249.0	37.8	286.8
80	203	1,165	304.5	45.4	349.9
90	240	1,362	360.0	53.1	413.1
100	278	1,560	417.0	60.8	477.8

* Based on increase from the 25.5 usage rate determined in the 1989 survey, the percent reductions listed in Table 30, and accident cost estimates recommended by the Federal Highway Administration (11). These costs are $1,500,000 for a fatality and $39,000 for an incapacitating injury.

** Serious injuries were defined as those listed as incapacitating on the accident report.

OCCUPANT RESTRAINT SURVEY

Date_____ Time_____ City_____ Location_____

Comments_____

CARS WITH CHILDREN UNDER 4

No. Ch.	Age		Restra.			Child Safety Seat					Position							Driver						
	<1	1-3	N	B	SS	Type	P	I	Reason	SS	F	R	C	S	L	ST	O	N	B	M	F	Y	M	O

OCCUPANTS OF OTHER CARS

	None						Belt or Harness		
Drivers									
Front Seat Passengers									
4-5									
6-12									
13-19									
Over 19									

Figure 1. Survey Data Collection Form.

Figure 2. Data Collection Coding Instructions.*

1. General Information
   - DATE — Date of Data Collection
   - TIME — Time Data Sheet Started
   - CITY — City Where Data Collected
   - LOCATION — Intersection Where Data Collected
   - COMMENTS — Relevant Comments Concerning Data

2. Data for Cars Containing Children under Four:
   - NO. CH. — Number of Children under Four in Vehicle
     Record Once for Each Vehicle
   - AGE — Check Best Estimate of Child's Age
     (Less Than 1 or 1-3)
   - RESTRAINT — Check Appropriate Code
     - N — None
     - B — Harness and Belt
     - SS — Child Restraint (Safety Seat)
   - CHILD SAFETY SEAT
     - TYPE — Brand and Model (e.g., Kantwet One-Step)
     - P-I — Check Whether Properly (P) or
       Improperly (I) Used
     - REASON — If Improperly Used, Give Explanation
       (e.g., Not Tethered)
     - SS — Safety Seat in Vehicle Not in Use
   - POSITION — Check One in Two Categories
     1. F — Front Seat
        R — Rear Seat
        C — Cargo Area
        Do Not Check Following Category if Child
        Restraint Used
     2. S — Seated in a Normal Manner
        L — Held in Lap
        ST — Standing in Seat
        O — Other (e.g., Standing or Sitting on
        Front Edge of Seat)
   - DRIVER — Check One in Three Categories
     1. N — No Restraint
        B — Safety Belt
     2. M — Male
        F — Female
     3. Y — Young (16 - 30 Years)
        M — Middle (31-50 Years)
        O — Older (51 or More)

3. Data for Drivers and Passengers of Other Vehicles
   For Each Driver, Determine Safety Belt Usage and
   Place a Mark in the Appropriate Category. For
   Each Passenger, Determine Safety Belt Usage and
   Place a Mark in the Appropriate Age Category.
   Put Maximum of Ten Marks in a Given Space.

Figure 3. Usage Rates of Child Safety Seat or Safety Belt for Children Under 4 Years of Age

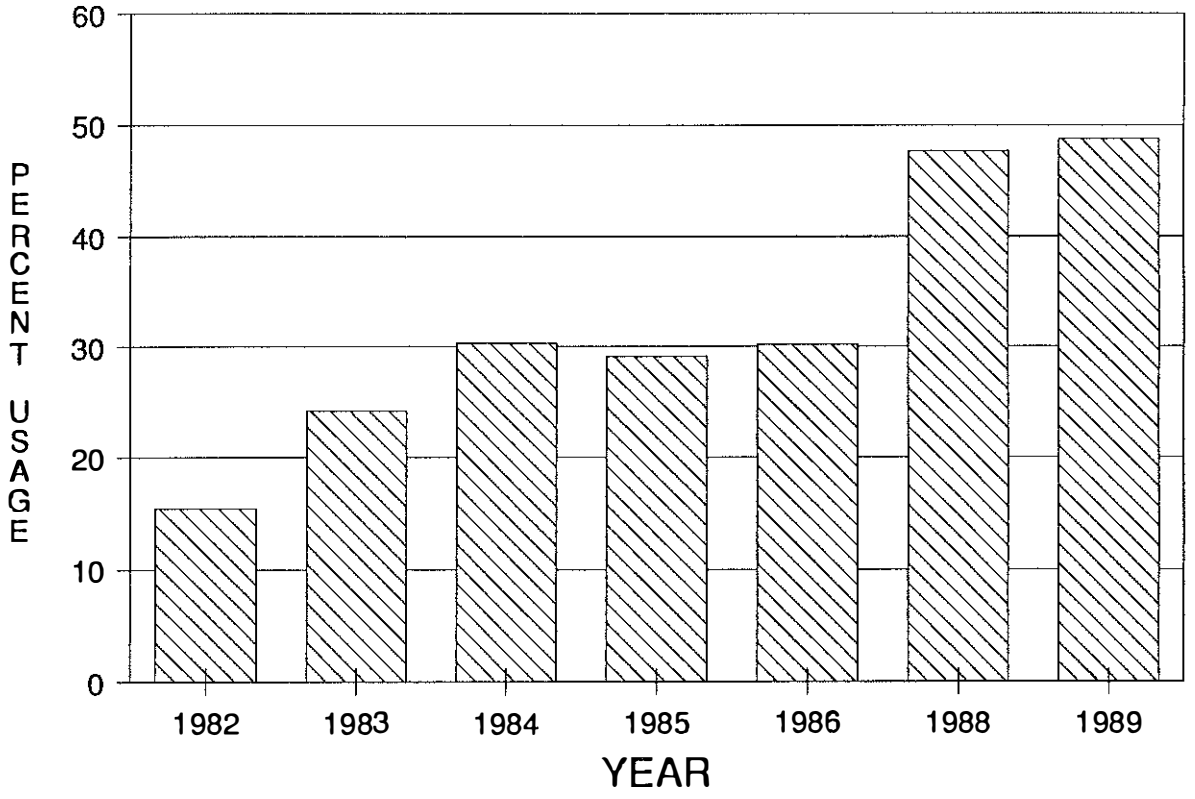


Figure 4. 1989 Child Safety Seat and Belt Usage Rate Versus Population

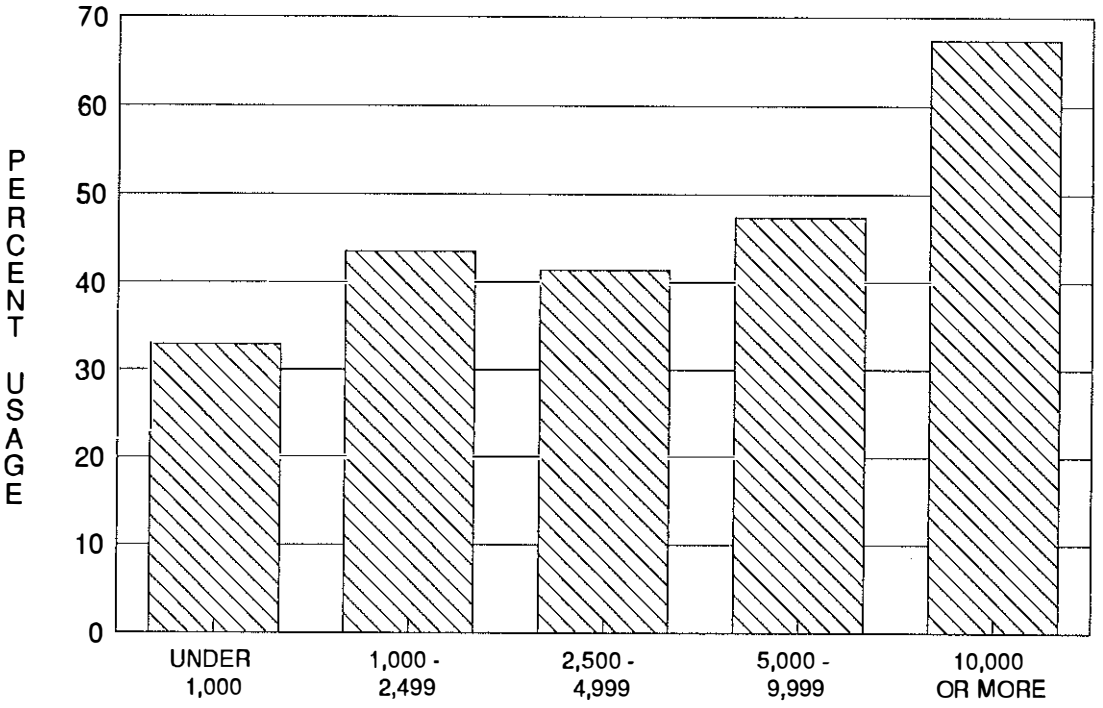


Figure 5. 1989 Driver Usage Rates Versus Population

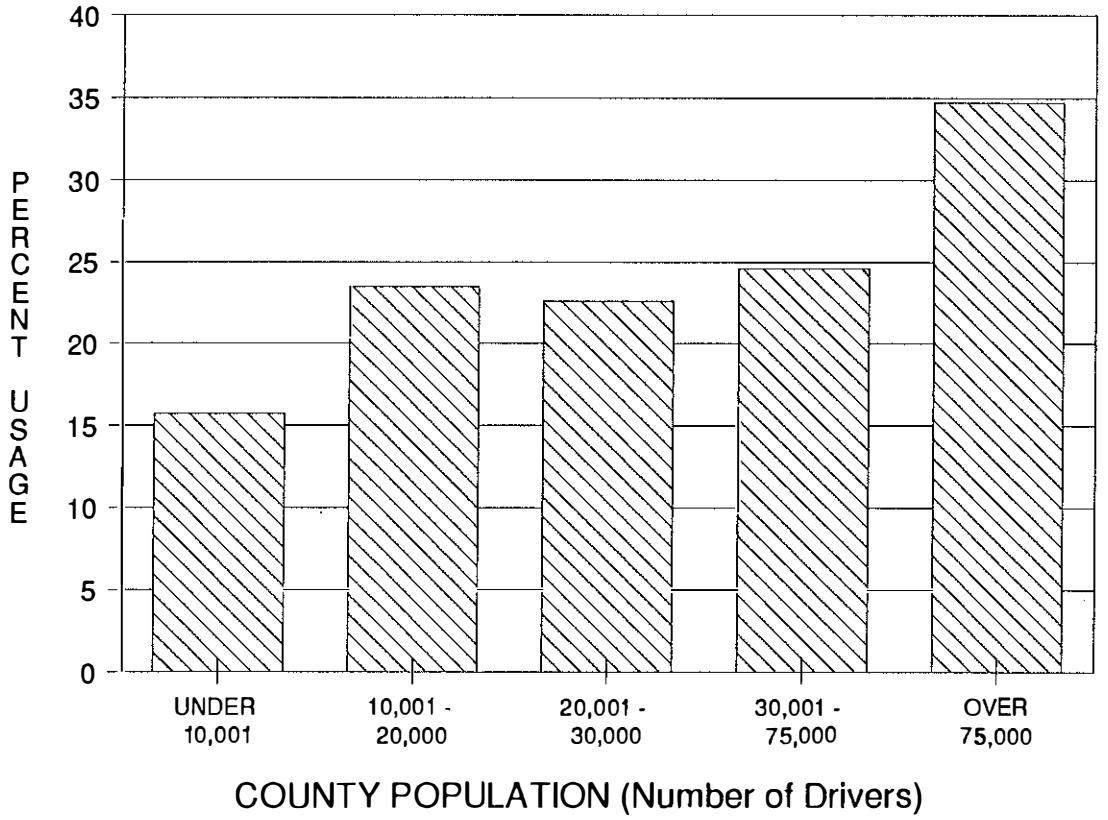
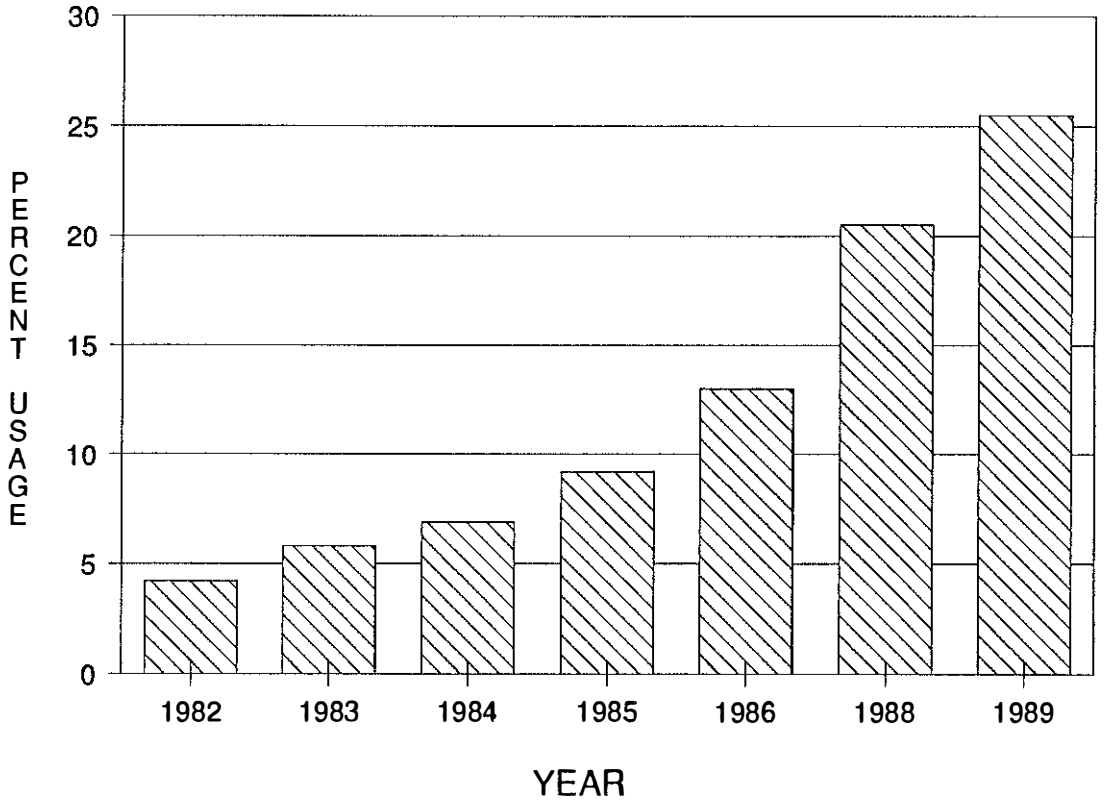


Figure 6. Usage Rate of Drivers



Finalized
Report
10/13/89