Research Report
KTC-91-9

1991 SAFETY BELT USAGE SURVEY AND EVALUATION OF EFFECTIVENESS IN KENTUCKY

by

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Commonwealth of Kentucky

September 1991

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
KTC-91-9		

4. Title and Subtitle

1991 Safety Belt Usage Survey and Evaluation of Effectiveness in Kentucky

5. Report Date
September 1991

6. Performing Organization Code

7. Author(s)
K. R. Agent

8. Performing Organization Report No.
KTC-91-9

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.
LE-91-03-005

13. Type of Report and Period Covered
Final

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

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The objective of the survey was to establish 1991 safety belt and child safety seat usage rates in Kentucky. Data were collected at 100 sites and combined based on vehicle miles travelled for a given type of highway, rural or urban location, and county population category. Also included in this report is an analysis of accident records evaluating the effectiveness of safety belts.

Statewide usage rates were 39 percent for drivers and front-seat passengers (over 19 years of age) and 57 percent for children under four years of age (front and rear seats). Driver usage rates had increased significantly in 1991 compared to 1990. Rates were highest on interstate highways and lowest on rural, non-interstate highways.

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 49 percent reduction in fatal or incapacitating injuries was determined for drivers wearing a safety belt compared to those who were not restrained.

The increased usage that resulted in Fayette County and Louisville after enactment of local mandatory usage laws was shown. The recommendation is that a statewide mandatory safety belt law should be passed or, in lieu of a statewide law, additional local governments should pass such a law.

17. Key Words	18. Distribution Statement
Safety Belt Child Safety Seat Accident Severity	Unlimited with approval of Kentucky Satate Police

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	44	

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

ACKNOWLEDGEMENTS

For their significant contributions toward completion of this report, an expression of appreciation is extended to the following employees of the Kentucky Transportation Center:

Carla Crossfield
Scott Cochran
JoAnn Browning

Overall guidance and coordination for the project was provided through the efforts of David Salyers with the Kentucky State Police's Highway Safety Branch.

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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. There have been efforts to increase safety belt and safety seat usage. In Kentucky, these efforts have usually involved public information campaigns. While most states have passed a statewide mandatory safety belt usage law, such a law has not been passed in Kentucky. 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. The 1988 Kentucky General Assembly strengthened the child restraint law to include a $50 fine for violation of the law. Also, local mandatory safety belt usage laws have been enacted by Kentucky's two largest cities. The first such local law was enacted by the Lexington-Fayette Urban County Government with an effective date of July 1, 1990. The second local law was enacted by the city of Louisville with an effective date of July 1, 1991.

Statewide observational surveys have been conducted in 19 cities across Kentucky annually beginning in 1982 (with the exception of 1987) to document safety belt and safety seat usage in Kentucky (1, 2, 3, 4, 5, 6, 7, 8). The number of sites was increased starting in 1990 in an attempt to obtain a more representative statewide sample (8). Statewide usage of child safety seats or safety belts for children under 4 years of age increased from about 15 percent in 1982 before enactment of the mandatory child restraint law to about 30 percent in 1984 and stayed at this level in 1985 and 1986. This percentage increased to almost 50 percent in 1988 and 1989 and to 57 percent in 1990 after a penalty was added to the law. Safety belt usage for the driver has increased each year of the survey. The statewide driver safety belt usage rate was only 4.2 percent in 1982 compared to 32 percent in 1990.

The objective of the survey summarized in this report is to establish statewide 1991 safety belt and child safety seat usage rates in Kentucky. These rates can be compared to those determined from previous surveys. Another objective of this study was to analyze accident data to evaluate the effectiveness of safety belts in reducing injuries to occupants of motor vehicles involved in traffic accidents.

PROCEDURE

DATA COLLECTION PROCEDURE

The data collection procedure used in the surveys was modified starting with the 1990 survey. The procedure used in the 1990 survey was again used in the 1991 survey. The procedure used for the first several surveys was changed in order to obtain a more representative statewide sample as well as to use a procedure that would be comparable to surveys taken in other states. The data collection form was changed as well as the site selection procedure.

The data collection form used in the survey is shown in Figure 1. Usage was recorded for drivers and front-seat passengers sitting in the outboard position. The exception was for children under four years of age for which data were collected for all positions in the front and the rear seats. Drivers were classified into three age categories and were classified by sex. Passengers were classified into several age categories. For drivers and front-seat passengers (over three years of age), usage was classified as either using a harness or belt or no restraint. For children one to three years of age, the categories included safety seat, booster seat, harness or belt, or no restraint. For children under one year of age, the categories were either safety seat or no restraint. When a safety seat was used, an attempt was made to determine if there was an obvious misuse.

The following list of guidelines for data collection was given to each observer, and each data collector went through a training period.

1. Always include the driver so the number of vehicles included in the sample will be known.

2. Include all vehicles at low-volume locations. When taking data on a multi-lane road, generally include only vehicles in the curb or near lane unless the traffic volume and roadway geometrics allow data to be collected in the next lane.

3. Collect data on only one approach at the intersection.

4. If traffic volume is too heavy to collect data for all vehicles, record data for the next vehicle in view after recording data for the prior vehicle.

5. Obtain a random sample of vehicles independent of whether the occupants are wearing a safety belt. (Do not attempt to include all vehicles having an occupant wearing a safety belt at a location where all vehicles cannot be obtained.)

6. Attempt to include data for children under four years of age for any vehicle in the sample in which such a child is a passenger.

7. Only include vehicles either stopped or moving so slowly that occupants can be readily observed.

8. Excluding children under four years of age, collect data only for drivers and passsengers in the right-front seat (exclude the center front and rear seating positions).

9. Do not include old passenger cars not equipped with a safety belt (those without a head rest).

10. Collect data during daylight hours on weekdays and weekends.

11. Collect data for four hours at each site.

12. Begin and end data collection at a specified time not considering whether the occupants are using a safety belt.

13. Collect data for cars, vans, and light trucks.

14. Do not include a vehicle in the count if use by the driver cannot be determined.

As noted, data were collected for four hours at each location. The decision was made to collect data for an equal time period for each location rather than attempt to collect a given sample size.

DATA COLLECTION LOCATIONS

Data for the surveys collected from 1982 through 1989 were conducted at 23 sites in 19 cities. The cities were selected so that they would be distributed across the state. These cities were also selected to represent a range of population categories to account for social and economic factors. In order to be able to relate the survey results to data taken in other states, it was necessary to expand the number of sites to include data in rural locations and for interstates. The distribution of the sites was based on vehicle miles travelled statewide for various categories of roads in counties of varying populations. The variables considered were the rural or urban designation of the road, the functional classification of the road, and the county population. This was done so that roads would be stratified to assure a proper representation of urban and rural areas and different road types. The percentages of vehicle miles travelled on various types of highways in counties within given population ranges are given in Table 1. These percentages represent the proportion of vehicle miles driven on roadways having the given characteristics of the total vehicle miles driven statewide. The data apply to roads for which a traffic volume was available (which is the state-maintained highway system of slightly over 27,000 miles). Local county and city roadways would not be included.

The decision was made to take survey data at 100 sites. The number of sites for any type of highway and county population category was equal to the percentage of vehicle miles travelled for the given type of highway and county population. For example, eight percent of all vehicle miles travelled was on rural arterial highways in counties having a population between 10,000 and 25,000 so eight sites were selected on highways meeting this criterion. A computer file was used to prepare a randomly selected list of sections of roadway for each of the categories given in Table 1. This list was used as a source for selecting sites. Data had been collected at 23

sites since 1982, and it was felt that it would be beneficial to maintain an historical record at these sites. Therefore, these sites were maintained. A list of the observation sites is presented in Table 2, and the 23 original sites are identified with an asterisk. Many of the other sites were obtained from the randomly selected list of highway sections.

The sites had to be selected at a location where traffic would stop. A list of all locations having a traffic signal was obtained and used in the selection of sites. Except for some interstate locations, all the sites are at an intersection. Most of the intersections are controlled by a traffic signal. The sites selected to obtain data for interstates were either at an exit ramp or at a rest area. This would be the only exception to the sites being at an intersection. Another variable which was considered was the geographical location of the sites. Sites were selected to assure that they were distributed across the state. Sites were selected in 62 of the 120 counties. The largest number in any one county was eight in Jefferson County. For each category, the county, location (road and intersecting road), and city (nearest city for rural locations) are given in Table 2.

SURVEY DATA ANALYSIS

Safety belt usage rates were obtained for the driver and for all front-seat occupants. Rates were also obtained by driver age and sex and by age of the front seat occupant. Statewide rates were obtained by weighting the usage determined for a given type of highway and county population by the percentage of vehicle miles given in Table 1 and combining the percentages from the various categories. Confidence intervals for the statewide usage rates were calculated.

For children under four years of age, rates were obtained for both front and rear seating positions as well for combined seating positions. Rates were separated into safety seat, booster seat, and harness or belt.

The 1991 usage rates for the 19 cities previously surveyed were compared to results determined in prior years. The rates for the various types of highway and county population categories were compared. Rates were also compared by region of the state.

ACCIDENT ANALYSIS

The computer files containing all reported accidents in Kentucky (for the years 1986 through 1990) were analyzed to determine the effectiveness of wearing safety belts or riding in a safety seat. The percent reductions in injuries were computed, and statistical tests were conducted to determine if the reductions were significant. This type of analysis was performed for drivers, children age three and under, and front-and rear-seat passengers. The effectiveness of safety belts was related to

several factors such as seating position, type of vehicle, and speed limit. The potential annual reduction in traffic accident fatalities and serious injuries and the accident savings from an increase in driver safety belt usage were estimated.

RESULTS

SURVEY DATA ANALYSIS

Driver usage rates for the various types of highways and county population categories are summarized in Table 3. The overall statewide rate, using the data collected at 100 sites and the weighting procedure described, was 39 percent. The sample size was 80,513 drivers. The confidence limits for a probability of 0.99 would be plus or minus 0.4 percent (9). For a given type of highway, the usage rate was higher for counties having larger populations.

While the data collection procedure in 1990 and 1991 changed from previous surveys, the usage rate may still be compared to the statewide rates from past years. The previous studies showed that driver usage rates statewide had steadily increased from 4.2 percent in 1982 to 32 percent in 1990. The 1991 survey shows that this increase has continued. The increase in the driver usage rate in 1991 compared to 1990 was determined to be statistically significant (probability of 0.99) (10).

Usage rates for front-seat passengers for the various types of highways and county population categories are summarized in Tables 4 through 7 for the different age categories. Usage for children in the four to five year of age cateory was 36 percent plus or minus about 4 percent. This compares to 39 percent for the 1990 but this slight reduction was not statistically significant. For children in the 6 to 12 years of age category, the usage rate was 38 percent plus or minus about 3 percent. This compares to 37 percent in 1990 with this slight increase not being statistically significant. For the 13 to 19 years of age category, the usage rate was 29 percent plus or minus about 2 percent. This was a decrease from 35 percent in 1990, and this decrease was statistically significant (probability of 0.99). For the category of over 19 years of age, the usage rate was 39 percent plus or minus about 1 percent. This was an increase from 32 percent in 1990, and this increase was statistically significant (probability of 0.99).

Usage rates for children one through three years of age are given in Table 8 while rates for children under one year of age are given in Table 9. These rates are for children in both the front and the rear. The usage rate for children under one year of age (73 percent with a confidence limit of about four percent) was higher than that for children one to three years of age (53 percent with a confidence limit of about two percent). The usage rate for the combination of these categories or children under four years of age was 57 percent with confidence limits for a probability of 0.99

percent of about two percent. The sample size for children under four years of age was 4,592. This age category corresponds to the children for which the mandatory child restraint law would apply. This usage rate of 57 percent is identical to the rate in 1990. This percentage was about 15 percent in 1982 before enactment of the child restraint law and increased to approximately 30 percent after enactment of the law having no penalty and increased again to almost 50 percent in 1988 after the addition of a dollar penalty to the child restraint law.

The usage rate for children under four was higher in the rear seat compared to the front seat. For children one to three years of age, the usage rate was 64 percent for the rear seat compared to 40 percent for the front seat. For children under one year old, the usage rate was 84 percent for the rear seat compared to 58 percent for the front seat.

Safety belt usage rates for drivers and front-seat passengers, by type of highway, are presented in Table 10. The highway usage rates were on interstates (both rural and urban). The lowest usage rates were on rural, non-interstate highways. For each category, the highest rate was for urban interstates with the lowest rate on rural, local highways. There was a substantial variation between highway types. For drivers, the percentage using a safety belt varied from 25 percent on rural, local highways to 60 percent on urban interstates. For front seat passengers, the percentage for those using a safety belt varied from 21 percent on rural, local highways to 56 percent on urban interstates. For children under four years of age, the percentage using a safety seat or safety belt varied from 38 percent on rural, local highways to 75 percent on urban interstates.

There was a variation in usage by the age and sex of the driver (Table 11). Females had a higher usage rate than males. The middle age category of 31 to 50 years of age had a slightly higher usage than the 16 to 30 and over 50 years of age categories.

The highest usage rate for front-seat passengers was for the under four years of age category (Table 12). This would be expected since the mandatory child restraint law would apply to this age category. The usage rate for the over 19 years of age category was the same as that for drivers. The usage rates for children in the range of 4 to 12 years of age were similar with a lower rate for teenagers.

The change in usage of safety belts by drivers in the 19 cities in which data have been collected since 1982 is presented in Table 13. The usage rate was higher in 1991 than in 1990 in 11 of the 19 cities with identical rates in five other cities. The largest increase was at the locations in Louisville, and this finding would be related to the passage of a mandatory usage law in Louisville. The usage rates in Louisville and Lexington were much higher than that in any other city. This shows the potential increase in usage which could be obtained with a mandatory belt law.

The lowest rate (19 percent) was in Hazard and Princeton with the other lowest rates occurring in the smallest cities. In 11 of the 19 cities, the rate has either increased or remained constant from one year to the next. Using the procedure followed in the previous surveys in which data were taken only at sites in these 19 cities results in a statewide usage rate of 40 percent. This rate is very close to that determined using the revised procedure in which data are collected at 100 sites.

The change in usage of safety seats or belts by children under 4 years of age in these 19 cities is presented in Table 14. In 17 of the 19 cities, the usage rate in 1991 either increased or stayed the same as in 1990. The highest usage was in Lexington, followed by Louisville. The lowest usage was in Hazard. As with usage rates for drivers, the rate was related to city population with usage generally increasing as population increased. Using the procedure followed in the previous surveys in which data were taken only at sites in these 19 cities results in a statewide usage rate of 67 percent. This rate is higher than that determined using the revised procedure in which data are collected at 100 sites.

A summary of the data collected is given in the Appendix. For each of the 100 data sites, the usage rate and sample size are given for drivers, front-seat passengers (by age category for over four years of age), and children in the one to three years of age and under one year old age categories (both front and rear seat).

Obvious improper usage of safety seats was determined to be about 15 percent (compared to 14 percent in the 1990 survey). Improper usage identified in the survey was limited to the types that could be easily noted as a vehicle passed slowly by the observer. The reasons for improper usage would include the child not being harnessed into the seat, an infant facing forward, the shield not used as required, a tether not used (if required), or the restraint not belted to the seat (typically for infants). 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 was higher in the front seat (20 percent) than in the rear seat (12 percent). Improper usage was also higher for children under one year of age (19 percent) compared to the one to three years of age category (12 percent).

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 are summarized in Table 15 (based on 1986 through 1990 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 (78 percent reduction) with the reduction decreasing for less severe injuries. For comparison, the reduction was eight percent for the "possible injury" category. The reductions in the percentage of each of the types of 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 the smaller reductions in the less severe injury classifications. There was a 49 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 injuries by between 40 and 55 percent (11).

The effectiveness of safety belts in reducing driver injuries was related to several variables. In Table 16, 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. The severity of injuries to drivers of passenger cars was higher than for drivers of trucks. Safety belts also reduced the percentage for 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. 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 17. 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 seat or safety belt. The reductions for all injury categories, except fatalities, were statistically significant (probability of 0.99). Of 41 fatalities, 27 involved children not using a safety seat or safety belt. The percent reductions were higher than that for drivers (as given in Table 15). There was a 72 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 18, the reductions in injuries applied to both the rear-and front-seating positions. The data in Table 18 show that accident severity was less in the rear than in the front seat. Of the 41 fatalities, 27 involved a front-seat passenger.

The number and percentage of occupants other than drivers sustaining a given injury as a function of safety belt usage are listed in Table 19. As with drivers, there was a large reduction in the percent injured (all reductions were statistically significant with a probability of 0.99). Overall, 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 in a traffic accident was reduced by 50 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 20. Only a lap belt is available in the rear seat in the majority of vehicles involved in accidents in the time period studied. 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 primarily a lap belt in the rear seat has been effective since primarily its use was associated with a reduction in fatal or incapacitating injuries of 62 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 21. The reduction in fatalities and associated accident cost savings were calculated using the reduction factors listed in Table 15, accident data for the years of 1986 through 1990, the 32.2 percent usage rate determined from the 1990 observational survey, and accident cost estimates recommended by the Federal Highway Administration (12).

SUMMARY

The methodology used to obtain statewide safety belt usage rates in 1991 was the same as that used for the 1990 survey. The data show that the usage rate for drivers in 1991 continued the increase that has been documented in previous years (Table 22). The statewide usage rate of safety belts by drivers was 39 percent. This compares to 32 percent in 1990. The usage rate varied by type of highway and type of area (rural or urban). The rate was generally higher in urban compared to rural areas. Rates were higher on interstate and arterial highways compared to collector or local streets. While Kentucky does not have a statewide mandatory usage law, local ordinances have been enacted in Fayette County (Lexington) and Louisville. The effect of these laws was shown with the very high usage determined for the observation sites in Lexington and Louisville.

The statewide usage rates for front-seat passengers were also obtained. Considering all passengers, the usage rate was 39 percent. Usage varied with age with the highest usage for the under four years of age category and the lowest usage for the 13 to 19 years of age category. The usage rate for the 13 to 19 years of age category actually decreased significantly in 1991 compared to 1990.

Kentucky has a law requiring children under 40 inches in height to be placed in a child restraint. The statewide usage rate for children under the age of four (including both the front and rear seat) was determined to be 57 percent. This was

identical to that determined in the 1990 survey but it represents an increase compared to surveys conducted prior to 1990 (Table 22).

The significant benefits, based upon 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 analysis of accident records. For example, one finding was that there was a 49-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 by 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, statewide usage is only about 39 percent with much lower usage rates (as low as under 15 percent) determined for some small cities. While public information has resulted in increases, the method which has been shown to result in a dramatic increase in safety belt usage is enactment of a mandatory safety belt law. This has been demonstrated in Kentucky after enactment of ordinances in Fayette County and Louisville. This resulted in almost doubling of the usage rate to a level of about 70 percent. Statewide laws have been enacted in the majority of states. National surveys have shown usage rates of 30 percent in cities without a belt law compared to 50 percent in cities having a law (11). Belt use as high as 90 percent has been reported in other countries having belt laws and high levels of enforcement (13). 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 (11). An analysis of Kentucky accident records showed the safety benefits associated with safety belt usage and the potential annual reductions in traffic accident fatalities and accident savings from an increase in driver safety belt usage was estimated. For example, an increase in the driver usage rate up to 50 percent usage would result in a potential annual reduction of 86 fatalities and an annual accident savings from the reduction in fatalities and serious injuries of about 151 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, additional local governments should consider passing mandatory safety belt laws.

Public information and education concerning the reasons to wear safety belts should continue. The survey shows that emphasis areas would be for the 13 to 19 years of age category and for rural areas.

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. Agent, K. R.; "1989 Usage Rates and Effectiveness of Safety Belts and Child Safety Seats in Kentucky," University of Kentucky, Transportation Center, Report KTC-89-42, September 1989.

8. Agent, K. R.; "1990 Safety Belt Usage Survey and Evaluation of Effectiveness in Kentucky," University of Kentucky, Transportation Center, Report KTC-90-18, September 1990.

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

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

13. 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.

Figure 1. Data Collection Form.

DATA COLLECTION FORM

Date:_____ Starting Time:_____ Ending Time:_____
Location:_____ Sheet No:_____
Observer:_____ Comment:_____

DRIVER USAGE

Age & Sex	Harness or Belt	None
16-30 M		
31-50 M		
> 50 M		
16-30 F		
31-50 F		
> 50 F		

FRONT-SEAT OCCUPANT USAGE (OVER 3 YEARS OF AGE)

Age	Harness or Belt	None
4-5		
6-12		
13-19		
Over 19		

USAGE FOR CHILDREN 1-3 YEARS OF AGE

	Safety Seat	Safety Seat (Improper)	Booster Seat	Harness or Belt	None
Front					
Rear					

USAGE FOR INFANTS (UNDER 1 YEAR OF AGE)

	Safety Seat	Safety Seat (Improper)	None
Front			
Rear			

TABLE 1. DISTRIBUTION OF VEHICLE MILES TRAVELED BY TYPE OF HIGHWAY AND COUNTY POPULATION

TYPE OF HIGHWAY	COUNTY POPULATION	PERCENTAGE OF ALL VEHICLE MILES
Rural Interstate	Over 100,000	1.04
	50,001-100,000	2.78
	25,001-50,000	4.96
	10,000-25,000	5.19
	Under 10,000	1.32
Rural Arterial	Over 50,000	3.14
	25,001-50,000	7.36
	10,000-25,000	8.12
	Under 10,000	1.93
Rural Collector	Over 100,000	0.65
	50,001-100,000	3.19
	25,001-50,000	7.70
	10,000-25,000	9.72
	Under 10,000	2.28
Rural Local	Over 50,000	0.74
	25,000-50,000	1.74
	Under 25,000	3.74
Urban Interstate	Over 100,000	8.32
	50,000-100,000	1.49
	Under 50,000	1.06
Urban Arterial	Over 100,000	10.23
	25,000-100,000	9.52
	Under 25,000	1.79
Urban Collector or Local	All	1.99

TABLE 2. STATEWIDE SURVEY LOCATIONS

TYPE LOCATION	COUNTY POPULATION	SURVEY SITE
Rural Interstate	Over 100,000	Fayette, I64 at KY 859, Lexington
	50,001-100,000	Boyd, I64 at US 23, Catlettsburg
		Christian, I24 at US 41A, Hopkinsville
		Hardin, I64 at rest area, Sonora
	25,001-50,000	Barren, I 64 at KY 70, Cave City
		Boone, I 75 at rest area, Florence
		Clark, I 64 at KY 627, Winchester
		Franklin, I 64 at US 60, Frankfort
		Laurel, I 75 at KY 80, London
	10,000-25,000	Henry, I 71 at KY 153, Sligo
		Rockcastle, I 75 at US 25, Mt. Vernon
		Scott, I 75 at rest area, Georgetown
		Shelby, I 64 at KY 53, Shelbyville
		Woodford, I 64 at KY 341, Midway
	Under 10,000	Trigg, I 24 at US 68, Cadiz
Rural Arterial	Over 50,000	Pike, Us 460 at US 119, Pikeville
		Daviess, US 60 at KY 144, Owensboro
		Hardin, US 31W at KY 835, West Point
	25,001-50,000	Perry, KY 15X at KY 476, Hazard*
		Knox, US 25E at KY 225, Barbourville
		Harlan, US 119 at KY 179, Cumberland
		Floyd, KY 80 at US 23, Allen
		Bullitt, US 31E at KY 44, Mt. Washington
		Carter, KY 1 at I 64, Grayson
		Laurel, US 25 at KY 80, London
	10,000-25,000	Mason, US 62 at KY 11, Maysville*

TABLE 2. STATEWIDE SURVEY LOCATIONS (continued)

TYPE LOCATION	COUNTY POPULATION	SURVEY SITE
Rural Arterial	10,000-25,000	Clay, US 421 at KY 80, Manchester
		Bourbon, US 68 at 5th St., Millersburg
		Casey, US 127 at KY 70, Liberty
		Meade, US 31W at KY 1638, Muldraugh
		Lincoln, US 127 at KY 78, Hustonville
		Russell, US 127 at KY 80, Russell Springs
		Washington, US 150 at KY 55, Springfield
	Under 10,000	Cumberland, KY 90 at KY 61, Burkesville
		Ballard, US 60 at KY 358, LaCenter
Rural Collector	Over 100,000	Fayette, KY 418 at I 75, Lexington
	50,001-100,000	Christian, US 41 at KY 1682, Hopkinsville
		McCracken, US 62 at US 68, Paducah
		Madison, KY 52 at KY 876, Richmond
	25,001-50,000	Barren, KY 255 at US 31W, Park City
		Nelson, US 62 at KY 48, Bloomfield
		Boone, KY 18 at KY 237, Burlington
		Oldham, KY 146 at KY 393, Buckner
		Knox, KY 11 at US 25E, Barbourville
		Henderson, KY 145 at US 60, Corydon
		Boyle, US 68 at US 150, Perryville
		Greenup, KY 1 at US 23, Greenup
	10,000-25,000	Caldwell, KY 139 at Jefferson, Princeton*
		Grayson, US 62 at KY 259, Leitchfield
		Allen, US 231 at US 31E, Scottsville
		Bath, US 60 at KY 36, Owingsville
		Larue, KY 84 at KY 61, Hodgenville
		Scott, US 62 at I 75, Georgetown
		Anderson, US 127 at US 127B, Lawrenceburg

TABLE 2. STATEWIDE SURVEY LOCATIONS (continued)

TYPE LOCATION	COUNTY POPULATION	SURVEY SITE
Rural Collector	10,000-25,000	Breathitt, KY 30 at KY 15, Jackson
		Webster, US 41 at KY 56, Sebree
		Garrard, KY 39 at US 27, Lancaster
	Under 10,000	Carroll, US 42 at Highland, Carrollton*
		Elliott, KY 32 at KY 7, Sandy Hook
Rural Local	Over 50,000	McCracken, KY 1286 at US 62, Paducah
	25,000-50,000	Harlan, KY 413 at US 119, Loyall
		Greenup, KY 7 at US 23, South Shore
	Under 25,000	Lewis, KY 10 at KY 57, Tollesboro
		Simpson, KY 73 at KY 100, Franklin
		Adair, KY 2290 at KY 55, Columbia
		Taylor, KY 208 at US 68, Campbellsville
Urban Interstate	Over 100,000	Kenton, I 275 at KY 17, Covington
		Kenton, I 75 at KY 371, Cresent Springs
		Fayette, I 75 at US 68, Lexington
		Jefferson, I 64 at KY 1747, Louisville
		Jefferson, I 64 at KY 1631, Louisville
		Jefferson, I 264 at US 31E, Louisville
		Jefferson, I 264 at US 42, Louisville
		Jefferson, I 264 at US 60, Louisville
	50,000-100,000	Warren, I 65 at US 231, Bowling Green
	Under 50,000	Boone, I 71 at KY 14, Verona
Urban Arterial	Over 100,000	Jefferson, US 31W at Gagel, Louisville*
		Jefferson, KY 1447 at Hubbards, Louisville*
		Jefferson, KY 1703 at Trevillian Way, Louisville*

TABLE 2. STATEWIDE SURVEY LOCATIONS (continued)

TYPE LOCATION	COUNTY POPULATION	SURVEY SITE
Urban Arterial	Over 100,000	Fayette, US 27 at KY 1683, Lexington*
		Fayette, Reynolds at Lansdowne, Lexington*
		Fayette, KY 4 at KY 353, Lexington*
		Kenton, US 25 at KY 236, Covington
		Kenton, KY 8 at KY 17, Covington
		Kenton, KY 16 at KY 177, Covington
		Fayette, US 25 at Fontaine, Lexington
	25,000-100,000	Campbell, US 27 at Carothers, Newport*
		Christian, US 41 at Ninth, Hopkinsville*
		Hopkins, US 41A at KY 70, Madisonville*
		Pulaski, US 27 at KY 80, Somerset*
		Franklin, US 60 at Sunset, Frankfort*
		Henderson, US 41A at First, Henderson*
		Nelson, US 31E at Beall, Bardstown
		Barren, US 68 at Race, Glasgow*
		Clark, US 60 at KY 1958, Winchester*
		Warren, US 31W at US 231, Bowling Green
	Under 25,000	Anderson, US 62 at Broadway, Lawrenceburg*
		Rowan, US 60 at KY 32, Morehead*
Urban Collector or Local	All	Hardin, Poplar at Sycamore, Elizabethtown*
		Kenton, KY 1072 at Highland, Covington*

* Original data collection site.

TABLE 3. DRIVER USAGE RATES

TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	73	212
	50,001-100,000	58	1,636
	25,001-50,000	55	2,052
	10,000-25,000	54	1,717
	Under 10,000	58	564
Rural Arterial	Over 50,000	36	2,494
	25,001-50,000	24	6,119
	10,000-25,000	31	6,041
	Under 10,000	22	1,692
Rural Collector	Over 100,000	58	1,178
	50,001-100,000	41	2,794
	25,001-50,000	31	4,788
	10,000-25,000	25	7,392
	Under 10,000	27	1,565
Rural Local	Over 50,000	44	480
	25,000-50,000	20	887
	Under 25,000	23	1,739
Urban Interstate	Over 100,000	63	6,599
	50,000-100,000	53	832
	Under 50,000	25	338
Urban Arterial	Over 100,000	59	11,399
	25,000-100,000	31	12,757
	Under 25,000	23	2,231
Urban Collector or Local	All	35	3,007
ALL	All	39	80,513

TABLE 4. FRONT-SEAT PASSENGER (AGE 4-5 YEARS) USAGE RATES

TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	0	1
	50,001-100,000	57	14
	25,001-50,000	35	17
	10,000-25,000	47	15
	Under 10,000	100	2
Rural Arterial	Over 50,000	39	31
	25,001-50,000	23	116
	10,000-25,000	24	79
	Under 10,000	19	36
Rural Collector	Over 100,000	50	6
	50,001-100,000	46	61
	25,001-50,000	30	77
	10,000-25,000	23	154
	Under 10,000	14	22
Rural Local	Over 50,000	43	7
	25,000-50,000	29	14
	Under 25,000	21	19
Urban Interstate	Over 100,000	67	55
	50,000-100,000	33	6
	Under 50,000	50	2
Urban Arterial	Over 100,000	51	135
	25,000-100,000	31	140
	Under 25,000	22	49
Urban Collector or Local	All	35	52
ALL	All	36	1,110

TABLE 5. FRONT-SEAT PASSENGER (AGE 6-12 YEARS) USAGE RATES			
TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	67	6
	50,001-100,000	63	24
	25,001-50,000	53	32
	10,000-25,000	41	39
	Under 10,000	54	13
Rural Arterial	Over 50,000	30	44
	25,001-50,000	20	164
	10,000-25,000	30	106
	Under 10,000	19	48
Rural Collector	Over 100,000	56	18
	50,001-100,000	45	91
	25,001-50,000	26	108
	10,000-25,000	23	225
	Under 10,000	15	39
Rural Local	Over 50,000	40	15
	25,000-50,000	22	41
	Under 25,000	14	56
Urban Interstate	Over 100,000	64	140
	50,000-100,000	59	22
	Under 50,000	0	4
Urban Arterial	Over 100,000	67	288
	25,000-100,000	32	263
	Under 25,000	28	65
Urban Collector or Local	All	41	97
ALL	All	38	1,948

TABLE 6. FRONT-SEAT PASSENGER (AGE 13-19 YEARS) USAGE RATES

TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	60	5
	50,001-100,000	36	36
	25,001-50,000	41	74
	10,000-25,000	41	70
	Under 10,000	42	31
Rural Arterial	Over 50,000	26	93
	25,001-50,000	17	360
	10,000-25,000	23	331
	Under 10,000	14	87
Rural Collector	Over 100,000	47	30
	50,001-100,000	27	81
	25,001-50,000	24	292
	10,000-25,000	15	338
	Under 10,000	21	62
Rural Local	Over 50,000	32	38
	25,000-50,000	14	65
	Under 25,000	20	93
Urban Interstate	Over 100,000	53	233
	50,000-100,000	31	35
	Under 50,000	20	64
Urban Arterial	Over 100,000	46	546
	25,000-100,000	21	517
	Under 25,000	15	99
Urban Collector or Local	All	35	194
ALL	All	29	3,774

TABLE 7. FRONT-SEAT PASSENGER (OVER 19 YEARS OF AGE) USAGE RATES

TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	62	58
	50,001-100,000	53	610
	25,001-50,000	55	1,350
	10,000-25,000	54	669
	Under 10,000	57	308
Rural Arterial	Over 50,000	37	644
	25,001-50,000	23	1,609
	10,000-25,000	34	1,629
	Under 10,000	25	361
Rural Collector	Over 100,000	59	331
	50,001-100,000	42	506
	25,001-50,000	32	1,081
	10,000-25,000	27	1,626
	Under 10,000	28	276
Rural Local	Over 50,000	38	72
	25,000-50,000	14	238
	Under 25,000	19	334
Urban Interstate	Over 100,000	59	1,233
	50,000-100,000	57	286
	Under 50,000	32	110
Urban Arterial	Over 100,000	60	2,241
	25,000-100,000	26	2,649
	Under 25,000	22	534
Urban Collector or Local	All	29	542
ALL	All	39	18,687

TABLE 8. USAGE RATES FOR CHILDREN 1-3 YEARS OF AGE (FRONT AND REAR)

TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	70	10
	50,001-100,000	57	51
	25,001-50,000	49	68
	10,000-25,000	57	84
	Under 10,000	75	16
Rural Arterial	Over 50,000	63	101
	25,001-50,000	41	283
	10,000-25,000	45	290
	Under 10,000	33	52
Rural Collector	Over 100,000	52	25
	50,001-100,000	48	82
	25,001-50,000	41	270
	10,000-25,000	35	310
	Under 10,000	32	79
Rural Local	Over 50,000	28	18
	25,000-50,000	36	44
	Under 25,000	36	58
Urban Interstate	Over 100,000	77	200
	50,000-100,000	52	33
	Under 50,000	60	10
Urban Arterial	Over 100,000	78	482
	25,000-100,000	63	760
	Under 25,000	56	163
Urban Collector or Local	All	46	109
ALL	All	53	3,598

TABLE 9. USAGE RATES FOR CHILDREN UNDER 1 YEAR OF AGE (FRONT AND REAR)

'TYPE OF HIGHWAY	COUNTY POPULATION	USAGE RATE (PERCENT)	SAMPLE SIZE
Rural Interstate	Over 100,000	100	2
	50,001-100,000	77	18
	25,001-50,000	93	14
	10,000-25,000	53	15
	Under 10,000	100	4
Rural Arterial	Over 50,000	83	18
	25,001-50,000	64	64
	10,000-25,000	71	65
	Under 10,000	35	17
Rural Collector	Over 100,000	100	4
	50,001-100,000	71	21
	25,001-50,000	68	88
	10,000-25,000	65	103
	Under 10,000	63	19
Rural Local	Over 50,000	67	3
	25,000-50,000	43	7
	Under 25,000	50	22
Urban Interstate	Over 100,000	94	54
	50,000-100,000	67	15
	Under 50,000	50	6
Urban Arterial	Over 100,000	92	158
	25,000-100,000	74	171
	Under 25,000	87	67
Urban Collector or Local	All	64	39
ALL	All	73	994

TABLE 10. USAGE RATES FOR DRIVERS AND PASSENGERS BY TYPE OF HIGHWAY			
	PERCENT USAGE		
TYPE OF HIGHWAY	DRIVERS	FRONT-SEAT PASSENGERS	CHILDREN UNDER FOUR YEARS OF AGE
Rural Interstate	56	53	60
Rural Arterial	28	28	49
Rural Collector	31	31	46
Rural Local	25	21	38
Urban Interstate	60	56	75
Urban Arterial	42	41	71
Urban Collector or Local	35	32	51
ALL	39	37	57

TABLE 11. STATEWIDE USAGE RATE BY AGE AND SEX OF DRIVER	
CATEGORY	USAGE RATE (PERCENT)
Male	36
Female	45
16-30 Years of Age	39
31-50 Years of Age	41
Over 50 Years of Age	38

TABLE 12. STATEWIDE USAGE RATE FOR FRONT SEAT PASSENGERS BY AGE AND SEX	
CATEGORY	USAGE RATE (PERCENT)
Under 4	44
4 - 5	36
6 - 12	38
13 - 19	29
Over 19	39

TABLE 13. CHANGE IN USAGE OF SAFETY BELTS BY DRIVERS IN ORIGINAL STATEWIDE SURVEY CITIES

	PERCENT USING SAFETY BELTS								
CITY	1982	1983	1984	1985	1986	1988	1989	1990	1991
Louisville	6	12	13	14	16	25	28	38	70
Lexington	8	10	10	17	24	31	42	80	69
Covington	8	9	12	16	22	28	32	39	37
Hopkinsville	3	3	4	6	10	20	21	24	27
Frankfort	5	7	7	11	14	19	24	38	38
Henderson	3	5	7	9	11	20	22	29	29
Newport	5	6	5	6	9	20	26	35	34
Madisonville	2	3	5	8	12	20	22	26	26
Elizabethtown	3	4	5	8	14	20	26	31	34
Winchester	2	3	6	9	12	25	33	37	35
Glasgow	3	3	3	5	6	12	15	19	27
Somerset	2	4	6	7	9	19	26	21	29
Maysville	2	3	6	6	13	19	25	29	34
Morehead	3	3	3	5	7	12	15	22	23
Princeton	2	2	2	3	6	12	15	17	19
Bardstown	4	4	6	7	13	19	21	23	30
Hazard	4	3	4	6	5	10	12	15	19
Lawrenceburg	1	2	3	6	5	9	15	19	22
Carrollton	3	5	5	7	10	16	19	35	34

TABLE 14. CHANGE IN USAGE OF SAFETY SEATS OR BELTS BY CHILDREN UNDER 4 YEARS OF AGE IN ORIGINAL STATEWIDE SURVEY CITIES

CITY	PERCENT USING SAFETY BELTS								
	1982	1983	1984	1985	1986	1988	1989	1990	1991
Louisville	22	36	49	42	40	68	65	80	86
Lexington	32	46	50	44	46	78	78	91	90
Covington	22	39	49	47	50	59	53	66	67
Hopkinsville	12	19	19	20	21	33	38	40	51
Frankfort	15	26	30	27	30	43	43	57	72
Henderson	14	18	26	30	31	36	42	53	53
Newport	11	27	20	22	22	60	60	57	75
Madisonville	12	18	29	35	38	52	51	54	60
Elizabethtown	11	27	34	30	32	41	42	51	46
Winchester	12	14	33	29	26	56	68	51	53
Glasgow	14	17	20	18	21	36	38	39	47
Somerset	7	23	24	22	26	48	47	48	62
Maysville	12	18	17	19	25	31	34	36	55
Morehead	10	14	13	15	14	25	27	35	51
Princeton	10	12	12	16	20	33	41	52	52
Bardstown	20	21	31	31	31	41	39	42	76
Hazard	7	10	9	11	13	19	20	25	34
Lawrenceburg	7	6	22	23	20	32	29	35	77
Carrollton	6	10	16	22	19	26	28	31	45

TABLE 15. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE (ALL DRIVERS)*

	NOT WEARING SAFETY BELT		WEARING SAFETY BELT		PERCENT
TYPE OF INJURY	NUMBER	PERCENT	NUMBER	PERCENT	REDUCTION
Fatal	2,094	0.28	227	0.06	78**
Incapacitating	23,340	3.12	6,247	1.69	46**
Non-Incapacitating	40,415	5.40	13,798	3.73	31**
Possible Injury	43,543	5.82	19,756	5.34	8**
Fatal or Incapacitating	25,434	3.40	6,474	1.75	49**

* Based on 1986 through 1990 accident data. Total sample size for not wearing a safety belt was 747,911 compared to 370,268 for wearing a safety belt.

** Statistically significant reduction (probability of 0.99).

TABLE 16. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE BY TYPE OF VEHICLE, SPEED LIMIT, AND TYPE OF ACCIDENT (ALL DRIVERS)*

		PERCENT SUSTAINING FATAL OR SEVERE INJURY		
VARIABLE	CATEGORY	NOT WEARING SAFETY BELT	WEARING SAFETY BELT	PERCENT REDUCTION
Type of Vehicle	Passenger Car	3.47	1.80	48
	Single-Unit Truck	1.89	0.73	61
	Combination Truck	2.51	1.13	55
Type of Accident (Non-Intersection)	Rear End	1.57	1.08	32
	Fixed Object	13.81	5.48	60
	Head-On	17.16	11.95	30
	Overturned	17.35	7.38	57
Speed Limit (mph)	35	2.39	1.25	48
	45	3.39	1.44	57
	55	8.03	3.83	52

* Based on 1986 through 1990 accident data.

TABLE 17. 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	27	0.11	8	0.05	6	0.05	55	54
Incapacitating	486	1.97	87	0.54	93	0.78	73**	61**
Non-Incapacitating	1,311	5.32	484	2.99	346	2.90	44**	46**
Possible Injury	1,770	7.19	696	4.29	568	4.75	40**	34**
Fatal or Incapacitating	513	2.08	95	0.59	99	0.83	72**	60**

* Based on 1986 through 1990 accident data. Total sample sizes were 24,630 for not using a safety seat or belt, 16,208 for using a safety seat, and 10,080 for using a safety belt.

** Statistically significant reduction (probability of 0.99).

TABLE 18. 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	21	0.12	6	0.05	63**
	Incapacitating	366	2.14	107	0.82	62**
	Non-Incapacitating	966	5.65	441	3.38	40**
	Possible Injury	1,367	8.00	686	5.26	34**
	Fatal or Incapacitating	387	2.27	113	0.87	62**
Rear	Fatal	6	0.08	8	0.05	33
	Incapacitating	120	1.59	73	0.48	70**
	Non-Incapacitating	345	4.57	389	2.57	44**
	Possible Injury	403	5.34	578	3.82	28**
	Fatal or Incapacitating	126	1.67	81	0.54	68**

* Based on 1986 through 1990 accident data. Total sample sizes were 17,083 and 7,547 for not using a safety seat or belt in the front and rear seats, respectively, and 13,031 and 15,123 for using either a safety seat or belt in the front and rear seats, respectively.

** Statistically significant reduction (probability of 0.99).

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

	NOT USING LAP BELT OR SHOULDER HARNESS		USING LAP BELT AND/OR SHOULDER HARNESS		
TYPE OF INJURY	NUMBER	PERCENT	NUMBER	PERCENT	PERCENT REDUCTION
Fatal	882	0.24	99	0.08	68**
Incapacitating	13,542	3.69	2,469	1.89	49**
Non-Incapacitating	26,620	7.25	5,872	4.49	38**
Possible Injury	28,862	7.86	8,772	6.71	15**
Fatal or Incapacitating	14,424	3.93	2,568	1.97	50**

* Based on 1985, 1987, 1988, 1989, and 1990 accident data. Total sample sizes were 367,059 not using a safety belt or seat compared to 130,681 using a safety belt.

** Statistically significant reduction (probability of 0.99).

TABLE 20. ACCIDENT SEVERITY VERSUS SAFETY BELT USAGE (OCCUPANTS OTHER THAN DRIVERS)*

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	684	0.25	79	0.09	66***
	Incapacitating	10,537	3.90	2,012	2.18	44***
	Non-Incapacitating	20,252	7.49	4,430	4.79	36***
	Possible Injury	22,427	8.30	6,792	7.35	11***
	Fatal or Incapacitating	11,221	4.15	2,091	2.26	46***
Rear**	Fatal	198	0.20	20	0.05	74***
	Incapacitating	3,005	3.10	457	1.19	62***
	Non-Incapacitating	6,368	6.58	1,442	3.77	43***
	Possible Injury	6,435	6.65	1,980	5.17	22***
	Fatal or Incapacitating	3,203	3.31	477	1.25	62***

* Based on 1985, 1987, 1988, 1989, and 1990 accident data. Total sample sizes were 270,274 and 96,785 for not using a safety belt in the front seat and rear seat, respectively, and 92,417 and 38,264 for using a safety belt in the front and rear seat, respectively.

** Lap belts only primarily used in rear seats.

*** Statistically significant reduction (probability of 0.99).

TABLE 21. POTENTIAL ANNUAL REDUCTION IN TRAFFIC ACCIDENT FATALITIES AND ACCIDENT SAVINGS FROM INCREASE IN DRIVER SAFETY BELT USAGE*

	POTENTIAL ANNUAL REDUCTION IN NUMBER OF		ANNUAL ACCIDENT SAVINGS MILLION $ FROM REDUCTION IN		
DRIVER USAGE RATE (PERCENT)	FATALITIES	SERIOUS INJURIES**	FATALITIES	SERIOUS INJURIES	TOTAL
40	38	249	57.0	9.7	66.7
50	86	569	129.0	22.2	151.2
60	134	888	201.0	34.6	235.6
70	183	1,208	274.5	47.1	321.6
80	231	1,527	346.5	59.6	406.1
90	279	1,847	418.5	72.0	490.5
100	328	2,166	492.0	84.5	576.5

* Based on increase from the 32.2 usage rate determined in the 1990 survey, the percent reductions listed in Table 15, 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.

TABLE 22. STATEWIDE USAGE RATES

	PERCENT USING SAFETY BELTS	
YEAR	DRIVERS	CHILDREN UNDER FOUR YEARS OF AGE*
1982	4	15
1983	6	24
1984	7	30
1985	9	29
1986	13	30
1988	21	48
1989	26	49
1990	32	57
1991	39	57

* Children using either safety seat or safety belt.
Children seated in either front or rear seat.

APPENDIX

SUMMARY OF DATA

LIST OF SURVEY LOCATIONS

1 Fayette, I64 at KY 859
2 Boyd, I64 at US 23
3 Christian,I24 at US 41A,Hopkinsville
4 Hardin, I64 at rest area, Sonora
5 Barren, I65 at KY 70, Cave City
6 Boone, I75 at rest area, Florence
7 Clark, I64 at KY 627, Winchester
8 Franklin, I64 at US 60, Frankfort
9 Laurel, I75 at KY 80, London
10 Henry, I71 at Ky 153, Sligo
11 Rockcastle, I75 at US 25, Mt. Vernon
12 Scott, I75 at rest area, Georgetown
13 Shelby, I64 at KY 53, Shelbyville
14 Woodford, I64 at KY 341, Midway
15 Trigg, I24 at US 68, Cadiz
16 Pike, US 460 at US 119, Pikeville
17 Daviess, US 60 at KY 144, Owensboro
18 Hardin, US 31W at KY 835, West Point
19 Perry, KY 15X at KY 476, Hazard
20 Knox, US 25E at KY 225, Barbourville
21 Harlan, US 119 at KY 179, Cumberland
22 Floyd, KY 80 at US 23, Allen
23 Bullitt, US 31E at KY 44, Mt. Washington
24 Carter, KY 1 at I64, Grayson
25 Laurel, US 25 at KY 80, London
26 Mason, US 62 at KY 11, Maysville
27 Clay, US 421 at KY 80, Manchester
28 Bourbon,US68 at 5th St., Millersburg
29 Casey, US 127 at KY 70, Liberty
30 Meade, US 31W at KY 1638, Muldraugh
31 Lincoln, US127 at KY 78, Hustonville
32 Russell,US127 at KY80,Russell Sprgs.
33 Washington,US 150 at KY 55, Springfield
34 Cumberland, KY 90 at KY 61, Burkesville
35 Ballard, US 60 at KY 358, LaCenter
36 Fayette, KY 418 at I75, Lexington
37 Christian, US 41 at KY 1682, Hopkinsville
38 McCracken, US 62 at KY 68, Paducah
39 Madison, KY 52 at KY 876, Richmond
40 Barren, KY 255 at US 31W, Park City
41 Nelson, US 62 at KY 48, Bloomfield
42 Boone, KY 18 at KY 237, Burlington
43 Oldham, KY 146 at KY 393, Buckner
44 Knox, KY 11 at US 25E, Barbourville
45 Henderson, KY 145 at US 60, Corydon
46 Boyle, US 68 at US 150, Perryville
47 Greenup, KY 1 at US 23, Greenup
48 Caldwell,KY 139 at Jefferson, Princeton
49 Grayson, US 62 at KY 259, Leitchfield
50 Allen, US 231 at US 31E, Scottsville
51 Bath, US 60 at KY36, Owingsville
52 Larue, KY 84 at KY 61, Hodgenville
53 Scott, US 62 at I75, Georgetown
54 Anderson, US 127 at US 127B, Lawrenceburg
55 Breathitt, KY 30 at KY 15, Jackson
56 Webster, US 41 at KY 56, Sebree
57 Garrard, KY 39 at US 27, Lancaster
58 Carroll, US 42 at Highland, Carrollton
59 Elliott, KY 32 at KY 7, Sandy Hook
60 McCracken, KY 1286 at US 62, Paducah
61 Harlan, KY 413 at US 119, Loyall
62 Greenup, KY 7 at US 23, South Shore
63 Lewis, KY 10 at KY 57, Tollesboro
64 Simpson, KY 73 at KY 100, Franklin
65 Adair, KY 55 at KY 80, Columbia
66 Taylor, KY 208 at US 68, Campbellsville
67 Kenton, I275 at KY 17, Covington
68 Kenton,I75 at KY 371, Crescent Springs
69 Fayette, I75 at US 68, Lexington
70 Jefferson, I64 at KY 1747, Louisville
71 Jefferson, I65 at KY 1631, Louisville
72 Jefferson, I264 at US 31E, Louisville
73 Jefferson, I264 at US 42, Louisville
74 Jefferson, I264 at US 60, Louisville
75 Warren, I65 at US 231, Bowling Green
76 Boone, I71 at KY 14, Verona
77 Jefferson, US 31W at Gagel, Louisville
78 Jefferson,KY 1447 at Hubbards, Louisville
79 Jefferson,KY 1703 at Trevillian,Louisville
80 Fayette, US 27 at KY 1683, Lexington
81 Fayette, Reynolds at Lansdowne, Lexington
82 Fayette, KY 4 at KY 353, Lexington
83 Kenton, US 25 at KY 236, Covington
84 Kenton, KY 8 at KY 17, Covington
85 Kenton, KY 16 at KY 177, Covington
86 Fayette, US 25 at Fontaine, Lexington
87 Campbell, US 27 at Carothers, Newport
88 Christian, US 41 at 9th, Hopkinsville
89 Hopkins, US 41A at KY 70, Madisonville
90 Pulaski, US 27 at KY 80, Somerset
91 Franklin, US 60 at Sunset, Frankfort
92 Henderson, US 41A at First St., Henderson
93 Nelson, US 31E at Beall, Bardstown
94 Barren, US 68 at Race St., Glasgow
95 Clark, US 60 at KY 1958, Winchester
96 Warren, US 31W at US 231, Bowling Green
97 Anderson, US 62 at US 127, Lawrenceburg
98 Rowan, US 60 at KY 32, Morehead
99 Hardin, Poplar at Sycamore, Elizabethtown
100 Kenton, KY 1072 at Highland, Covington

TABLE A-1. SUMMARY OF DATA

LOCATION NUMBER	DRIVERS		FRONT-SEAT PASSENGERS										FRONT AND REAR			
			4-5 Years		6-12 Years		13-19 Years		OVER 19 Years		UNDER 4 Years		1-3 Years		UNDER 1 Year	
	SAMPLE	USAGE*	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE
1	212	73	1	0	6	67	5	60	58	62	4	75	10	70	2	100
2	529	41	3	67	7	14	11	0	156	28	6	50	10	60	5	80
3	638	66	6	67	8	100	6	67	160	72	8	75	17	82	7	100
4	469	66	5	40	9	67	19	47	294	57	12	17	24	38	6	50
5	318	57	0	**	2	0	4	50	110	55	12	17	25	32	3	67
6	353	65	6	17	18	56	12	50	228	65	8	38	20	50	8	100
7	488	43	5	20	2	50	7	14	88	40	4	100	8	88	1	100
8	389	61	0	**	4	75	16	44	97	46	1	0	2	50	0	**
9	504	52	6	67	6	50	35	40	217	56	5	40	13	54	2	100
10	413	37	1	0	10	30	13	31	101	39	6	50	16	25	1	100
11	437	55	8	50	12	67	17	41	190	61	17	35	32	56	11	36
12	341	66	4	25	3	0	16	38	221	58	8	38	25	64	1	100
13	286	58	2	100	10	40	22	50	82	44	2	100	9	89	1	100
14	240	60	0	**	4	25	2	50	75	53	1	100	2	100	1	100
15	564	58	2	100	13	54	31	42	308	57	6	67	16	75	4	100
16	734	25	10	30	16	19	35	11	183	22	18	28	28	50	1	100
17	944	31	17	47	23	35	41	24	183	27	15	47	34	65	3	67
18	816	52	4	25	5	40	17	59	278	54	17	71	39	72	14	86
19	1,288	19	27	19	41	22	121	11	333	17	50	22	59	34	11	36
20	624	25	2	0	8	0	30	20	247	25	26	42	32	41	13	62
21	405	18	3	0	19	11	51	10	114	12	18	11	22	14	7	43
22	665	29	7	43	15	20	29	34	142	27	15	20	25	28	3	100
23	1,143	38	31	45	35	43	28	32	196	46	27	44	36	56	13	62
24	638	22	8	0	9	11	37	11	157	32	30	30	29	34	9	78
25	1,356	16	38	13	37	8	64	23	420	14	40	30	80	55	8	100
26	1,216	34	23	17	28	39	81	21	284	38	54	39	76	46	23	83
27	711	13	0	**	17	35	47	4	189	7	24	33	38	37	6	33
28	731	37	13	8	14	29	14	57	197	43	8	63	21	48	2	100
29	751	19	6	17	6	33	44	9	189	22	29	14	32	19	6	67
30	1,024	50	3	67	9	11	56	38	317	49	23	74	29	69	6	100
31	261	25	1	0	6	17	14	14	89	16	7	29	10	30	4	75
32	523	30	6	17	6	0	22	14	139	37	22	36	23	48	8	50
33	824	27	27	37	20	35	53	36	225	35	31	55	61	51	10	60
34	1,060	20	29	14	33	18	47	15	211	24	34	9	35	20	14	29
35	632	27	7	43	15	20	40	13	150	27	8	50	17	59	3	67
36	1,178	64	6	50	18	56	30	47	331	59	22	68	25	52	4	100
37	735	31	9	22	14	21	31	32	169	41	17	24	27	15	2	50
38	636	35	20	50	30	60	20	10	139	35	11	55	17	65	6	67
39	1,423	45	32	50	47	43	30	33	198	47	25	48	38	63	13	77
40	477	33	5	20	7	29	35	29	186	46	13	38	18	50	5	80
41	454	27	2	0	4	0	23	22	98	32	16	38	22	36	6	100
42	885	34	9	33	28	29	61	41	153	33	33	67	49	76	30	67
43	943	47	23	52	24	50	64	30	177	40	24	42	41	54	13	85
44	830	20	15	20	21	5	60	7	198	21	70	21	77	17	18	44
45	158	18	6	33	5	0	5	0	29	17	4	50	9	56	3	100
46	445	28	6	0	3	67	11	9	77	32	24	38	24	46	5	60
47	596	22	11	18	16	19	33	18	163	25	18	17	30	23	8	63
48	1,015	19	19	21	30	27	57	18	171	19	23	30	43	49	3	100
49	1,948	21	66	33	78	22	68	18	354	29	79	33	79	34	39	59
50	649	26	10	10	13	46	55	16	138	28	12	8	17	18	4	75
51	1,107	14	39	8	37	0	53	0	219	19	28	29	32	25	13	69
52	310	28	1	100	15	27	16	38	83	16	8	25	12	33	3	67
53	657	46	1	100	23	48	15	53	256	49	15	60	26	65	12	75
54	382	34	4	25	2	100	21	5	82	32	9	33	13	46	3	100
55	353	13	2	0	3	0	8	0	119	8	39	18	52	25	10	50
56	575	17	4	0	18	11	30	10	124	22	20	15	20	15	6	33
57	396	23	8	25	6	17	15	7	80	24	10	30	16	44	10	80
58	1,040	34	15	13	21	29	24	21	153	40	21	43	28	36	10	70
59	525	14	7	14	18	0	38	21	123	12	37	19	51	29	9	56
60	480	44	7	43	15	40	38	32	72	38	15	40	18	28	3	67
61	265	16	5	40	17	18	28	14	86	9	9	22	16	38	3	33
62	622	22	9	22	24	25	37	14	152	16	18	17	28	36	4	50
63	142	13	1	0	7	14	9	22	31	13	5	40	4	50	2	50
64	479	23	5	40	15	20	30	23	83	22	5	40	9	33	2	50
65	541	22	7	0	22	9	34	18	106	24	17	12	29	24	6	67
66	577	25	6	33	12	17	20	20	114	13	20	45	16	56	12	42
67	714	36	10	70	8	50	10	30	154	30	23	52	38	53	14	86
68	843	58	11	64	10	80	36	50	172	62	18	67	39	87	11	82
69	676	64	4	50	13	54	18	39	221	65	12	67	31	81	7	100

TABLE A-1. SUMMARY OF DATA (continued)

			FRONT-SEAT PASSENGERS										FRONT AND REAR			
	DRIVERS		4-5 Years		6-12 Years		13-19 Years		OVER 19 Years		UNDER 4 Years		1-3 Years		UNDER 1 Year	
LOCATION NUMBER	SAMPLE	USAGE*	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE	SAMPLE	USAGE
70	774	71	7	71	18	67	38	58	143	67	13	69	16	69	6	100
71	843	62	5	100	19	63	38	45	175	63	5	60	14	79	3	67
72	670	63	4	50	18	44	37	54	138	68	7	100	24	83	7	100
73	1,058	69	12	67	31	87	32	66	123	57	7	86	21	90	4	100
74	1,021	71	2	50	23	52	24	63	107	60	3	67	17	82	2	100
75	832	53	6	33	22	59	35	31	286	57	20	30	33	52	15	67
76	338	25	2	50	4	0	64	20	110	32	5	20	10	40	6	50
77	1,230	61	18	61	23	78	110	53	278	68	37	68	34	65	10	90
78	1,256	73	17	76	35	89	49	59	155	73	54	93	61	92	32	100
79	1,604	75	12	83	43	88	76	70	328	80	30	80	40	75	18	100
80	992	67	11	64	30	83	55	51	249	67	29	86	45	87	19	95
81	875	67	15	73	17	71	22	55	135	59	16	94	41	93	12	92
82	1,076	72	2	100	21	71	36	58	219	75	24	79	47	89	17	88
83	1,028	36	25	28	48	44	51	24	230	38	24	29	65	65	18	94
84	929	38	10	20	10	50	39	15	164	41	19	58	24	63	8	88
85	1,152	26	21	29	39	26	58	22	207	18	28	43	57	58	7	71
86	1,257	62	4	0	22	77	50	40	276	61	31	84	55	85	17	82
87	1,403	34	14	21	21	71	51	14	231	26	62	68	171	74	30	80
88	1,489	27	15	33	19	16	52	23	246	23	35	29	74	51	15	47
89	1,620	26	18	28	63	21	90	19	283	18	43	33	88	59	12	67
90	1,037	29	10	30	28	21	56	30	252	26	23	43	47	62	3	67
91	1,392	38	8	38	12	58	17	29	323	33	21	62	45	73	9	67
92	1,231	29	11	45	32	28	87	20	229	26	27	26	67	49	11	73
93	1,470	30	26	31	23	43	56	13	380	28	48	58	118	72	43	88
94	1,210	27	28	29	30	27	32	16	209	23	35	37	47	38	15	73
95	823	35	6	33	12	42	22	36	261	27	18	56	38	55	7	43
96	1,082	38	4	25	23	39	54	26	235	24	31	58	65	69	26	73
97	1,030	22	13	23	13	46	26	15	204	20	55	71	84	71	39	90
98	1,201	23	36	22	52	23	73	15	330	23	51	33	79	41	28	82
99	1,969	34	46	33	72	42	106	40	393	28	51	29	80	40	32	59
100	1,038	37	6	50	25	40	88	28	149	30	11	55	29	62	7	86

* Percent
** No data available.