

2008 Colorado 16 to 20 Year Old Youth Seat Belt Survey

SEAT BELT
STUDY



State of Colorado

Colorado
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INSTITUTE OF TRANSPORTATION MANAGEMENT

EXECUTIVE SUMMARY

A seat belt usage assessment of 16 to 20 year old drivers and front seat passengers of non-commercial vehicles in the State of Colorado was conducted by the Institute of Transportation Management (ITM) from April 7 through April 18, 2008. The study was sponsored by the Colorado Department of Transportation, Safety and Traffic Engineering Branch, Occupant Protection Program and involved observations at 208 sites in 17 counties across the State of Colorado. Specifically, drivers and front seat outboard passengers ages 16-20 were observed for seat belt usage within cars, vans, sport utility vehicles (SUVs), and light trucks normally used for personal transportation. Commercial vehicles were excluded from this survey.

Observational data were entered into a SAS system database for computation and review. The survey data and subsequent analyses yielded the following results for seat belt usage of 16 to 20 year old individuals in the State of Colorado:

Cars:	76.7%
Vans:	91.9%
SUVs:	82.9%
Trucks:	74.4%

Overall Estimated Usage Rate 79.2%

ADMINISTRATIVE EVALUATION

Drs. G.J. Francis and Walter Hivner served as Principal Investigator and Project Statistician, respectively. Observers and supervisors were trained in how to properly conduct the field observations and collect data. The need for consistency and accuracy in the process of data collection was emphasized in the training and pre-survey phase of the study.

Seat belt usage data were collected from 208 separate sites on the weekdays between April 7 and April 18, 2008.

Retired Colorado State Highway Patrol Officers comprise the core of the observers who collected data. The experience and expertise of the retired Highway Patrol Officers strengthened the validity of the results of the survey. Because of their familiarity with interstate highways, state highways, local and county roads, and safety procedures, many potential location and safety problems were minimized or eliminated.

The use of the Statistical Laboratory of the College of Natural Sciences at Colorado State University was also an important factor in the success of this study. The Laboratory's statistical analyses contributed to the reliability and validity of the usage estimates and gave the analyses independence from the survey process.

With the analyses of the data and the submission of this report, all project tasks and requirements were met within the time constraints and financial parameters of the contract.

Objectives of the Study

The primary objectives of the study were to:

- Conduct a seat belt usage survey within the State of Colorado to estimate the seat belt usage of 16 to 20 year old drivers and outboard passengers in cars, vans, SUVs, and light trucks.
- Design a sampling procedure that would allow the optimal selection of survey sites and be statistically representative of State usage figures.
- Design a methodology that would minimize sampling error and variability.
- Complete the study within budget with a final report filed on or before July 1, 2008.

SURVEY DESIGN

The sampling design for the study is a statewide, multistage probability-based sample of possible observation sites. The following steps were taken in drawing the sample sites where observations were to be conducted:

1. Selection of strata
2. Determination of sample clusters
3. Selection of observation sites

For this survey, eight strata were determined; each stratum represents a unique geographic, sociological segmentation (i.e., Eastern Plains and a farming economy and the recreation/tourism economy of the Western Slope). Within each stratum, clusters, based on the identification of average vehicle miles and population, were determined. These clusters are represented by counties within the strata. Finally, the selection of high schools, community colleges, state colleges, and universities within the selected counties was made. Exact sites for observation and data collection were then determined for each school. These sites were selected as representing the highest concentration of individuals in the age group being studied and thus minimized observational error.

For the purposes of this survey, an observational site was defined as a specific road intersection or parking lot entrance/exit where observations take place. Observations were conducted at each selected site for 40 minutes once per week over the two week time period. Thus, each site was observed twice to collect data.

Groupings of counties were used to form the primary strata. The counties were then selected based on population contribution to the state population of 16 to 20 year olds and the number of high schools and colleges. The last stage of the sample design was the selection of specific observation sites within the counties.

The 2008 survey of 16 to 20 year olds was designed to meet all the criteria set by the Uniform Criteria for State Observational Surveys of Seat Belt Use 23 CFR Part 1340, Docket No. NHTSA-98-4280. RIN 2127-AH46, Final Rule. Specifically,

1. Samples were probability-based on population and vehicle miles, and estimates are therefore representative of seat belt usage for the State's 16 to 20 year old driver and outboard front seat passenger population.
2. The sample data were collected through direct observation of seat belt usage on selected roadways and in parking lots close to high schools and colleges by qualified and trained observers. Observation times were determined and assigned for 40 minutes of every hour scheduled.
3. The population of interest was the driver and the outboard front seat passenger of cars, vans, SUVs, and non-commercial light trucks.
4. Observations were conducted in daylight hours from April 7 through April 18, 2008
5. Observational data were recorded on counting sheets and summarized. The data were then transcribed to create a digital record. The digital record served as input into SAS programs for data reduction. The reduced data were returned to Dr. Walter Hivner for analysis and interpretation.

Determination of Sample Size

Sample size determination was, in large measure, governed by time constraints and the precision requirement of the study (the relative error: standard error divided by the parameter estimate ≤ 0.05). The decision as to how many sites to select and assign for observation during the observation period required finding a balance among issues of statistical reliability, observer productivity, and site feasibility.

Statistical theory, which considers correlations and the need for independent observation, would suggest that the number of site locations be as large as possible. However, there was a practical need to select a small enough number of sites for study so that observers would not spend inordinate amounts of time traveling from site to site. In addition, sites needed to be selected that would provide access to the targeted population of 16 to 20 year old people. Sites near high schools, community colleges, and college and university dorms were therefore given priority.

Estimation

The basic estimate derived from this study was the estimate of seat belt usage for all drivers and outboard front seat occupants (drivers and passengers) between the ages of 16 and 20 years of age in cars, vans, sport utility vehicles (SUVs), and light trucks.

The seat belt usage rate for Colorado for this survey was determined by using a survey sampling methodology to obtain information about a large population of Colorado vehicle drivers and outboard front seat passengers (16 to 20 years old) by selecting and measuring a sample of that population. The basis for the analyses of the data from the survey lies in the concept of cluster analysis. Cluster analysis is a loose collection of statistical methods that can be used to assign cases to groups (cluster). Group members share certain properties in common, and it is hoped that the resultant classification will provide insight into seat belt usage among 16 to 20 year old individuals in the State of Colorado.

SURVEY METHODOLOGY

The PROC SURVEYREG procedure of SAS was used to perform statistical analyses of the survey data. This analytical procedure takes into account the design used to select the sample to be analyzed. The sample design was a complex design which incorporated clustering and unequal weighting of the clusters. The survey design included eight strata, three each in the Western Slope and Front Range and two in the Eastern Plains. These strata are based on population and vehicle miles traveled. Next, the county clusters from each stratum were determined along with the county cluster weighting. Observation sites within the county clusters were selected as the final step.

The SURVEYREG procedure fits linear models for survey data and computes regression coefficients and the variance-covariance matrix. The procedure also provides significance tests for the regression model effects and for any specified estimable linear functions of the model parameters.

SURVEY RESULTS

The 2008 Colorado 16 to 20 Year Old Youth Seat Belt Usage Survey of the State of Colorado was conducted at 208 sites as a multistage stratified random sample. The design for the survey was developed in compliance with the National Highway Traffic Safety Administration's **Guidelines for State Observational Surveys of Safety Belt and Motorcycle Helmet Use** (Docket No. 92-12, Notice No. 02) and **Uniform Criteria for State Observational Surveys of Seat Belt Use** (23 CFR 1340; Docket NHTSA -98-4280). Driver and outboard front seat passenger seat belt usage data were collected from these 208 sites from April 7, 2008 through April 18, 2008.

There were 43,264 vehicle observations in the 17 counties surveyed. The data were recorded, tabulated, and analyzed with assistance from the Statistical Laboratory of the College of Natural Sciences. As shown in Table 3, the statewide point estimate of the overall seat belt usage rate for the 2008 Colorado 16 to 20 Year Old Youth Seat Belt Usage Survey was 79.2%. This estimate may vary due to sampling variability and a number of uncontrolled sampling errors that may have entered into the observational survey. Therefore, a 95% Confidence Interval constructed about the point estimated seat belt usage rate ranged from 73.9% to 84.5%.

Tables 1, 2, and 3 show estimates of seat belt usage by type of vehicle (cars, vans, SUVs, and trucks) for the years 2005, 2007, and 2008, respectively.

Table 1: 2005 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	70.5%
Van	78.2%
SUV	74.7%
Truck	57.0%
Overall Average	70.4%

Table 2: 2007 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	72.0%
Van	82.0%
SUV	76.2%
Truck	64.3%
Overall Average	72.9%

Table 3: 2008 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	76.7%
Van	91.9%
SUV	82.9%
Truck	74.4%
Overall Average	79.2%

There was no youth study conducted in 2006 as the 2005 survey was conducted in October and the 2007 surveys were planned for the spring. It was determined that instead of performing two studies within a six-month period, it was better to omit the 2006 observations.

Tables 3a, 3b, and 3c show a summary of the estimates of seat belt usage by region, county, weather, and vehicle type for the years 2005, 2007, and 2008, respectively.

**Table 3a: 2005 Summaries of Estimates of Seat Belt Usage
Confidence Interval**

	Estimate %	Std Error	CV	Lower 95% Limit	Upper 95% Limit
Vehicles Overall Usage	70.4	1.9	2.63	66.4	74.5
County					
Adams	67.9	3.2	4.69	61.4	74.4
Arapahoe	70.8	1.9	2.66	67.1	74.6
Boulder	90.0	1.3	1.47	87.2	92.7
Denver	71.6	2.1	2.99	67.3	75.9
Douglas	80.6	1.3	1.67	77.8	83.4
El Paso	81.9	1.5	1.85	78.8	84.9
Garfield	60.7	1.3	2.08	57.5	64.0
Gunnison	49.7	3.8	7.73	*	*
Jefferson	71.3	2.1	2.98	67.0	75.5
LaPlata	65.2	5.2	8.02	*	*
Larimer	60.4	1.2	2.04	57.9	62.9
Logan	40.5	6.9	17.0	*	*
Mesa	62.5	1.1	1.7	60.2	64.9
Moffat	57.8	0.1	.19	*	*
Montrose	55.5	4.0	7.16	*	*
Morgan	69.4	2.5	3.61	*	*
Pueblo	66.1	1.7	2.59	62.5	69.7
Routt	82.5	4.4	5.34	*	*
Weld	78.0	2.0	2.60	73.8	82.2
Region					
Eastern	70.8	0.9	1.26	59.5	82.1
Front Range	72.9	2.4	3.33	67.0	78.9
Western	60.9	3.0	4.99	51.2	70.5
Weather					
Clear	70.5	1.9	2.64	66.4	74.6
Not Clear	69.6	4.6	6.63	56.8	82.5
Vehicle Type					
Car	70.5	2.0	2.89	66.0	75.0
Van	78.2	2.7	3.51	72.2	84.3
SUV	74.7	2.7	3.63	68.7	80.7
Truck	57.0	3.5	6.2	49.2	64.7

***Note:** In these counties, there were too few observations to make an estimate of Confidence Intervals.

Table 3b: 2007 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV	Confidence Interval	
				Lower 95% Limit	Upper 95% Limit
Vehicles Overall Usage	72.9	1.3	1.82	70.0	75.8
County					
Adams	64.0	2.1	3.35	59.6	68.3
Arapahoe	71.8	0.8	1.17	70.1	73.5
Boulder	79.1	2.0	2.58	74.9	83.2
Denver	79.4	1.4	1.81	76.5	82.3
Douglas	77.5	4.1	5.26	68.7	86.3
El Paso	76.9	1.9	2.46	73.1	80.7
Garfield	66.5	*	*	*	*
Gunnison	64.3	*	*	*	*
Jefferson	76.3	1.6	2.05	73.2	79.4
LaPlata	42.2	*	*	*	*
Larimer	95.2	0.7	0.72	93.7	96.7
Logan	54.6			*	*
Mesa	67.6	1.0	1.0	65.1	70.0
Montrose	69.4	*	*	*	*
Morgan	53.8	*	*	*	*
Pueblo	66.2	3.1	4.76	59.4	73.0
Routt	80.3	*	*	*	*
Weld	62.5	4.8	7.69	52.5	72.5
Region					
Eastern	58.1	3.5	5.97	43.2	73.0
Front Range	74.2	1.7	2.24	70.2	78.3
Western	68.5	1.7	2.49	63.7	73.2
Weather					
Clear	72.9	1.2	1.69	70.2	75.2
Not Clear	73.7	5.0	6.79	61.8	85.5
Vehicle Type					
Car	72.0	1.7	2.39	68.2	75.8
Van	82.0	4.4	5.41	72.3	91.7
SUV	76.2	1.4	1.89	73.1	79.4
Truck	64.3	3.9	6.04	55.8	72.8

***Note:** In these counties, there were too few observations to make an estimate of Confidence Intervals.

Table 3c: 2008 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV	Confidence Interval	
				Lower 95% Limit	Upper 95% Limit
Vehicles Overall Usage	79.2	2.4	3.06	73.9	84.5
County					
Adams	75.1	1.1	1.5	72.8	77.4
Arapahoe	78.4	1.1	1.45	76.1	80.7
Boulder	75.4	2.1	2.78	71.1	79.7
Denver	83.1	1.3	1.62	80.4	85.8
Douglas	83.0	1.5	1.77	79.9	86.0
El Paso	81.6	1.4	1.76	78.7	84.5
Garfield	75.0	*	*	*	*
Gunnison	70.5	*	*	*	*
Jefferson	74.4	1.2	1.64	71.9	76.8
LaPlata	65.2	*	*	*	*
Larimer	95.1	0.5	.57	93.9	96.2
Logan	71.3			*	*
Mesa	72.5	1.1	1.45	70.0	75.0
Montrose	71.5	*	*	*	*
Morgan	63.7	*	*	*	*
Pueblo	66.8	2.1	3.21	62.2	71.3
Routt	87.7	*	*	*	*
Weld	74.3	2.1	2.8	69.9	78.6
Region					
Eastern	72.6	2.3	3.17	62.7	82.5
Front Range	80.1	2.8	3.52	73.2	87.0
Western	75.5	3.0	4.02	65.8	85.1
Weather					
Clear	79.4	2.6	3.33	73.6	85.2
Not Clear	77.7	2.3	2.93	72.4	82.9
Vehicle Type					
Car	76.7	1.9	2.42	72.6	80.7
Van	91.9	3.6	3.89	84.0	99.8
SUV	82.9	2.3	2.76	77.9	87.9
Truck	74.4	4.7	6.3	64.1	84.7

***Note:** In these counties, there were too few observations to make an estimate of Confidence Intervals.

The columns in Tables 3a, 3b, and 3c labeled Std Error, CV, and Lower 95% and Upper 95% Confidence Intervals are statistical terms defining measures of risk. Standard Error (Std Error) is a measure of the sampling errors that are uncontrollable in a statistical experiment. It is preferred that these sampling errors are below 5.0 or 5%. Coefficient of Variation (CV) is a dimensionless measure of variability, designed to allow comparisons of variation for samples with different sizes. The CV for vehicle types is quite low and indicates a small variation within samples. The Confidence Intervals (Lower and Upper 95%) give results that are most likely to be observed in repeated trials of this statistical study.

Analysis

Using the procedures discussed above, usage rates in Colorado for 16 to 20 year old drivers and outboard front seat passengers were estimated along with estimates of the Standard Error and Coefficient of Variation. The overall estimate of State seat belt usage in Colorado from this survey is 79.2%. This estimate may vary because of sampling errors, since not all areas within the State were observed and other types of survey errors may also be possible. Thus, a 95% Confidence Interval of the estimated usage provides a range of 73.9% to 84.5%.

The survey sample size is large enough to allow estimates of usage rates for various subgroups: regions, counties with adequate numbers of observations, weather, and vehicle types. Estimates based upon the speed of vehicles were not included in this study as observations were conducted close to ingress and/or egress roads for parking lots of high schools, community colleges, and college and university dorms. The Estimates, Standard Errors, Coefficient of Variation (CV), and Confidence Intervals are shown in Tables 3a, 3b, and 3c for 2005, 2007, and 2008, respectively, for information and comparison.

Table 4.0 illustrates the differences in estimates of the 2007 and 2008 surveys. The 2008 survey results show an improvement in the seat belt usage in every category over the 2007 data.

Table 4.0: Differences in Estimates of the 2007 and 2008 Surveys

Vehicle Type	Observed Seat Belt Usage		Standard Error	
	2007	2008	2007	2008
Car	72.0%	76.7%	1.7	1.9
Van	82.0%	91.9%	4.4	3.6
SUV	76.2%	82.9%	1.4	2.3
Truck	64.3%	74.4%	3.9	4.7
Overall Average	72.9%	79.2%	1.3	2.4

Observations in Table 4.0 show a distinct improvement of seat belt usage from 2007 to 2008 for 16 to 20 year old drivers and passengers.

CONCLUSIONS

In conclusion, the survey of 208 sites and 43,264 vehicles observed provided an excellent sample as confirmed by the consistency of the results when compared to previous studies.

The results indicate that on a statewide basis 16 to 20 year olds had a 6.3% higher seat belt usage than in 2007. The greatest improvement was in trucks (10.1%) and vans (9.9%). While it is difficult to know with any certainty the cause for the improvement, it does appear that educational processes as well as other factors are indeed affecting the seat belt usage in the 16-20 age group. Future studies will help ascertain the cause and duration of this upward movement in seat belt usage.

Weather did not contribute to seat belt usage in a significant manner (clear observation days versus nonclear observation days), and as mentioned earlier in the report, estimated speed was not considered a part of the study.

The data generated by the study provide an additional baseline with which to make comparisons in the future. Patterns of seat belt usage among this age group appear to be similar to adult seat belt usage in previous seat belt usage surveys. Future surveys will help determine if the gains made in seat belt usage will remain stable. Additional improvement will likely be dependent upon successfully addressing cultural and lifestyle issues through education, public announcements, and enforcement.