

2014 State of Colorado Teen Seat Belt Survey

Colorado Department of
Transportation

SEAT BELT
T
STUDY

Colorado State University

COLLEGE OF BUSINESS

Institute of Transportation Management

EXECUTIVE SUMMARY

The annual seat belt usage assessment of teen drivers and teen front seat outboard passengers of non-commercial vehicles was conducted in the State of Colorado by the Institute of Transportation Management (ITM) from April 21 through May 2, 2014. The study was sponsored by the Colorado Department of Transportation, Office of Transportation Safety, Occupant Protection Program and involved observations at 200 sites in 18 counties across the State of Colorado. Specifically, teen drivers and teen front seat outboard passengers 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 an SAS system database for computation and review. Although there was a slight drop in usage from 2013 (down from 84.8%), the 84.2% estimate is statistically the same and is higher than the usage estimate of the more comprehensive 2013 statewide study (82.1%).

The survey data and subsequent analyses yielded the following results for seat belt usage among teen drivers and front seat outboard passengers for specific vehicle types in the State of Colorado:

Cars:	83.7%
Vans:	85.3%
SUVs:	87.5%
Trucks:	74.7%

Overall Estimated Usage Rate 84.2%

ADMINISTRATIVE EVALUATION

Dr. G.J. Francis served as Principal Investigator, Burt Deines as Project Coordinator, and Felicia Zamora as Field Administrator. Observers were trained in how to properly conduct the field observations and collect data during an all day session held at the Colorado State Highway Patrol Headquarters in Golden. 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 200 separate sites on the weekdays from April 21 through May 2, 2014.

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

James zumBrunnen of the Franklin A. Graybill Statistical Laboratory in the College of Natural Sciences at Colorado State University performed the statistical analyses, which 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 teen drivers and teen 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, 2014.

SURVEY DESIGN

The sampling design for the study is a statewide, multistage probability-based sample of possible observation sites. The following steps were taken to determine the 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 and sociological segmentation of the State. 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 with observation points near ingress and egress roads that had public access. While these sites were not on school property, the direct proximity to the schools allowed for the highest concentration of individuals in the age group being studied and thus minimized observational error.

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

The 2014 survey of teens was designed to meet the following criteria:

1. Samples were probability-based on population and vehicle miles so that estimates are therefore representative of seat belt usage for the State's teen drivers and teen outboard front seat passenger population.
2. The sample data were collected through direct observation of seat belt usage on selected roadways and the ingress/egress of parking lots close to high schools and colleges by qualified and trained observers. Observation times were assigned for 40 minutes of every hour scheduled.
3. The population of interest was teen drivers and teen outboard front seat passenger of cars, vans, SUVs, and non-commercial light trucks.

4. Observations were conducted in daylight hours on weekdays from April 21 through May 2, 2014.
5. Observational data were recorded on counting sheets and then transcribed to create a digital record. The digital record served as input into SAS programs for data reduction.

Determination of Sample Size

Sample size determination was, in large measure, governed by time constraints and the precision requirements of the study (the coefficient of variation: standard error divided by the parameter estimate $\leq 5\%$). 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 study assign as many observation sites as possible. However, there is also a practical need to select sites for study that will not require inordinate amounts of time traveling from site to site. In addition, selected sites must provide access to the targeted population of teen drivers. Sites near high schools, community colleges, and college and university dorms were therefore given priority.

Estimation

The basic estimate derived from this study is for seat belt usage of teen drivers and teen outboard front seat passengers in cars, vans, sport utility vehicles (SUVs), and pickup 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 by selecting and measuring a sample of that population. The fundamental basis for the analyses of the data from the survey lies in the concept of cluster analysis. Group or "cluster" members share certain properties in common, such as age, and the resultant classification should provide insight into seat belt usage among teens 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 is a complex design which incorporates clustering and unequal weighting of the clusters. The survey design includes eight strata, three each in the Western Slope and Front Range and two in the Eastern Plains. These strata were based on population and vehicle miles traveled. Next, the county clusters from each stratum were determined along with the county cluster weighting. Specific 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 2014 Colorado Teen Seat Belt Usage Survey of the State of Colorado was conducted at 200 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 once per week on weekdays from the 200 sites during a two-week period from April 21 through May 2, 2014.

There were 37,567 vehicle observations in the 18 counties surveyed. The data were recorded, tabulated, and analyzed with assistance from the Franklin A. Graybill 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 2014 Colorado Teen Seat Belt Usage Survey was 84.2%. Because of possible sampling variability and a number of uncontrolled sampling errors that may have entered into the observational survey, a 95% Confidence Interval was constructed on either side of the point estimated seat belt usage rate giving a range of 78.5% to 89.9%.

Estimates of seat belt usage for teen drivers and outboard front seat passengers by type of vehicle (cars, vans, SUVs and trucks) are shown in Tables 1, 2, and 3 for the years 2012, 2013, and 2014, respectively.

Table 1: 2012 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	83.3%
Van	80.8%
SUV	85.6%
Truck	71.3%
Overall Average	82.7%

Table 2: 2013 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	84.7%
Van	84.0%
SUV	86.8%
Truck	76.6%
Overall Average	84.8%

Table 3: 2014 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	83.7%
Van	85.3%
SUV	87.5%
Truck	74.7%
Overall Average	84.2%

Over the last three years, seat belt usage for teens in vans and SUVs has continued to improve. The usage rate for vans has moved from 80.8% in 2012 to 85.3% in 2014. The SUV rate has improved from 85.6% to 87.5% in the same time frame. Cars and trucks peaked in 2013 (84.7% and 76.6%, respectively); however, 2014 is higher than 2012 for both vehicle types.

Tables 4a, 4b, and 4c show a summary of the estimates of seat belt usage by county, region, weather, and vehicle type for the years 2012, 2013, and 2014. The columns in the tables 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 0.05 or 5%. Coefficient of Variation (CV) is a dimensionless measure of variability, designed to allow comparisons of variation for samples with different means and variances. For example, the CV for counties is quite low and indicates a small variation within counties and regions. The Confidence Intervals (Lower and Upper 95%) give a range of results that are most likely to be observed in repeated trials of this statistical study.

Table 4a: 2012 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV%	Confidence Interval	
				Lower 95% Limit	Upper 95% Limit
Vehicle Overall Usage	82.7	1.9	2.26	78.7	86.8
County					
Adams	67.6	1.4	2.13	64.7	70.5
Arapahoe	81.4	2.2	2.67	77.0	85.7
Boulder	86.6	1.5	1.73	83.5	89.7
Denver	77.6	2.2	2.82	73.2	81.9
Douglas	88.6	0.8	0.91	86.9	90.3
El Paso	83.6	1.3	1.61	80.9	86.3
Garfield	80.8	*	*	*	*
Gunnison	69.5	*	*	*	*
Jefferson	81.4	1.2	1.47	79.0	83.8
LaPlata	80.0	2.8	3.48	72.8	87.1
Larimer	90.7	1.0	1.11	88.6	92.8
Logan	78.8	*	*	*	*
Mesa	85.9	3.3	3.88	78.0	93.8
Montrose	81.3	*	*	*	*
Morgan	79.7	*	*	*	*
Pueblo	61.7	1.9	3.09	57.6	65.8
Routt	83.3	*	*	*	*
Weld	87.4	0.9	1.01	85.6	89.3
Region					
Eastern	84.4	2.9	3.42	72.0	96.9
Front Range	82.9	2.1	2.47	77.9	87.9
Western	80.0	1.9	2.41	74.6	85.4
Weather					
Clear	82.9	1.8	2.12	79.1	86.8
Not Clear	65.2	*	*	*	*
Vehicle Type					
Car	83.3	3.0	3.64	76.7	89.9
Van	80.8	3.6	4.49	72.9	88.7
SUV	85.6	1.4	1.67	82.5	88.7
Truck	71.3	1.9	2.69	67.1	75.4

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

Table 4b: 2013 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV%	Confidence Interval	
				Lower 95% Limit	Upper 95% Limit
Vehicle Overall Usage	84.8	2.7	3.13	79.0	90.6
County					
Adams	67.3	2.7	3.98	61.8	72.7
Arapahoe	86.3	1.2	1.45	83.8	88.8
Boulder	85.1	1.3	1.55	82.3	87.8
Denver	75.2	2.9	3.89	69.4	81.1
Douglas	89.3	0.7	0.73	87.9	90.7
El Paso	85.7	1.7	1.97	82.4	89.1
Garfield	82.8	*	*	*	*
Gunnison	57.7	*	*	*	*
Jefferson	80.9	1.0	1.21	78.9	82.8
LaPlata	84.8	*	*	*	*
Larimer	95.8	0.5	0.48	94.8	96.7
Logan	74.6	*	*	*	*
Mesa	91.1	1.5	1.70	87.4	94.7
Montrose	69.9	*	*	*	*
Morgan	71.8	*	*	*	*
Pueblo	59.7	1.6	2.74	56.2	63.2
Routt	94.9	*	*	*	*
Weld	85.1	0.9	1.00	83.4	86.9
Region					
Eastern	80.3	4.3	5.30	62.0	98.6
Front Range	85.2	3.0	3.49	77.9	92.5
Western	82.3	5.4	6.62	67.2	97.4
Weather					
Clear	84.6	2.7	3.23	78.7	90.6
Not Clear	85.2	2.9	3.37	78.6	91.8
Vehicle Type					
Car	84.7	3.2	3.79	77.7	91.7
Van	84.0	3.4	3.99	76.7	91.3
SUV	86.8	2.0	2.35	82.4	91.3
Truck	76.6	5.2	6.76	65.3	87.9

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

Table 4c: 2014 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV%	Confidence Interval	
				Lower 95% Limit	Upper 95% Limit
Vehicle Overall Usage	84.2	2.6	3.10	78.5	89.9
County					
Adams	70.4	1.6	2.29	67.1	73.7
Arapahoe	84.5	1.4	1.69	81.6	87.3
Boulder	87.9	1.1	1.28	85.6	90.2
Denver	75.3	3.4	4.55	68.5	82.2
Douglas	90.6	0.7	0.79	89.1	92.1
El Paso	86.2	1.1	1.29	83.9	88.4
Garfield	86.8	*	*	*	*
Gunnison	48.4	*	*	*	*
Jefferson	79.7	0.8	1.03	78.1	81.4
LaPlata	87.5	*	*	*	*
Larimer	94.6	0.6	0.63	93.3	95.8
Logan	76.9	*	*	*	*
Mesa	93.0	1.9	2.07	88.5	97.6
Montrose	85.0	*	*	*	*
Morgan	90.0	*	*	*	*
Pueblo	60.6	2.4	4.03	55.4	65.8
Routt	90.6	*	*	*	*
Weld	84.2	0.5	0.60	83.2	85.3
Region					
Eastern	82.6	2.8	3.41	70.5	94.7
Front Range	84.2	2.8	3.34	77.3	91.0
Western	86.1	5.2	6.08	71.6	99.9
Weather					
Clear	84.3	2.7	3.17	78.5	90.2
Not Clear	79.2	*	*	*	*
Vehicle Type					
Car	83.7	3.4	4.06	76.3	91.2
Van	85.3	3.0	3.50	78.8	91.8
SUV	87.5	1.6	1.80	84.1	91.0
Truck	74.7	4.4	5.89	65.1	84.3

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

The results for counties in 2014 are generally reflective of the two previous years. Larimer and Mesa Counties once again have the highest usage rates at 94.6% and 93.0%, respectively. Although Routt County also had a high usage rate (90.6%), there were too few observations to determine a standard error or confidence intervals. Just as in 2013, Gunnison County had the lowest observed usage rate (48.4%), but like Routt County there were too few observations to assign any statistical validity. As in previous years, Pueblo County (60.6%) and Adams County (70.4%) have two of the lowest rates while Montrose (85.0%) and Morgan (90.0%) improved to a level above the overall State usage rate. As in previous studies, the more rural counties such as Gunnison (48.4%) and Logan (76.9%) were among the lowest usage rates.

When comparing the three regions of the State, it is important to note the continuing improvement of the Western Slope as it now has the highest usage rate of any region for the last three years. Conversely, the Eastern Plains dropped to the lowest usage rate among the regions. The Front Range dropped from a high of 85.2% in 2013 to 84.2% in 2014.

Analysis

Using the statistical procedures discussed above, usage rates in Colorado for teen drivers and teen outboard front seat passengers were estimated along with estimates of the Standard Error and Coefficient of Variation. The overall estimate of State teen seat belt usage in Colorado from this survey is 84.2%. This estimate may vary because of sampling errors, since not all counties within the State were observed and other types of survey errors may also be possible. The standard error of 2.6 is well within the acceptable limits and is indicative of a sufficient sample upon which estimates can be made.

The survey sample size is large enough to also allow estimates of usage rates for various subgroups: regions, most of the surveyed counties, 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. Table 5.0 illustrates the differences in estimates of the 2013 and 2014 surveys.

Table 5.0: Differences in Estimates of the 2013 and 2014 Surveys

Vehicle Type	Observed Seat Belt Usage		Standard Error	
	2013	2014	2013	2014
Car	84.7	83.7	3.2	3.4
Van	84.0	85.3	3.4	3.0
SUV	86.8	87.5	2.0	1.6
Truck	76.6	74.7	5.2	4.4
Overall Average	84.8	84.2	2.7	2.6

CONCLUSIONS

The results for teen drivers and passengers demonstrate a consistently high level of seat belt usage over the last three years. The improvement since 2005 (70.4%) is especially significant as teens in 2014 had a usage rate that is higher than the overall 2013 statewide survey result of 82.1%. This year there was improvement in vans and SUVs while usage in cars and trucks were slightly lower than last year.

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

The survey of 200 sites across 18 counties included 37,567 vehicles observed and can be considered a representative sample as confirmed by the standard error (2.6) and consistency of the results when compared to previous studies. The data generated by the study provide an updated baseline with which to make comparisons in the future. Patterns of seat belt usage among teens now appear to be similar to the results of the more comprehensive statewide surveys and have consistently been higher than the overall statewide usage rates.

When compared to the 2005 results, the usage data in recent years become even more impressive. The 2005 study, then known as the 16 to 20 Year Old Youth Seat Belt Survey, was the first of the statewide teen seat belt surveys. Within this relatively short period of time, the overall seat belt usage rate for teen drivers and passengers improved by approximately 14.0% (70.4% to 84.2%). The improvement by vehicle types included almost a 13% gain for SUVs (74.7% to 87.5%) and a 7.1% gain for vans (78.2% to 85.3%). Car usage improved from 70.5% to 83.7% while trucks had a change of 17.7% (57.0% to 74.7%). The human, societal, and economic impact of such gains are undeniable benefits of the educational efforts of the teen motor vehicle safety coalitions and the initiatives implemented in high schools throughout the State. Although difficult to measure, the teen seat belt usage results are also due to some degree to the educational messages that youth are exposed to in grade school well before they become teenagers. In order to maintain this high level of seat belt usage, educational efforts focused upon teens will require some degree of consistency in the investment of time and money. Additional improvements will likely be dependent upon successfully addressing cultural and lifestyle issues through education, public announcements, and enforcement.