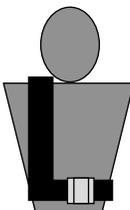


2013 State of Colorado Teen Seat Belt Survey

Colorado Department of
Transportation

SEAT BELT
STUDY



Colorado
State
University®

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 15 through 26, 2013. 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. Results demonstrate a continuous improvement in teen seat belt usage with the overall rate higher than the 2012 statewide survey.

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

| | |
|----------------|--------------|
| Cars: | 84.7% |
| Vans: | 84.0% |
| SUVs: | 86.8% |
| Trucks: | 76.6% |

Overall Estimated Usage Rate 84.8%

ADMINISTRATIVE EVALUATION

Dr. G.J. Francis served as Principal Investigator, Burt Deines as Project Coordinator, Felicia Zamora as Field Administrator, and Steve Medland as Data Coordinator. 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 15 through 26, 2013.

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 and their familiarity with interstate highways, state highways, local, and county roads, and safety procedures, 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, 2013.

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 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 2013 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 15 through 26, 2013.
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 ≤ 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 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 was the estimate of seat belt usage for 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 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 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 2013 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 April 15 through 26, 2013.

There were 36,607 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 2013 Colorado Teen Seat Belt Usage Survey was 84.8%. 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 79.0% to 90.6%.

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 2011, 2012, and 2013, respectively.

Table 1: 2011 Statewide Seat Belt Usages by Vehicle Type

| Vehicle Type | Usage Observed |
|-----------------|----------------|
| Car | 82.2% |
| Van | 82.3% |
| SUV | 85.8% |
| Truck | 72.6% |
| Overall Average | 82.4% |

Table 2: 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 3: 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% |

From 2011 through 2013, the overall seat belt usage rate and the usage rate for cars improved each year.

Although van seat belt usage dropped in 2012, the 84.0% usage rate in 2013 was the highest in the last three years. SUV seat belt usage has remained the most consistent over the last three years remaining in the 85-86% range. This year's 86.8% SUV usage rate was the highest for the years 2011-2013.

While the usage rate for pickup trucks was the lowest for all vehicle types, the improvement from 71.3% in 2012 to 76.6% this year represented the greatest gain of all vehicle types.

With every vehicle type showing an improvement in seat belt usage since last year, the 2013 overall average of 84.8% established a new high for seat belt usage among teens.

Tables 4a, 4b, and 4c show a summary of the estimates of seat belt usage by region, county, weather, and vehicle type for the years 2011, 2012, and 2013, respectively. 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 .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. The CV for vehicle types is quite low and indicates a small variation within types. 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: 2011 Summaries of Estimates of Seat Belt Usage

| | Estimate % | Std Error | CV | Confidence Interval | |
|-----------------------|------------|-----------|------|---------------------|-----------------|
| | | | | Lower 95% Limit | Upper 95% Limit |
| Vehicle Overall Usage | 82.4 | 2.4 | 2.94 | 77.1 | 87.6 |
| County | | | | | |
| Adams | 68.3 | 2.9 | 4.18 | 62.5 | 74.1 |
| Arapahoe | 81.1 | 1.5 | 1.83 | 78.1 | 84.0 |
| Boulder | 83.4 | 1.3 | 1.55 | 80.8 | 86.1 |
| Denver | 73.1 | 2.4 | 3.33 | 68.2 | 78.0 |
| Douglas | 88.8 | 0.9 | 1.04 | 86.9 | 90.7 |
| El Paso | 85.6 | 1.6 | 1.87 | 82.4 | 88.8 |
| Garfield | 76.2 | * | * | * | * |
| Gunnison | 75.7 | * | * | * | * |
| Jefferson | 79.6 | 1.1 | 1.4 | 77.3 | 81.8 |
| LaPlata | 67.1 | * | * | * | * |
| Larimer | 92.2 | 0.9 | 0.95 | 90.4 | 94.0 |
| Logan | 81.0 | * | * | * | * |
| Mesa | 77.0 | 0.5 | 0.61 | 75.8 | 78.1 |
| **Montrose | 71.9 | * | * | * | * |
| Morgan | 76.5 | * | * | * | * |
| Pueblo | 59.6 | 3.1 | 5.16 | 53.1 | 66.2 |
| Routt | 72.2 | * | * | * | * |
| Weld | 83.7 | 1.5 | 1.85 | 80.5 | 86.9 |
| Region | | | | | |
| Eastern | 82.6 | 1.2 | 1.42 | 77.6 | 87.7 |
| Front Range | 83.0 | 2.6 | 3.15 | 76.6 | 89.4 |
| Western | 75.1 | 1.4 | 1.89 | 71.1 | 79.0 |
| Weather | | | | | |
| Clear | 82.2 | 2.4 | 2.92 | 77.0 | 87.4 |
| Not Clear | 84.8 | 3.2 | 3.81 | 76.9 | 92.7 |
| Vehicle Type | | | | | |
| Car | 82.2 | 3.1 | 3.81 | 75.4 | 89.1 |
| Van | 82.3 | 2.0 | 2.41 | 78.0 | 86.7 |
| SUV | 85.8 | 1.9 | 2.16 | 81.7 | 89.8 |
| Truck | 72.6 | 2.4 | 3.26 | 67.5 | 77.8 |

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

**Montrose County was added in 2011.

Table 4b: 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/weather, there were too few observations to make an estimate of Confidence Intervals.

**Montrose County was added in 2011.

Table 4c: 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.

**Montrose County was added in 2011.

The results for counties in 2013 are generally reflective of the two previous years. Larimer and Mesa Counties have the highest usage rates at 95.8% and 91.1%, respectively. Although Routt County also had a high usage rate (94.9%), there were too few observations to determine a standard error or confidence intervals. Gunnison County had the lowest observed usage rate of 57.7%, but like Routt County there were too few observations to assign any statistical validity. Just as last year, Pueblo County (59.7%) and Adams County (67.3%) have two of the lowest rates while LaPlata (84.8%) improved to the level of the overall State usage rate. As in previous studies, the more rural counties such as Gunnison (57.7%), Morgan (71.8), and Logan (74.6%) were among the lowest rates of usage.

When comparing the three regions of the State, it is important to note the continuing improvement of the Western Slope as it had the highest usage rate of the last three years. Conversely, the Eastern plains dropped to the lowest usage rate in the three-year period. The Front Range remained the highest and also had the greatest gains improving to 85.2%.

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 84.8%. 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 2.7 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 2012 and 2013 surveys.

Table 5.0: Differences in Estimates of the 2012 and 2013 Surveys

| Vehicle Type | Observed Seat Belt Usage | | Standard Error | |
|-----------------|--------------------------|------|----------------|------|
| | 2012 | 2013 | 2012 | 2013 |
| Car | 83.3 | 84.7 | 3.0 | 3.2 |
| Van | 80.8 | 84.0 | 3.6 | 3.4 |
| SUV | 85.6 | 86.8 | 1.4 | 2.0 |
| Truck | 71.3 | 76.6 | 1.9 | 5.2 |
| Overall Average | 82.7 | 84.8 | 1.9 | 2.7 |

CONCLUSIONS

The statewide results for teen drivers and their passengers indicate a higher seat belt usage in 2013 (84.8%) than in 2012 (82.7%). The overall improvement in seat belt usage continues the upward movement for seat belt usage among teens. The improvement since 2005 (70.4%) is especially significant as teens in 2013 had a usage rate that is somewhat higher than the overall 2012 statewide survey result of 80.7%. Improvement occurred in all four vehicle types with the greatest gains occurring within vans (+3.2) and trucks (+5.3).

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.

In conclusion, the survey of 200 sites across 18 counties included 36,607 vehicles observed and can be considered a representative sample as confirmed by the standard error (2.7) and consistency of the results when compared to previous studies. The data generated by the study provide an additional 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 surpassed the statewide usage rates of 2012.

When compared to the 2005 results, the 2013 data 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. As this first iteration was conducted in September, it preceded the 2013 study by seven and a half years. Within this relatively short period of time, the overall seat belt usage rate for teen drivers and passengers improved by more than 14.0% (70.4% to 84.8%). The improvement by vehicle types included a 12.1% gain for SUVs (74.7% to 86.8%), and a 5.8% gain for vans (78.2% to 84.0%). Car usage improved 14.2% (70.5% to 84.7%) while trucks had a change of nearly 20% (57.0% to 76.6%). 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. In order to maintain this level of 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.