2011 State of Colorado Teen Seat Belt Survey

Colorado Department of Transportation

SEAT BELT STUDY

INSTITUTE OF TRANSPORTATION MANAGEMENT

EXECUTIVE SUMMARY

A 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 11 through April 22, 2011. The study was sponsored by the Colorado Department of Transportation, Office of Transportation Safety, Occupant Protection Program and involved observations at 206 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. 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:	**82.2%**
Vans:	**82.3%**
SUVs:	**85.8%**
Trucks:	**72.6%**

Overall Estimated Usage Rate 82.4%

ADMINISTRATIVE EVALUATION

Drs. G.J. Francis and Walter Hivner served as Principal Investigator and Project Statistician, respectively. Brenda Ogden was the field coordinator of observers and lead trainer, and Burt Deines managed the observers during data collection. 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 206 separate sites on the weekdays from April 11 through April 22, 2011.

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.

The Franklin A. Graybill Statistical Laboratory, College of Natural Sciences at Colorado State University performed the statistical analyses, which 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 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, 2011.

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. 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 is 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 to collect data.

The 2011 survey of teens 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 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 11, 2011 through April 22, 2011.

5. Observational data were recorded on counting sheets and transferred onto a field summary form. 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 requirements 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 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 need to 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 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 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 2011 Colorado Teen Seat Belt Usage Survey of the State of Colorado was conducted at 206 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 206 sites during April 11, 2011 through April 22, 2011.

There were 37,033 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 2011 Colorado Teen Seat Belt Usage Survey was 82.4%. 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 77.1% to 87.6%.

Tables 1, 2, and 3 show estimates of seat belt usage for teen drivers and outboard front seat passengers by type of vehicle (cars, vans, SUVs and trucks) for the years 2009, 2010, and 2011, respectively.

Table 1: 2009 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	79.7%
Van	88.7%
SUV	83.3%
Truck	70.2%
Overall Average	80.6%

Table 2: 2010 Statewide Seat Belt Usages by Vehicle Type

Vehicle Type	Usage Observed
Car	81.6%
Van	89.0%
SUV	85.2%
Truck	71.0%
Overall Average	82.2%

Table 3: 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%

From 2009 through 2011, the overall seat belt usage rate and the usage rate for every vehicle type improved each year except for vans. The drop in 2011 for vans was a rather precipitous decline of 6.7% from 2010. Most likely, the decline can be explained by the small number of observations for vans. In the previous two years, there were over 1900 van observations. This year the total for both weeks was only 910. Future studies will help determine if this year was an anomaly, or if there is the beginning of a trend of fewer vans on the road.

Even with this drop in seat belt usage in vans, the overall estimate of 82.4% is the highest rate of teen seat belt usage achieved since this age group was first studied in 2005.

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 2009, 2010, and 2011, 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 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 a range of results that are most likely to be observed in repeated trials of this statistical study.

Table 3a: 2009 Summaries of Estimates of Seat Belt Usage

	Estimate %	Std Error	CV	Confidence Interval Lower 95% Limit	Confidence Interval Upper 95% Limit
Vehicle Overall Usage	80.6	1.9	2.33	76.5	84.7
County					
Adams	78.6	1.4	1.73	75.8	81.3
Arapahoe	79.9	1.4	1.74	77.1	82.6
Boulder	80.2	1.3	1.68	77.4	82.9
Denver	76.3	1.5	1.96	73.3	79.3
Douglas	84.9	0.8	0.99	83.1	86.6
El Paso	87.3	1.3	1.46	84.8	89.9
Garfield	65.8	*	*	*	*
Gunnison	64.4	*	*	*	*
Jefferson	75.4	1.2	1.58	73.1	77.8
LaPlata	59.2	*	*	*	*
Larimer	92.2	0.9	0.97	90.4	94.0
Logan	76.5	*	*	*	*
Mesa	71.3	0.7	1.04	69.5	73.0
Morgan	76.8	*	*	*	*
Pueblo	63.3	2.2	3.53	58.5	68.1
Routt	80.0	*	*	*	*
Weld	81.9	1.5	1.8	78.8	85.0
Region					
Eastern	80.7	1.4	1.70	74.8	86.7
Front Range	81.9	2.2	2.69	76.5	87.3
Western	71.0	2.7	3.79	63.5	78.4
Weather					
Clear	80.2	2.1	2.63	75.6	84.8
Not Clear	83.3	0.9	1.14	81.0	85.6
Vehicle Type					
Car	79.7	1.7	2.19	75.9	83.5
Van	88.7	1.5	1.64	85.5	91.9
SUV	83.3	1.8	2.18	79.4	87.3
Truck	70.2	3.7	5.27	62.1	78.3

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

Table 3b: 2010 Summaries of Estimates of Seat Belt Usage

				Confidence Interval	
	Estimate %	Std Error	CV	Lower 95% Limit	Upper 95% Limit
Vehicle Overall Usage	82.2	2.0	2.45	77.8	86.6
County					
Adams	85.2	1.7	2.01	81.7	88.7
Arapahoe	85.0	1.2	1.42	82.6	87.5
Boulder	81.9	1.7	2.02	78.5	85.3
Denver	78.0	2.0	2.61	73.9	82.0
Douglas	85.5	0.5	0.69	84.3	86.8
El Paso	88.7	2.2	2.46	84.4	93.1
Garfield	73.6	*	*	*	*
Gunnison	73.3	*	*	*	*
Jefferson	78.3	1.2	1.59	75.8	80.8
LaPlata	68.9	*	*	*	*
Larimer	85.9	2.3	2.64	81.3	90.6
Logan	55.4	*	*	*	*
Mesa	74.7	1.0	1.39	72.2	77.1
Morgan	57.5	*	*	*	*
Pueblo	70.3	2.1	2.98	65.9	74.8
Routt	74.3	*	*	*	*
Weld	81.4	2.6	3.23	76.0	86.9
Region					
Eastern	76.8	5.7	7.47	52.1	99.9
Front Range	83.3	2.2	2.66	77.8	88.7
Western	74.2	0.7	0.96	72..2	76.1
Weather					
Clear	82.2	2.1	2.52	77.7	86.7
Not Clear	82.0	4.3	5.27	71.4	92.5
Vehicle Type					
Car	81.6	2.1	2.56	77.0	86.1
Van	89.0	1.4	1.57	86.0	92.1
SUV	85.2	1.6	1.87	81.7	88.6
Truck	71.0	2.5	3.55	65.5	76.5

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

Table 3c: 2011 Summaries of Estimates of Seat Belt Usage

				Confidence Interval	
	Estimate %	Std Error	CV	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.

The results for counties in 2011 are generally reflective of the two previous years. Larimer and Douglas Counties have the highest usage rates at 92.2% and 88.8%, respectively. Pueblo County at 59.6% and LaPlata County with 67.1% are the two lowest rates. While these results are similar to the 2009 rates for Pueblo County, it represents over a 10-point drop from 2010. Montrose County was included in the study for the first time, and the relatively small sample resulted in a 71.9% usage rate.

When comparing the three regions of the State, it is important to note the continuing improvement in the Western Slope and the Eastern Plains as each region had their highest usage rate of the last three years. The Front Range remained statistically the same at 83.0%.

Analysis

Using the 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 82.4%. 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. The standard error of 2.4 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 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 4.0 illustrates the differences in estimates of the 2010 and 2011 surveys.

Table 4.0: Differences in Estimates of the 2010 and 2011 Surveys

Vehicle Type	Observed Seat Belt Usage		Standard Error	
	2010	2011	2010	2011
Car	81.6	82.2	2.1	3.1
Van	89.0	82.3	1.4	2.0
SUV	85.2	85.8	1.6	1.9
Truck	71.0	72.6	2.5	2.4
Overall Average	82.2	82.4	2.0	2.4

CONCLUSIONS

The results on a statewide basis indicate that teen drivers and their passengers had a slightly higher seat belt usage in 2011 (82.4%) than in 2010 (82.2%). While the overall improvement in seat belt usage is small, it continues the upward movement for seat belt usage among teens. The improvement since 2005 (70.4%) is especially significant as teens in 2011 had a usage rate that is now close to the overall 2010 statewide figure (82.9%).

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 a part of this study.

In conclusion, the survey of 206 sites and 37,033 vehicles observed was a representative sample as confirmed by the 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.

When compared to the 2005 results, the 2011 data becomes 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 studies. As this first iteration was conducted in September, it preceded the 2011 study by five and a half years. Within this relatively short period of time, the overall seat belt usage rate for teen drivers and passengers improved by 12.0% (70.4% to 82.4%). The improvement by vehicle types included an 11.1% gain for SUVs (74.7% to 85.8%), and vans moved from 78.2% to 82.3% for a 4.1% improvement. While there was an 11.7% increase in the usage rates for cars (70.5% to 82.2%), trucks showed the greatest change (15.6%) from 57.0% to 72.6%. The human, societal, and economic impact of such gains is an undeniable benefit of the educational efforts of the teen motor vehicle safety coalitions and the initiatives presented in high schools throughout the State. However, 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.