REVISED
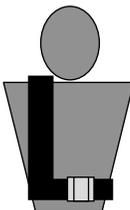# 2009 Regional Emergency and Trauma Advisory Councils (RETAC) Seat Belt Survey

Colorado Department of Transportation

SEAT BELT STUDY

Colorado State University®

INSTITUTE OF TRANSPORTATION MANAGEMENT

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EXECUTIVE SUMMARY

This report summarizes the findings of a survey designed to assess the seat belt usage within six regions of the Regional Emergency and Trauma Advisory Councils (RETAC) of the State of Colorado. Counties with predominately rural regions were selected on the basis of anticipated funding for safety education planned for implementation in the fall of 2009. This study was thus conducted to collect and analyze baseline data for the purpose of tracking and measuring the impact of the future safety education programs.

The study was sponsored by the Office of Transportation Safety of the Colorado Department of Transportation. It involved seat belt surveys at 250 sites within the 20 selected counties over a two-week period from May 31 through June 13, 2009. Drivers and outboard front seat passengers were observed for seat belt usage in cars, vans, sport utility vehicles (SUVs), and pickup trucks. Commercial vehicles were not included in the 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 among drivers and outboard front seat passengers for the following Colorado RETAC Regions for 2009:

2009 RETAC Regions (Counties)	Seat Belt Usage
Northeastern (Logan, Morgan, Sedgwick, Weld)	71.6
Northwestern (Moffat, Garfield, Mesa, Routt)	73.7
Southern (Fremont, Las Animas, Huerfano, Pueblo	73.4
Southeastern (Baca, Prowers)	55.4
Southwestern (LaPlata, Montezuma)	77.5
Western (Delta, Ouray, Gunnison, Montrose)	73.6

Estimates for seat belt usage include combined driver and outboard front seat passengers for all vehicle types (cars, trucks, SUVs, and vans).

Detailed results by region, county, and vehicle types are presented in the Survey Results of this report. While the seat belt usage for the six RETAC Regions is below the Statewide average of 81.1, it is comparable to the usage rate for rural counties, as reported in the Statewide Seat Belt Survey for 2009.

ADMINISTRATIVE EVALUATION

Drs. G.J. Francis and Walter Hivner served as Principal Investigator and Project Data Analyst, respectively. Dr. Mike Gould was the Coordinator of the project who along with Brenda Ogden, Manager of Payroll, conducted the training sessions for the observers. Observers and supervisors were trained in observation and recording methods in order to properly conduct the field survey 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 250 separate sites on two different occasions (250 x 2) from May 31 through June 13, 2009. With the analyses of the data and the submission of this report, all project tasks and requirements were met within the time and financial parameters of the contract.

The majority of observers in the study were retired Colorado State Highway Patrolmen. Because of their familiarity with interstate and state highways, local and county roads, and safety procedures, many potential location and safety problems were minimized or eliminated. The experience and expertise of the retired Highway Patrolmen strengthened the validity of the results of the survey.

The use of the Franklin A. Graybill Statistical Laboratory in 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.

Objectives of the Study

The primary objectives of the study were to:

- Conduct a seat belt usage survey within selected counties of six of the rural RETAC regions to establish baseline data.
- Design a sampling procedure that would allow the optimal selection of survey sites and be statistically representative of regional and county 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 September 1, 2009.

SURVEY DESIGN

The survey was designed to produce an estimate of seat belt usage within six RETAC Regions. The sampling design for the Colorado RETAC Seat Belt Usage Survey is a multistage probability-based sample of road segments. The following steps were taken in drawing the sample sites where observations were to be conducted:

1. Select strata
2. Sample clusters
3. Select specific observation sites

For this survey, six strata were selected, corresponding to the RETAC sampling regions; each stratum represents a unique geographic, and sociological segmentation. Within each stratum, clusters based on the identification of average vehicle miles and populations were determined. These clusters are represented by counties within the strata. Finally, the selection of major roads and local roads for observation sites was determined. The major road selection is a probability-based decision from available road segments of the design.

The local road selection is also probability-based and makes use of United States Census tracts. A major road is determined by the road's length and volume of traffic.

Local roads were selected within sample tracts, and the number of tracts selected was proportional to the population of the county. All road segments in the sample counties were identified, and a sample of these segments was selected for observation. A total of 250 sites (road segments) on major roads and local roads were selected for the sample. Traffic was always observed from inside the sample road segment at or near the point where the traffic was leaving the segment (for safety reasons).

For the purposes of this survey, an observational site was defined as a specific road intersection or interstate ramp where observations take place. Observations were conducted at each site for 40 minutes of each hour. Twenty minutes were allowed for recording data and moving to the next observation site.

The 2009 RETAC Seat Belt Usage Survey has been 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 were therefore representative of seat belt usage for the counties' and Regions' driver and front seat passenger population.

2. The sample data were collected through direct observation of seat belt usage on selected roadways by qualified and trained observers. Observation times were assigned and rescheduled if weather interferes or other conditions exist which would make observations at a particular site unsafe.

3. The population of interest was drivers and the outboard front seat passengers of cars, vans, SUVs, and non-commercial light trucks.

4. Observations were conducted in daylight hours from May 31 through June 13, 2009.

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 by the Franklin A. Graybill Statistical Laboratory of the College of Natural Sciences. The reduced data were then 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). A decision as to how many roadways to select and assign for observation during the observation period required finding a balance between issues of statistical reliability and observer productivity. Statistical theory, which considers correlations and the need for independent observation, would suggest that the number of roadway locations be as large as possible. However, there was a practical need to select an optimal number of road segments for study so that observers would not spend inordinate amounts of time traveling from site to site. With all of those issues given consideration as well as the needs of the contracting organization, a total sample of 250 observational time periods and sites were selected.

Estimation

The basic findings derived from this 2009 RETAC Seat Belt Usage Survey are the point estimates and the 95% Confidence Intervals of seat belt usage for all drivers and outboard front seat occupants of cars, vans, sport utility vehicles (SUVs), and light trucks for each of the six regions.

The seat belt usage rate for this survey was determined by using a survey sampling methodology to obtain information about a specific population of Colorado vehicle drivers and passengers by selecting and measuring a sample of that population. The fundamental basis of the statistical approach for this survey lies in the concept of cluster analysis. This analysis should provide insight into seat belt usage within the six RETAC Regions.

SURVEY METHODOLOGY

The 2009 RETAC Seat Belt Usage Survey was conducted at 250 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 250 sites on two separate occasions from May 31 through June 13, 2009.

The PROC SURVEYREG procedure of SAS was used to perform statistical analysis 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 six strata (RETAC Regions) which represent the desired population of interest. 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

There were 65,205 vehicle observations in this RETAC study. The data were recorded, tabulated, and analyzed with assistance from the Statistical Laboratory of the College of Natural Sciences. The point estimates of the overall seat belt usage rate for the RETAC Seat Belt Usage Survey are shown in Table 1. These estimates 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 is shown in Tables 1 and 2 for the Regions and each vehicle type by RETAC Region.

Table 1: 2009 Seat Belt Usage by RETAC Region

RETAC Region	Seat Belt Usage	Standard Error	Lower Confidence Interval	Upper Confidence Interval
Northeastern	71.6	7.2*	48.6	94.6
Northwestern	73.7	2.1	67.1	80.2
Southern	73.4	1.5	68.6	78.3
Southeastern	55.4	3.2	49.1	61.7
Southwestern	77.5	1.6	57.3	97.8
Western	73.6	1.3	69.6	77.7

*The Standard Error is a measure of sampling errors that are uncontrollable in a statistical experiment. It is preferred that these sampling errors remain below 5%; however, in this study, standard errors above 5% are usually due to a small sample size.

The Southeastern Region had the lowest seat belt usage of the six regions. It should be noted that the two counties of Baca and Prowers observed in the Southeastern Region have a small population base which contributed to an inordinately small sample for the survey. There were fewer than 2500 observations (2485) in the Southeastern Region compared to 16,608 observations in the Northwestern Region.

Results of the other regions are more consistent with the findings for rural counties in the Statewide Seat Belt Survey. However, given the high standard error for the Northeastern Region, the Confidence Intervals for seat belt usage have a very large span of 48.6 to 94.6

Table 2: 2009 Seat Belt Usage for RETAC Region by Vehicle Type

RETAC Region	Vehicle Type	Seat Belt Usage Estimate	Standard Error*	Lower Conf Estimate	Upper Conf Estimate
Northeastern	Car	77.1	5.6*	59.4	94.9
Northwestern		77.9	2.8	69.0	86.8
Southern		75.4	2.2	68.4	82.4
Southeastern		57.0	0.3	53.1	60.9
Southwestern		79.6	1.0	67.5	91.8
Western		77.1	2.7	68.4	85.8
Northeastern	Van	80.6	4.8	65.3	96.0
Northwestern		77.5	2.6	69.1	85.8
Southern		80.6	3.0	71.0	90.3
Southeastern		69.0	2.0	43.9	94.2
Southwestern		84.8	10.0*	0.1	99.9
Western		81.1	3.4	70.3	91.9
Northeastern	SUV	75.3	9.2*	46.0	99.9
Northwestern		80.7	2.9	71.3	90.1
Southern		73.8	0.8	71.4	76.3
Southeastern		59.7	1.8	37.3	82.1
Southwestern		79.8	0.4	74.5	85.1
Western		80.2	1.1	76.6	83.8
Northeastern	Truck	56.2	8.1*	30.4	82.1
Northwestern		61.5	3.2	51.3	71.7
Southern		66.4	1.1	62.9	70.0
Southeastern		44.9	7.7*	0.1	99.9
Southwestern		70.3	1.2	55.2	85.5
Western		64.0	1.0	60.9	67.0

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

Overall, van front seat occupants were highest in seat belt usage among vehicle types while pickup truck drivers and passengers were the lowest. Seat belt usage among drivers and passengers of cars and SUVs tended to be fairly consistent across all regions except for the Southeastern Region. The Southeastern Region was the "outlier" on the low end of the scale for all vehicle types.

The differences in usage rates between trucks and all other vehicle types are statistically significant. Thus, it appears the differences in seat belt usage rates for front seat occupants between trucks and the other types of vehicles are due to something other than sampling error. While the seat belt usage rate for pickups is generally low across the State, rural areas seem to regularly have the lowest rates.

Table 3 presents the overall seat belt usage rate by county. These results combine drivers and passenger data as well as data from all vehicle types. Baca County has the lowest estimate of seat belt usage of 45.3, and Weld County recorded the highest estimate of seat belt usage of 84.8. Prowers, the other county in the Southeastern Region, had the next lowest usage rate of 57.4, and second to Weld County was Sedgwick (80.0), another Northeastern County.

Table 3: 2009 Summaries of Estimates of Seat Belt Usage for RETAC Counties

RETAC Counties	# of Sites (250)	Seat Belt Usage Estimate	Std Error		Confidence Interval Lower 95% Limit	Upper 95% Limit
Baca	10	45.3	4.3		36.2	54.4
Delta	20	77.6	1.5		74.6	80.7
Fremont	10	67.8	1.5		64.6	71.0
Garfield	7	77.1	1.0		74.9	79.2
Gunnison	11	72.9	1.5		69.8	76.1
Huerfano	15	73.7	1.6		70.6	76.9
LaPlata	15	78.5	1.2		76.2	80.9
Las Animas	15	67.5	2.0		63.4	71.6
Logan	16	62.6	1.3		59.9	65.3
Mesa	10	74.4	0.8		72.7	76.0
Moffat	10	52.4	2.9		46.4	58.5
Montezuma	12	73.6	2.0		69.5	77.8
Montrose	10	72.1	1.1		69.8	74.4
Morgan	15	78.2	1.3		75.4	81.0
Ouray	15	76.8	2.1		72.5	81.1
Prowers	10	57.4	1.8		53.7	61.1
Pueblo	8	77.7	2.2		73.1	82.4
Routt	11	75.6	2.3		70.9	80.3
Sedgwick	15	80.0	6.6*		66.4	93.6
Weld	15	84.8	3.2		78.3	91.2

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

Tables 4-7 provide usages rates by county for the various vehicle types. Because of the small number of observations, Baca County has a standard error above 5.0 for each of the vehicle types. Low traffic volume also influenced the results for a few other counties for specific types of vehicles.

The highest county seat belt usage rates by type of vehicle were as follows:

Cars	91.8 (Sedgwick) and 85.9(Weld)
Vans	91.7 (LaPlata) and 91.5 (Sedgwick)
SUVs	94.7 (Sedgwick) and 89.1 (Weld)
Trucks	75.5 (Weld) and 71.2 (LaPlata)

The lowest county seat belt usage rates by type of vehicle were as follows:

Cars	56.8 (Prowers) and 58.3 (Baca)
Vans	55.4 (Moffat) and 57.8 (Baca)
SUVs	52.5 (Baca) and 59.4 (Moffat)
Trucks	32.0 (Baca) and 41.6 (Moffat)

Again, caution should be exercised when drawing conclusions about seat belt usage estimates that have a standard error higher than 5.0, i.e., Baca County. However, for most counties, the data is representative of actual seat belt usage and provide adequate baseline figures.

Table 4: 2009 Summaries of Estimates of Seat Belt Usage in Cars for RETAC Counties

RETAC Counties	Sites # (250)	Seat Belt Usage Estimate	Std Error		Confidence Interval Lower 95% Limit	Confidence Interval Upper 95% Limit
Baca	10	58.3	6.4*		44.8	71.7
Delta	20	81.4	1.2		78.9	83.9
Fremont	10	68.6	2.4		63.6	73.6
Garfield	7	85.5	2.3		80.5	90.5
Gunnison	11	77.4	1.5		74.2	80.6
Huerfano	15	74.5	1.9		70.6	78.3
LaPlata	15	80.5	1.5		77.2	83.4
Las Animas	15	72.0	2.1		67.8	76.2
Logan	16	69.9	2.1		65.6	74.3
Mesa	10	76.9	1.0		74.8	79.0
Moffat	10	58.8	5.7*		46.9	70.7
Montezuma	12	77.7	0.9		75.8	79.6
Montrose	10	73.1	1.4		70.1	76.1
Morgan	15	81.7	1.5		78.5	84.8
Ouray	15	83.3	2.5		78.1	88.5
Prowers	10	56.8	2.6		51.4	62.2
Pueblo	8	82.3	3.4		75.0	89.5
Routt	11	80.0	2.6		74.6	85.5
Sedgwick	15	91.8	3.8		84.0	99.6
Weld	15	85.9	2.2		81.4	90.3

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

Table 5: 2009 Summaries of Estimates of Seat Belt Usage in Vans for RETAC Counties

RETAC Counties	Sites # (250)	Seat Belt Usage Estimate	Std Error		Confidence Interval	
					Lower 95% Limit	Upper 95% Limit
Baca	10	57.8	7.2*		42.7	73.0
Delta	20	84.1	3.0		77.9	90.2
Fremont	10	70.3	5.4*		59.1	81.5
Garfield	7	83.8	2.0		79.4	88.2
Gunnison	11	87.3	4.3		78.4	96.2
Huerfano	15	82.6	2.0		77.5	86.7
LaPlata	15	91.7	2.1		87.5	95.9
Las Animas	15	70.7	7.8*		54.7	86.6
Logan	16	74.2	2.5		69.1	79.2
Mesa	10	74.9	2.0		70.7	79.0
Moffat	10	55.4	11.2*		32.0	78.8
Montezuma	12	66.1	7.3*		51.0	81.3
Montrose	10	76.3	1.4		73.4	79.3
Morgan	15	83.7	3.4		76.8	90.6
Ouray	15	77.6	3.2		71.1	84.2
Prowers	10	70.1	3.6		62.6	77.6
Pueblo	8	88.4	2.3		83.5	93.3
Routt	11	80.2	2.3		75.3	85.0
Sedgwick	15	91.5	5.9*		79.4	99.9
Weld	15	88.2	1.2		85.8	90.5

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

Table 6: 2009 Summaries of Estimates of Seat Belt Usage in SUVs for RETAC Counties

RETAC Counties	Sites # (250)	Seat Belt Usage Estimate	Std Error		Confidence Interval Lower 95% Limit	Confidence Interval Upper 95% Limit
Baca	10	52.5	5.3*		41.3	63.7
Delta	20	82.1	2.3		77.5	86.8
Fremont	10	71.5	2.6		66.0	77.0
Garfield	7	76.5	1.4		73.5	79.4
Gunnison	11	77.6	2.2		73.1	82.2
Huerfano	15	73.9	1.7		70.4	77.4
LaPlata	15	80.0	1.7		76.6	83.5
Las Animas	15	69.3	3.3		62.6	76.1
Logan	16	63.1	1.8		59.4	66.7
Mesa	10	79.7	1.0		77.6	81.9
Moffat	10	59.4	2.0		55.3	63.6
Montezuma	12	77.4	2.5		72.3	82.6
Montrose	10	80.9	1.1		78.6	83.2
Morgan	15	86.0	1.4		83.1	88.8
Ouray	15	84.0	1.9		80.2	87.8
Prowers	10	60.7	3.2		54.1	67.3
Pueblo	8	75.8	1.8		72.0	79.5
Routt	11	85.2	2.0		81.0	89.5
Sedgwick	15	94.7	2.9		88.7	99.9
Weld	15	89.1	2.8		83.4	94.8

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

Table 7: 2009 Summaries of Estimates of Seat Belt Usage in Trucks for RETAC Counties

RETAC Counties	Sites # (250)	Seat Belt Usage Estimate	Std Error		Confidence Interval Lower 95% Limit	Confidence Interval Upper 95% Limit
Baca	10	32.0	6.7*		18.1	45.9
Delta	20	68.4	3.4		61.5	75.4
Fremont	10	64.3	2.5		59.2	69.5
Garfield	7	63.5	1.3		60.7	66.4
Gunnison	11	63.2	2.7		57.6	68.9
Huerfano	15	67.9	2.7		62.5	73.4
LaPlata	15	71.2	1.6		67.9	74.4
Las Animas	15	62.3	2.8		56.6	68.0
Logan	16	46.8	2.0		42.7	50.9
Mesa	10	66.4	1.1		64.2	68.7
Moffat	10	41.6	3.6		34.0	49.1
Montezuma	12	68.4	2.7		62.9	73.9
Montrose	10	63.1	1.8		59.3	67.0
Morgan	15	67.7	2.1		63.4	72.0
Ouray	15	62.4	4.9		52.4	72.3
Prowers	10	50.4	2.4		45.4	55.3
Pueblo	8	66.5	1.7		62.9	70.1
Routt	11	61.7	2.4		56.7	66.6
Sedgwick	15	45.7	5.5*		34.5	56.9
Weld	15	75.5	6.9*		61.3	89.6

* The Standard Error is a measure of sampling errors (such as small sample size) that are uncontrollable in a statistical experiment. It is generally preferred that these sampling errors remain below 5%.

CONCLUSIONS

The survey of 65,205 vehicles within the six RETAC Regions provided an excellent sample for establishing baseline data. Two hundred and fifty sites were observed twice over a two-week period for a total of 500 site observations utilized for the study. While some low volume sites may be shifted for future surveys to take advantage of higher levels of traffic, there are counties which have low population numbers and low vehicle miles traveled, i.e. Baca County.

However, even given low numbers in some counties, sufficient data were collected to establish a baseline of data that can be used in the future for comparative analyses. County data for cars and SUVs were especially consistent and provide an excellent base for trend analyses when additional data are gathered over the next three years.

As in other surveys conducted in the State of Colorado, trucks had the lowest rate of seat belt usage. In fact, the usage rates among trucks in rural areas of the State are so low that there is a noticeable negative impact upon the overall seat belt usage rate of the State.

The ability of the upcoming educational efforts in the counties of the six RETAC Regions to influence behavioral changes could become an important determinant of the future structure and focus of such programs for the entire State. With this study, baseline data has been put in place that will provide the capability to track and measure the impact of educational programs.