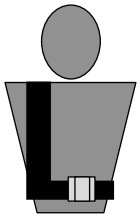
COLORADO
Department of Transportation

2016 State of Colorado RURAL Seat Belt Survey

Colorado Department of Transportation

SEAT BE  T STUDY

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PREFACE

This report presents the results of a rural seat belt usage study conducted for the Colorado Department of Transportation (CDOT), Office of Transportation Safety (OTS). The primary objective of this study was to provide an estimate of the seat belt usage rate for rural counties in the State of Colorado in 2016.

This objective was accomplished by conducting a comprehensive rural seat belt usage survey at selected observation sites throughout the State. A team of observers was trained to make direct observations of traffic to properly collect and record data during a period of two consecutive weeks (June 19 through July 2, 2016) in order to determine actual seat belt usage among Colorado drivers and outboard front seat passengers. With the data and analyses emanating from this study, CDOT, Office of Transportation Safety will have current and accurate information upon which to base future transportation safety program decisions.

The Institute of Transportation Management (ITM) is pleased to have had the opportunity to work with the Office of Transportation Safety in the conduct of the 2016 Colorado Rural Seat Belt Survey. The design of this study made use of 16 counties from the Statewide Study plus four other rural counties. As this research focused upon rural, local traffic only, secondary roads were included in the study. With the submission of this report, the project objectives have been completed within the time parameters and budget agreed to by CDOT and ITM. The data and the analyses that are submitted to CDOT/OTS are, to the best of my knowledge, accurate and complete.

G. James Francis
Principal Investigator
Institute of Transportation Management
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EXECUTIVE SUMMARY

The Institute of Transportation Management (ITM) at Colorado State University conducted a seat belt usage study in 20 rural counties in the State of Colorado from June 19 through July 2, 2016. Trained staff observed vehicles at 20 sites per county for a total of 400 sites. A total of 47,576 vehicles were observed including cars, vans, sport utility vehicles (SUVs), pickup trucks, and select commercial vehicles (10,000 pounds and under). Drivers and front seat outboard passengers of the eligible vehicles were observed for seat belt usage at predetermined observation sites within the 20 counties.

Dr. G.J. Francis served as Principal Investigator and Burt Deines as Project Coordinator. Mary Kato of Atelior served as the lead statistician in the analysis of the data. Ms. Kato and James zumBrunnen assumed major roles in the research design and methodology which gave the statistical analyses independence from the survey process.

Field observers and supervisors were trained by the ITM team 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. Each observer was supplied with data collection sheets, maps, and site locations, as well as safety vests and hard hats.

As in previous seat belt usage surveys conducted by the Institute of Transportation Management, retired Colorado State Highway Patrol Officers were used as observers whenever possible. Because of their familiarity with interstate and state highways, as well as local and county roads and safety procedures, many potential location and safety problems were minimized. The retired patrol officers have proven to be very conscientious and reliable and have helped strengthen the validity of the results. This staffing arrangement worked very well and the continued use of the patrol officers is planned for future studies. By using independent contractors, the Institute has taken measures to ensure the integrity of the survey and analyses while involving people in the study who have the most relevant skills.

The data collected through the observations were recorded, summarized, and entered into appropriate categories for analyses. Analyses of the data yielded the following seat belt usage results among the various vehicle types:

Analyses of the data yielded the following seat belt usage results among the various vehicle types:

Vehicle Type	Usage	Standard Error
Cars	87.0%	0.9%
SUVs	87.3%	1.1%
Vans	92.2%	1.0%
Trucks	77.9%	1.0%
Commercial	79.3%	1.4%
All Vehicle Types	84.4%	0.8%

When compared to 2015, the overall seat belt usage rate in the 20 counties improved from 83.8% to 84.4%. All vehicle types had an increase in usage except for SUVs.

Comparison of Rural Usage Rates

Vehicle Type	2016	2015
Cars	87.0%	85.6%
SUVs	87.3%	88.1%
Vans	92.2%	90.1%
Trucks	77.9%	76.6%
Commercial	79.3%	79.0%
All Vehicle Types	**84.4%**	**83.8%**

County usage rates, speed of vehicles, and road classification data will be presented under the "Results" section of this report. A conclusion section will provide an overall summary of the study followed by Appendices which contain examples of the forms and processes used during the survey stage of the study.

SURVEY DESIGN AND METHODOLOGY

The 2016 Colorado Rural Seat Belt Usage Survey has been designed to meet all of the requirements established by the Uniform Criteria for State Observational Surveys of Seat Belt Use issued by the National Highway Traffic Safety Administration (NHTSA) Final Rule, Federal Register, Vol. 76, No. 63, April 1, 2011.

For the statewide seat belt study conducted during the first two weeks of June, it is required by the "Final Rule" that counties accounting for 85% of the crash-related fatalities in the State are to be included in the survey sample. As shown in Appendix 1, 29 of the 64 counties accounted for 85% of the fatalities for the period of 2007 to 2009. For this study focusing upon only rural counties, there were only four (4) counties not included in the 29 aforementioned counties: Cheyenne, Gunnison, Teller, and Washington. The other 16 counties comprising the sample are noted with an asterisk in Appendix 1. All 20 counties were used as strata for sampling road segments.

Road segments were selected systematically with probability proportional to size (PPS) from all segments in the stratified counties. The road segments were serpentine sorted by latitude and longitude within counties, which makes the sampling spatially more uniform within counties. The research design therefore involves a stratified system PPS sample of data collection sites.

Roads within the counties were grouped according to the secondary and local classifications. Primary roads were not included in the sample frame as the objective was to focus upon local traffic in rural areas of the state. Classifications are determined by the length of the road and the volume of traffic. All road segments in the sample counties were identified, and a sample of these segments was selected for observation. Definitions for road segments are provided in Appendix 2, and the selected road segments within each county are listed in Appendix 3. Appendix 4 illustrates the weights of the segments within each county that were used in the calculation of the estimate of the statewide seat belt usage

Sample Size

A total of 400 sites (road segments) of secondary and local roads was determined to be a representative sample. Sample size determination was, in large measure, governed by time constraints and the precision requirement of the study since NHTSA requires the standard error to be <2.5%. A decision as to how many roadways to select and assign for observation during the observation period required a balance between issues of statistical reliability and observer productivity. 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 NHTSA requirements and needs of the

contracting organizations, a total sample of 400 observational time periods and sites were selected.

Data Collection and Analysis

Observers and quality control monitors were trained in the appropriate procedures for observing seat belt usage and recording data. Scheduling, site locations, and internal operational protocol were included in the training syllabus which also gives an overview of the topics covered during the session (Appendix 5).

For the purposes of this survey, an observational site was defined as a specific road intersection where observations take place. Observations were conducted at each site for 40 minutes of each hour between the hours of 7:00 a.m. and 6:00 p.m. during a period of two consecutive weeks (June 19 through July 2, 2016). Twenty minutes were allowed for recording data and moving to the next observation site. Start times and days were staggered in order to have a representative sample from both peak and non-peak traffic. When possible, traffic was observed for safety reasons from inside the sample road segment at or near the point where the traffic was leaving the segment.

Drivers and front seat outboard passengers were observed in cars, vans, pickup trucks, SUVs, and select commercial vehicles (10,000 pounds and under). Observers generally chose one lane of traffic traveling in one direction to observe seat belt usage. The data were recorded as "yes," "no," or "non-observable" for the driver and front seat outboard passenger.

The data were transferred from the field summary sheets to forms placing the data in specific categories for analysis. To maintain continuity with results from prior years, the SAS code from past studies was translated into ratio estimates computed by the R Survey package. The R code was then applied to 2015 data to ensure similar estimates were produced. The overall usage estimate (percentage) and usage estimates by vehicle type were then calculated for the 2016 data using the svyratio function. For the usage estimates by the various domains (vehicle speed, road class, and county) the svyby function was used. Both the svyratio and svyby functions take into account the design used in selecting the sample. The cv and coef functions were employed to calculate the coefficients of variation and 95% confidence interval limits for the estimates.

Using this procedure, seat belt usage rates in the 20 rural counties were estimated along with a determination of the standard errors and coefficients of variation. The survey sample size was large enough to allow estimates of usage rates for various domains of counties, vehicle types, speed, and road class.

In summary, the research design included the following elements that were critical to this study:

1. Samples were probability-based from the population of road segments within each county, yielding unbiased estimates of seat belt usage for the State's driver and outboard front seat passenger population for vehicles falling within the parameters of this study.

2. The sample data were collected through direct observation of seat belt usage at the pre-determined sites by qualified and trained observers. Observation times were assigned and rescheduled if weather interfered or other conditions existed which made observations at a particular site unsafe or unproductive.

3. The population of interest was the driver and outboard front seat passenger of cars, vans, SUVs, light trucks, and select commercial vehicles (10,000 pounds and under).

4. Observations were conducted in daylight hours from June 19 through July 2, 2016 between the hours of 7:00 AM and 6:00 PM.

5. Observation start times were staggered in order to obtain a representative sample from rush hour (peak traffic) and non-rush hour (non-peak traffic) time frames.

6. Observational data were recorded on counting sheets and summarized (See Appendix 6). The data were then transcribed to create a digital record and entered onto field summary forms, which served as input into the R survey package for data reduction.

RESULTS

Rural Survey Results

The 2016 Colorado Rural Seat Belt Usage Survey was designed to meet, as closely as possible, all the requirements established by the Uniform Criteria for State Observational Surveys of Seat Belt Use issued by the National Highway Traffic Safety Administration (NHTSA) Final Rule, Federal Register, Vol. 76, No. 63, April 1, 2011. The exception, because of the need to sample only rural counties, was the inclusion of four counties outside the 85% guideline mentioned earlier in this report.

The rural survey collected data at 400 sites as a multistage, stratified, random sample. As shown in Table 1, the 2016 rural seat belt usage estimate for Colorado (cars, SUVs, vans, pickup trucks, and select commercial vehicles 10,000 pounds and under) over the sampling period was 84.4%. A 95% confidence interval constructed with regard to the overall seat belt usage rate is from 82.9% to 86.0%.

Vans and SUVs had the highest seat belt usage rates of 92.2% and 87.3%, respectively. Although higher this year at 77.9%, trucks still had the lowest usage rates. Commercial vehicles were somewhat higher at 79.3%, and cars were well above the overall rate with an 87.0% seat belt usage.

Table 1: 2016 Rural Seat Belt Usage Rates for Colorado

Obs	VehicleType	Percent	StdErr	LowerCL	UpperCL
1	Overall for All Vehicles	84.4	0.8	82.9	86.0
2	Cars	87.0	0.9	85.3	88.8
3	SUV	87.3	1.1	85.1	89.5
4	Vans	92.2	1.0	90.3	94.2
5	Trucks	77.9	1.0	76.0	79.9
6	Commercial	79.3	1.4	76.6	82.0

Unlike other CDOT/ITM seat belt surveys, the results for the rural study demonstrate rather mixed data regarding the usual correlation between speed and seat belt usage. There are several hypotheses as to why this phenomenon exists, including the influence of a "rural" culture, but none have been tested and cannot be associated with this data. In other studies, higher speeds translated into drivers/passengers being more likely to use their seat belts. Commercial vehicles were the only vehicle types that conformed to the usual correlation of seat belt usage being consistently higher as speeds increase.

Table 2: 2016 Seat Belt Usage Rates by Speed

	VehicleType	Speed	Percent	StdErr	LowerCL	UpperCL
1	All Vehicles	0-30	81.6	2.5	76.6	86.6
2	All Vehicles	31-50	85.8	1.0	83.9	87.7
3	All Vehicles	>50	83.1	1.5	80.2	86.0
4	Cars	0-30	82.5	2.6	77.4	87.6
5	Cars	31-50	88.7	1.1	86.6	90.8
6	Cars	>50	85.4	1.8	81.9	88.9
7	SUVs	0-30	88.5	2.0	84.6	93.7
8	SUVs	31-50	87.7	1.1	85.6	92.4
9	SUVs	>50	86.7	2.3	82.2	89.8
10	Vans	0-30	80.8	6.4	68.2	93.4
11	Vans	31-50	93.9	1.4	91.1	96.7
12	Vans	>50	91.1	1.3	88.5	93.7
13	Trucks	0-30	74.7	5.3	64.4	85.0
14	Trucks	31-50	80.2	1.4	77.4	83.0
15	Trucks	>50	75.5	1.3	72.9	78.1
16	Commercial	0-30	72.1	3.8	64.6	79.6
17	Commercial	31-50	78.0	2.8	72.5	83.5
18	Commercial	>50	81.4	1.6	78.3	84.4

Seat belt usage by road class is displayed in Table 3. Because the objective of the study was to determine the seat belt usage rate of the rural population on local roads neither primary roads or interstate highways were included. Since the primary highways carry a large percentage of out of state tourist traffic during the summer months, the traffic is not representative of local, rural Colorado population.

Vans have the highest usage rate on both local roads (95.0%) and secondary roads (89.1%). The only vehicle type to have a higher rate on secondary roads is the SUV category (88.3% vs. 86.5%). When considering all vehicles, the usage rate on local roads and streets is higher (85.3%) than on the secondary roads (83.5%).

Table 3: 2016 Seat Belt Usage Rates by Road Class

Obs	VehicleType	MTFCC	Percent	StdErr	LowerCL	UpperCL
1	All Vehicles	S1200	83.5	0.9	81.7	85.3
2	All Vehicles	S1400	85.3	1.3	82.8	87.7
3	Cars	S1200	86.0	1.1	83.8	88.2
4	Cars	S1400	88.1	1.4	85.4	90.8
5	SUVs	S1200	88.3	0.7	86.8	89.7
6	SUVs	S1400	86.5	2.0	82.6	90.3
7	Vans	S1200	89.1	1.4	86.3	91.8
8	Vans	S1400	95.0	1.3	92.4	97.6
9	Trucks	S1200	75.0	1.1	72.8	77.2
10	Trucks	S1400	80.2	1.5	77.3	83.1
11	Commercial	S1200	77.6	2.4	73.0	82.3
12	Commercial	S1400	80.8	2.1	76.8	84.9

S1200 = Secondary Road
S1400 = Local Neighborhood Road, Rural Road, City Street

Table 4 displays individual county results for the rural seat belt survey for all vehicle types. Mesa had the highest seat belt usage rate at 93.0% with Washington (91.9%), Huerfano (89.9%), and Eagle (86.0%) being second through fourth. Cheyenne, which was the highest last year, was the lowest at 75.0%. However, the standard error of 4.1 (the highest of all counties) would indicate a relatively small sample which would cause some variability in the results over multiple replications. Only two counties, Cheyenne and Park, had standard errors above the 2.0% level.

Table 4: County Results for 2016 Colorado Rural Seat Belt Survey

Obs	VehicleType	County	Percent	StdErr	LowerCL	UpperCL
1	All Vehicles	Cheyenne	75.0	4.1	66.9	83.1
2	All Vehicles	Delta	82.0	1.9	78.2	85.7
3	All Vehicles	Eagle	86.0	1.3	83.4	88.5
4	All Vehicles	Fremont	83.2	1.0	81.3	85.1
5	All Vehicles	Garfield	82.8	1.6	79.7	85.9
6	All Vehicles	Gunnison	83.8	1.2	81.4	86.1
7	All Vehicles	Huerfano	89.9	1.1	87.8	92.0
8	All Vehicles	La Plata	82.9	1.7	79.7	86.2
9	All Vehicles	Las Animas	77.4	1.1	75.3	79.6
10	All Vehicles	Lincoln	84.8	1.9	81.1	88.4
11	All Vehicles	Logan	80.6	1.3	78.0	83.1
12	All Vehicles	Mesa	93.0	1.5	90.1	96.0
13	All Vehicles	Montezuma	75.3	1.7	72.1	78.6
14	All Vehicles	Montrose	74.9	1.5	72.0	77.7
15	All Vehicles	Morgan	82.7	1.2	80.3	85.1
16	All Vehicles	Park	81.7	2.2	77.4	86.1
17	All Vehicles	Summit	82.4	1.8	78.8	85.9
18	All Vehicles	Teller	84.7	1.5	81.8	87.6
19	All Vehicles	Washington	91.9	0.9	90.1	93.7
20	All Vehicles	Weld	83.2	2.0	79.2	87.2
21	Cars	Cheyenne	77.4	4.7	68.1	86.7
22	Cars	Delta	82.8	2.0	78.8	86.8
23	Cars	Eagle	85.1	1.3	82.7	87.6
24	Cars	Fremont	84.9	1.4	82.2	87.6
25	Cars	Garfield	88.6	1.5	85.6	91.7
26	Cars	Gunnison	81.6	1.4	78.8	84.4
27	Cars	Huerfano	93.2	1.4	90.5	95.9
28	Cars	La Plata	86.8	1.7	83.5	90.0
29	Cars	Las Animas	81.7	2.5	76.8	86.6

Obs	VehicleType	County	Percent	StdErr	LowerCL	UpperCL
30	Cars	Lincoln	87.8	2.1	83.7	91.9
31	Cars	Logan	82.2	1.4	79.4	84.9
32	Cars	Mesa	96.4	0.8	94.8	97.9
33	Cars	Montezuma	80.9	1.8	77.3	84.5
34	Cars	Montrose	77.2	1.8	73.6	80.7
35	Cars	Morgan	82.7	1.8	79.3	86.2
36	Cars	Park	82.9	1.9	79.1	86.7
37	Cars	Summit	81.8	2.6	76.7	86.8
38	Cars	Teller	85.7	1.8	82.3	89.2
39	Cars	Washington	93.3	1.4	90.5	96.0
40	Cars	Weld	85.1	2.6	80.0	90.3
41	SUVs	Cheyenne	89.0	3.2	82.6	95.3
42	SUVs	Delta	87.7	2.0	83.8	91.5
43	SUVs	Eagle	91.3	1.0	89.3	93.3
44	SUVs	Fremont	88.0	0.8	86.5	89.6
45	SUVs	Garfield	88.8	1.8	85.2	92.3
46	SUVs	Gunnison	89.0	1.2	86.6	91.3
47	SUVs	Huerfano	94.9	0.8	93.4	96.4
48	SUVs	La Plata	86.1	2.1	81.9	90.3
49	SUVs	Las Animas	89.0	1.3	86.5	91.5
50	SUVs	Lincoln	91.4	1.8	88.0	94.8
51	SUVs	Logan	90.7	1.6	87.6	93.7
52	SUVs	Mesa	94.7	1.7	91.3	98.0
53	SUVs	Montezuma	79.1	2.6	73.9	84.3
54	SUVs	Montrose	78.6	1.4	76.0	81.3
55	SUVs	Morgan	86.9	0.9	85.2	88.6
56	SUVs	Park	89.8	1.7	86.5	93.2
57	SUVs	Summit	87.8	1.5	84.8	90.8
58	SUVs	Teller	87.3	1.8	83.9	90.8
59	SUVs	Washington	95.6	1.2	93.3	97.9
60	SUVs	Weld	84.7	3.3	78.3	91.2

Obs	VehicleType	County	Percent	StdErr	LowerCL	UpperCL
61	Vans	Cheyenne	90.0	2.8	84.4	95.6
62	Vans	Delta	89.5	2.3	85.0	94.0
63	Vans	Eagle	90.4	2.5	85.5	95.4
64	Vans	Fremont	87.0	1.9	83.3	90.7
65	Vans	Garfield	88.0	2.0	84.0	92.0
66	Vans	Gunnison	90.5	2.0	86.5	94.5
67	Vans	Huerfano	94.5	1.2	92.1	96.9
68	Vans	La Plata	82.9	3.2	76.6	89.2
69	Vans	Las Animas	88.3	4.3	79.9	96.7
70	Vans	Lincoln	96.2	1.9	92.5	99.9
71	Vans	Logan	86.0	3.4	79.3	92.6
72	Vans	Mesa	97.4	1.8	93.8	99.9
73	Vans	Montezuma	84.0	1.9	80.3	87.7
74	Vans	Montrose	84.1	2.5	79.1	89.0
75	Vans	Morgan	91.4	2.4	86.6	96.2
76	Vans	Park	77.1	8.7	60.1	94.2
77	Vans	Summit	89.1	2.5	84.2	94.0
78	Vans	Teller	88.9	2,5	83.9	93.9
79	Vans	Washington	93.8	3.1	87.8	99.7
80	Vans	Weld	96.6	1.2	94.2	99.0
81	Trucks	Cheyenne	64.5	5.3	54.1	74.8
82	Trucks	Delta	75.0	2.7	69.7	80.3
83	Trucks	Eagle	81.5	2.2	77.3	85.8
84	Trucks	Fremont	76.1	2.0	72.2	80.0
85	Trucks	Garfield	73.5	1.9	69.8	77.3
86	Trucks	Gunnison	76.0	1.6	73.0	79.1
87	Trucks	Huerfano	79.8	1.5	76.8	82.7
88	Trucks	La Plata	76.3	2.1	72.3	80.3
89	Trucks	Las Animas	66.5	2.9	60.9	72.1
90	Trucks	Lincoln	75.4	2.7	70.1	80.7
91	Trucks	Logan	68.3	2.4	63.7	73.0

Obs	VehicleType	County	Percent	StdErr	LowerCL	UpperCL
92	Trucks	Mesa	86.8	2.7	81.5	92.2
93	Trucks	Montezuma	67.1	1.8	63.5	70.7
94	Trucks	Montrose	67.4	2.2	63.0	71.8
95	Trucks	Morgan	77.4	2.3	72.8	82.0
96	Trucks	Park	72.0	4.3	63.5	80.5
97	Trucks	Summit	75.4	3.2	69.0	81.8
98	Trucks	Teller	81.9	1.8	78.4	85.4
99	Trucks	Washington	90.9	1.4	88.1	93.7
100	Trucks	Weld	76.2	1.8	72.7	79.8
101	Commercial	Cheyenne	44.9	9.2	26.9	62.9
102	Commercial	Delta	77.4	3.0	71.5	83.2
103	Commercial	Eagle	69.5	3.1	63.4	75.6
104	Commercial	Fremont	64.1	2.5	59.3	68.9
105	Commercial	Garfield	57.8	6.1	45.7	69.8
106	Commercial	Gunnison	85.1	3.9	77.4	92.8
107	Commercial	Huerfano	72.0	2.7	66.7	77.3
108	Commercial	La Plata	78.8	5.1	68.9	88.7
109	Commercial	Las Animas	66.8	2.6	61.7	71.9
110	Commercial	Lincoln	61.2	8.3	44.9	77.5
111	Commercial	Logan	60.9	8.1	44.9	76.8
112	Commercial	Mesa	95.2	2.8	89.7	99.9
113	Commercial	Montezuma	56.4	5.1	46.5	66.3
114	Commercial	Montrose	78.9	2.8	73.4	84.3
115	Commercial	Morgan	79.8	4.1	71.8	87.8
116	Commercial	Park	77.4	6.1	65.4	89.4
117	Commercial	Summit	67.1	4.2	58.9	75.4
118	Commercial	Teller	67.3	3.5	60.5	74.1
119	Commercial	Washington	78.8	5.7	67.5	74.1
120	Commercial	Weld	84.3	1.6	81.3	87.4

Non-Observables: The non-observable rate of 2.7% for the study was well below the 10% limit established by NHTSA. Overall, there were 1,689 individuals for which the use of seat belts could not be determined. Tinted windows, sun reflection, height of some trucks and commercial vehicles, and color of clothing/seat belts were among the reasons for the non-observable designation. Below are the non-observable rates by vehicle types:

Vehicle Type	Non-Observable Individuals	% Non-Observable
Car	546	3.1%
Van	36	0.8%
SUV	409	2.0%
Truck	648	3.7%
Commercial	50	1.4%
Overall	1689	2.7%

Given the low non-observable rate and the exceptionally low standard error of 0.8% for the study, the overall seat belt usage rate of 84.4% appears, statistically, to be quite sound.

Successes: While it is difficult to track the impact of any one specific program or effort, the following list of possible explanations undoubtedly worked in concert to maintain the relatively high levels of seat belt usage in the State of Colorado.

1. The success of the educational efforts of CDOT and the Department of Public Health and Environment to inform the public of the dangers of not using seat belts.
2. An improvement in the general knowledge of the public of the need for the use of seat belts by vehicle operators and front seat passengers.
3. The "Click It or Ticket" program may have impacted drivers and front seat occupants enough to improve usage rates.
4. Enforcement efforts have impacted drivers and vehicle passengers and caused more awareness of the need to use seat belts.

Travel Variables: The following findings demonstrate the differences in seat belt usage when considering some of the variables involved in travel. From a road classification standpoint, seat belt usage was higher on local roads (85.3%) than on secondary roads (83.5%). While this difference in the road class usage rates would generally be attributed to the average speed on the roads, the corollary data on the speed variable does not support this attribution. Unlike previous studies, seat belts are not used more consistently at higher speeds than at lower speeds on rural Colorado streets and roads (see below). The data for the “speed” variable appears to be somewhat different when compared to the results of other studies. Although seat belt usage is the lowest at low speeds, the highest usage rate is for the “mid-range” speed of 31-50 mph (85.8%). Seat belt usage at speeds over 50 mph is 2.7% lower at 83.1%.

- Road Class*: Secondary 83.5%
  Local 85.3%

  *Definitions of road classes are included in Appendix 2.

- Speed observations: 0-30 mph 81.6%
  31-50 mph 85.8%
  50+ mph 83.1%

CONCLUSIONS

The 400 observation sites included in this study were surveyed during the two-week period from June 19 through July 2, 2016. Total observations of 47,576 vehicles yielded an estimate of 84.4% for rural seat belt usage. This usage rate is slightly higher than the 84.0% result for the Statewide Study, but statistically it is essentially the same.

Pickup trucks had a relatively high usage rate of 77.9%. The commercial usage rate was higher with 79.3% but is still well below the other vehicle types. In agricultural states, secondary and rural road traffic is likely to have more pickup trucks that travel at lower speeds on local roads which, in most cases, contribute to an overall lower seat belt usage rate.

As in previous seat belt studies, vans and SUVs had the highest seat belt usage at 92.2% and 87.3%, respectively. Cars were also above the overall rate at 87.0%.

Among the 20 counties, Mesa County (93.0%) and Washington County (91.9%) had the highest overall usage rates, and Cheyenne was the lowest at 75.0%. Eight counties had usage rates within the confidence levels of the overall study (82.9-86.0%), three were above, and nine were below. Only four of these nine counties were below 80.0%.

This was the fifth year wherein "non-observables" were officially recorded in seat belt studies. By rule, if observers are not able to see whether or not a driver or front seat occupant is buckled up, it is to be recorded as "non-observable." The overall non-observable rate for the study was 2.7%. Given this low non-observable rate and standard error of 0.8%, the overall results of 84.4% can be considered a representative usage rate of the rural population of Colorado.

The challenges of maintaining this high seat belt usage rate in a secondary law state will likely continue, but the investments in education and enforcement are proving worthwhile. The value of the return on investment, in terms of lives saved and social and economic saving, makes the effort one of the most important endeavors for the State of Colorado.

APPENDICES

APPENDIX 1

Colorado Average Motor Vehicle Crash-Related Fatalities by County 2007-2009

County	FIPS	Average Fatality Counts (2007-2009)	Fatality Percentage Within Colorado	Cumulative Fatality Percentage
WELD*	123	43.7	8.2	8.2
EL PASO	041	42.7	8.0	16.2
DENVER	031	40.3	7.6	23.8
ARAPAHOE	005	36.3	6.8	30.7
JEFFERSON	059	35.3	6.6	37.3
ADAMS	001	33.3	6.3	43.6
LARIMER	069	26.0	4.9	48.5
PUEBLO	101	23.7	4.5	52.9
MESA*	077	20.0	3.8	56.7
BOULDER	013	19.0	3.6	60.3
DOUGLAS	035	15.7	2.9	63.2
GARFIELD*	045	14.3	2.7	65.9
LA PLATA*	067	12.3	2.3	68.2
DELTA*	029	8.7	1.6	69.8
EAGLE*	037	8.7	1.6	71.5
MONTROSE*	085	6.7	1.3	72.7
PARK*	093	6.7	1.3	74.0
FREMONT*	043	6.0	1.1	75.1
ROUTT	107	6.0	1.1	76.2
LAS ANIMAS*	071	5.7	1.1	77.3
MONTEZUMA*	083	5.3	1.0	78.3
HUERFANO*	055	5.0	0.9	79.2
GRAND	049	4.7	0.9	80.1
LINCOLN*	073	4.7	0.9	81.0
MORGAN*	087	4.7	0.9	81.9
SUMMIT*	117	4.7	0.9	82.8
BACA	009	4.0	0.8	83.5
LOGAN*	075	4.0	0.8	84.3
ALAMOSA**	003	3.7	0.7	85.0

*Counties included in the rural study.

**Elbert was substituted for Alamosa in 2013.

APPENDIX 2

Codes for Road Segment File

Code	Road Class	Definition
S1100	Primary Road	Primary roads are generally divided, limited-access highways within the interstate highway system or under state management, and are distinguished by the presence of interchanges. These highways are accessible by ramps and may include some toll highways.
S1200	Secondary Road	Secondary roads are main arteries, usually in the U.S. Highway, State Highway or County Highway system. These roads have one or more lanes of traffic in each direction, may or may not be divided, and usually have at-grade intersections with many other roads and driveways. They often have both a local name and a route number.
S1400	Local Neighborhood Road, Rural Road, City Street	These are generally paved non-arterial streets, roads, or byways that usually have a single lane of traffic in each direction. Roads in this feature class may be privately or publicly maintained. Scenic park roads would be included in this feature class, as would (depending on the region of the country) some unpaved roads.

APPENDIX 3

Roadway Functional Strata by County, Road Segments Population (N), Total Length, and Number of Segments Selected (n)

County		MTFCC Code			Total
		Primary: S1100	Secondary: S1200	Local: S1400	
ADAMS	N	1010	1476	28868	31354
	Length(mi)	134	159	2945	3238
	n	15	16	13	44
ARAPAHOE	N	419	784	30488	31691
	Length	77	79	2575	2731
	n	11	7	26	44
BACA	N		33		33
	Length		155		155
	n		11		11
BOULDER	N	1	1998	21514	23513
	Length	1	239	1894	2134
	n		28	16	44
DELTA	N		732		732
	Length		122		122
	n		11		11
DENVER	N	622	812	25307	26741
	Length	49	56	1921	2026
	n	15	9	20	44
DOUGLAS	N	411	554	19308	20273
	Length	87	91	2043	2221
	n	15	12	17	44
EAGLE	N	503	608		1111
	Length	114	86		200
	n	4	7		11
ELBERT	N	95	215	4497	4807
	Length	52	69	1413	1534
	n		11		11
EL PASO	N	384	1880	51310	53574
	Length	78	213	4378	4669
	n	2	21	21	44
FREMONT	N		858		858
	Length		160		160
	n		11		11
GARFIELD	N	544	654		1198
	Length	126	99		225
	n	6	5		11
GRAND	N		722		722
	Length		166		166
	n		11		11
HUERFANO	N	175	533		708
	Length	59	112		171
	n	3	8		11

JEFFERSON	N	498	1781	35498	37777
	Length	78	211	3082	3371
	n	6	20	18	44
LA PLATA	N		996		996
	Length		156		156
	n		11		11
LARIMER	N	293	1945	31878	34116
	Length	78	266	3397	3741
	n	3	22	19	44
LAS ANIMAS	N	221	393		614
	Length	78	170		248
	n	7	4		11
LINCOLN	N	175	382		557
	Length	59	162		221
	n	2	9		11
LOGAN	N	117	599		716
	Length	92	161		253
	n	3	8		11
MESA	N	477	893	15317	16687
	Length	129	181	2064	2374
	n	6	21	17	44
MONTEZUMA	N	3	1384		1387
	Length(mi)	0.2	229		229.2
	n		11		11
MONTROSE	N		908		908
	Length		190		190
	n		11		11
MORGAN	N	188	653		841
	Length	72	146		218
	n	3	8		11
PARK	N		663	11386	12049
	Length		161	2215	2376
	n		25	19	44
PUEBLO	N	443	1380	18557	20380
	Length	94	216	2261	2571
	n	6	24	14	44
ROUTT	N		496		496
	Length		109		109
	n		11		11
SUMMIT	N	164	411		575
	Length	46	75		121
	n	6	5		11
WELD	N	343	2151	25488	27982
	Length	127	466	4288	4881
	n	3	28	13	44

APPENDIX 4

Weights for the Colorado State Seat Belt Usage Observational Survey

County	MTFC	Sampling Weight	Selection Probability
Adams	S1100/S1200	93	0.0108
Adams	S1400	1673	0.0006
Arapahoe	S1100/S1200	66	0.0152
Arapahoe	S1400	1185	0.0008
Baca	S1200	31	0.0325
Boulder	S1200	73	0.0138
Boulder	S1400	1307	0.0008
Delta	S1200	67	0.0150
Denver	S1100/S1200	65	0.0155
Denver	S1400	1162	0.0009
Douglas	S1100/S1200	46	0.0216
Douglas	S1400	834	0.0012
Eagle	S1100/S1200	101	0.0099
Elbert	S1200	29	0.0350
El Paso	S1100/S1200	116	0.0086
El Paso	S1400	2092	0.0005
Fremont	S1200	78	0.0128
Garfield	S1100/S1200	109	0.0092
Grand	S1200	66	0.0152
Huerfano	S1100/S1200	64	0.0155
Jefferson	S1100/S1200	97	0.0104
Jefferson	S1400	1739	0.0006
La Plata	S1200	91	0.0110
Larimer	S1100/S1200	91	0.0110
Larimer	S1400	1640	0.0006
Las Animas	S1100/S1200	56	0.0179
Lincoln	S1100/S1200	51	0.0197
Logan	S1100/S1200	65	0.0154
Mesa	S1100/S1200	50	0.0198
Mesa	S1400	909	0.0011
Montezuma	S1200	126	0.0079
Montrose	S1200	83	0.0121
Morgan	S1100/S1200	76	0.0131
Park	S1200	29	0.0340
Park	S1400	530	0.0019
Pueblo	S1100/S1200	65	0.0154
Routt	S1200	45	0.0222
Summit	S1100/S1200	52	0.0191
Weld	S1100/S1200	89	0.0113
Weld	S1400	1600	0.0006

APPENDIX 5

Training Syllabus

Welcome and distribution of equipment

Survey overview

Data collection techniques
- Definitions of belt/booster seat use, passenger vehicles
- Observation protocol
- Weekday/weekend/rush hour/non-rush hour
- Weather conditions
- Duration at each site

Scheduling and rescheduling
- Site Assignment Sheet
- Daylight
- Temporary impediments such as weather
- Permanent impediments at data collection sites

Site locations
- Locating assigned sites
- Interstate ramps and surface streets
- Direction of travel/number of observed lanes
- Non-intersection requirement
- Alternate site selection

Data collection forms
- Cover sheet
- Recording observations
- Recording alternate site information

Assembling forms for shipment

Safety and security

Timesheet and expense reports

Field practice at ramps and surface streets

APPENDIX 6

Data Collection Form

Colorado Seat Belt Usage – Field Survey Form – Survey: _____

__ First Week __ Second Week Page ____ of ____

County No.:	County:		Site No:	Observer(s):	
# Lanes Available:	Weather 1 = clear 2 = rain 3 = snow 4 = fog	Speed 1 = 0-30 MPH 2 = 31-50 MPH 3 = >50 MPH	Site Location:	Date (Month/Day/Year):	Day of Week: Sun Mon Tues Wed Thurs Fri Sat
# Lanes Observed:				Start Time: a.m. p.m.	End Time: a.m. p.m.

Line #	CARS				VANS				SUVs				LIGHT TRUCKS				COMMERCIAL			
	Driver		Passenger		Driver		Passenger		Driver		Passenger		Driver		Passenger		Driver		Passenger	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1																				
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Observ-ables	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**	**Total:**