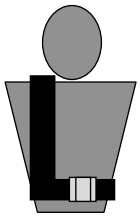
2011
State of Colorado
STATEWIDE
Seat Belt Survey

Colorado Department of Transportation

SEAT BELT STUDY



Colorado State University®

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PREFACE

The primary objective of this study was to conduct a comprehensive statewide seat belt usage survey in order to determine the usage rate for the State of Colorado in 2011. The statewide survey was conducted in the same month (June) as preceding surveys with essentially the same field observers used in previous studies in order to leverage the training and experience and to maintain statistical confidence in the data-gathering task. The survey was conducted by the Institute of Transportation Management, College of Business, Colorado State University under the sponsorship of the Colorado Department of Transportation, Office of Transportation Safety. Observational data were analyzed by the Institute of Transportation Management with the assistance of the Franklin A. Graybill Statistical Laboratory of the College of Natural Sciences.

During the statewide study, seat belt usage was observed during two consecutive weeks (June 5 through June 18, 2011) to determine actual usage among Colorado drivers and outboard front seat passengers. With the data and analyses emanating from this study, the CDOT Office of Transportation Safety will have current and accurate information upon which to base future transportation safety program decisions.

EXECUTIVE SUMMARY

The Institute of Transportation Management (ITM) at Colorado State University conducted a comprehensive seat belt usage study in the State of Colorado from June 5 through June 18, 2011. Trained staff personally observed vehicles at 386 sites in 25 counties. Each site was observed twice over the two-week period for an actual total of 772 observation sites throughout the State. The total of 172,900 vehicles observed for the study included cars, vans, sport utility vehicles (SUVs), and light trucks normally used for personal transportation. Commercial vehicles were excluded from this survey. Drivers and front seat outboard passengers of the eligible (non-commercial) vehicles were observed for seat belt usage at selected observation sites throughout the State.

Raw data were entered into the SAS system database and submitted to the Franklin A. Graybill Statistical Laboratory in the College of Natural Sciences for independent analysis. The analyses of the data are included herein. Results for seat belt usage among the various vehicle types are provided below:

	Usage
Cars	83.9%
Vans	88.5%
SUVs	84.4%
Trucks	70.8%
All Vehicle Types	82.1%

The Institute of Transportation Management is pleased to have had the opportunity to work with the Colorado Department of Transportation in the conduct of the 2011 Colorado Statewide Seat Belt Survey. The design of this study is representative of the population movements and trends within the State of Colorado and thus provides a realistic projection of actual seat belt usage. The data and the analyses that are submitted to CDOT/OTS are, to the best of my knowledge, accurate and complete.

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ADMINISTRATIVE EVALUATION

To complete this project and associated tasks, observers and supervisors received training emphasizing the need for consistency and accuracy in data collection and the survey process. Each observer was supplied with data collection sheets, maps, site locations, and the supervisor's telephone numbers to facilitate completion of the survey of seat belt usage.

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. This staffing arrangement worked very well and the continued use of the Patrolmen is planned for future studies. 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.

The Franklin A. Graybill Statistical Laboratory of the College of Natural Sciences also provided a major contribution to this survey. Besides contributing to the reliability and validity of usage estimates with statistical analyses, the Statistical Laboratory also gives the analyses independence from the survey process.

By using these two groups of 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. Overall the project objectives were accomplished within the time parameters and budget agreed to by CDOT and ITM.

SUMMARY OF FINDINGS

Statewide Survey Results

The 2011 Statewide Seat Belt Usage Survey was conducted at 386 sites on two different dates as a multistage, stratified, random sample. The survey design was developed in compliance with the National Highway Transportation Safety Administration - Guidelines for State Observational Surveys of Safety Belt and Motorcycle Helmet Use - Docket No. 92-12, Notice No. 02, and National Highway Transportation Safety Administration 23 CFR Part 1340 [Docket No. NHTSA-98-4280] RIN 2127-AH46 Uniform Criteria for State Observational Surveys of Seat Belt Use, Final Rule.

A total of 772 observation sites (386 x 2) were used in conducting the 2011 Statewide Seat Belt Survey. As shown in Table 1, the 2011 statewide seat belt usage for Colorado (cars, vans, SUVs and pickup trucks combined) over the sampling period was 82.1 percent. This estimate may vary due to a number of uncontrolled sampling errors that may have entered into the study. Therefore, a 95 percent confidence interval constructed with regard to the overall seat belt usage rate is from 80.8 to 83.5 percent.

Upon examination of the three study design regions, Eastern Plains, Front Range, and Western Slope, the Eastern Region's combined vehicle seat belt usage is estimated to be 82.2 percent, the Front Range seat belt usage is estimated to be 82.8 percent, and the Western Region is estimated to be 80.3 percent (see Table 2).

Table 3 shows the seat belt usage for the last five years in the State of Colorado. Tables 4 through 10 provide comparative data of weighted estimates of seat belt usage for Colorado for the last five years. It should be noted in secondary law states such as Colorado having a high seat belt usage that the investment in media and educational efforts must be significant in order to maintain current levels and to continue making even small gains.

Table 11 displays individual county results for 2011. The county data also illustrates the differences in seat belt usage between urban and rural areas of the State. While the more urban counties in the Front Range generally have higher usage rates, these counties also tend to have a more balanced number of vehicle types (cars, SUVs, vans, and pickup trucks). The more rural counties on the Western Slope and Eastern Plains have a higher proportion of pickup trucks influencing the usage rate in a downward manner. However, in those rural counties that have observation sites along one of the interstate highways, the usage rate is much higher.

The two counties with the highest overall usage rates were Larimer and Clear Creek with rates of 89.7 and 89.2, respectively. Kit Carson, a rural county on the Eastern Plains, had the lowest usage rate of 50.9. 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. For example, seat belt usage was higher on major roads (82.5%) than on local roads (79.8%). Also as demonstrated in previous studies, seat belts are used more at higher speeds than at lower speeds (see below). Both the type of road and vehicle speed showed statistical significance ($p<0.05$) in the differences in seat belt usage. Weekend and weekday seat belt usage was the same (82.1%).

- Major roads: 82.5 percent
- Local Roads: 79.8 percent
- Speed observations:

0-30 mph	73.7 percent
31-50 mph	81.4 percent
50+ mph	83.7 percent

Other comparisons based on time of day and weather conditions were:

- Non-peak hours: 81.4 percent
- Peak hours: 84.4 percent
- Comparative weather related results were 82.1 percent for clear weather and 83.4 percent for weather observed as “other.” It should be noted that the “other” seat belt usage was a very small sample size.

Table 1: 2011 Statewide Seat Belt Usage for Colorado

	Percent Usage
Cars	83.9%
Vans	88.5%
SUVs	84.4%
Trucks	70.8%
All Vehicle Types	82.1%

Table 2: 2011 Seat Belt Usage by Region

	Percent Usage				
Region	Cars	Vans	SUVs	Trucks	All
Eastern Plains	83.2%	83.7%	87.9%	67.4%	82.2%
Front Range	83.8%	90.1%	84.5%	73.6%	82.8%
Western Slope	85.3%	86.8%	82.6%	68.6%	80.3%
Statewide Usage	83.9%	88.5%	84.4%	70.8%	82.1%

Table 3: Seat Belt Usage Annual Estimates 2007 - 2011

(Cars, Vans, SUVs, and Trucks Combined)

	2011	2010	2009	2008	2007
	Estimate	Estimate	Estimate	Estimate	Estimate
Total	**82.1%**	**82.9%**	**81.1%**	**81.7%**	**81.1%**
Standard error	**0.6**	**0.8**	**0.8**	**1.1**	**1.1**
Region					
Eastern	**82.2%**	**79.8%**	**78.1%**	**77.4%**	**77.3%**
Front Range	**82.8%**	**83.9%**	**83.4%**	**83.6%**	**82.9%**
Western	**80.3%**	**81.7%**	**77.7%**	**79.4%**	**79.3%**
Weather					
Clear	**82.1%**	**82.9%**	**81.0%**	**81.7%**	**81.0%**
Other*	**83.4%**	**82.7%**	**82.2%**	**80.6%**	**84.3%**
Time					
Non-Peak Hours	**81.4%**	**81.7%**	**80.2%**	**80.6%**	**80.5%**
Peak Hours	**84.4%**	**86.2%**	**83.8%**	**84.5%**	**82.8%**
Day of the Week					
Weekday	**82.1%**	**82.9%**	**80.5%**	**81.2%**	**81.0%**
Weekend	**82.1%**	**82.9%**	**83.5%**	**83.0%**	**81.3%**
Speed					
0-30 mph	**73.7%**	**72.4%**	**75.9%**	**75.5%**	**72.4%**
31-50 mph	**81.4%**	**81.2%**	**79.3%**	**79.4%**	**78.2%**
50+ mph	**83.7%**	**85.1%**	**83.6%**	**84.1%**	**84.7%**
Road Class					
Local	**79.8%**	**79.0%**	**78.3%**	**76.4%**	**76.0%**
Major	**82.5%**	**83.5%**	**.7%**	**82.5%**	**82.1%**

*Based on a small number of observations.

Table 4: 2011 Weighted Estimates of Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Number of Observation Sites	Estimate	CV	Standard Error	95 Percent Confidence Limits Lower Limit	95 Percent Confidence Limits Upper Limit
Total	772	**82.1%**	0.77	0.6	**80.8%**	**83.5%**
Region						
Eastern	184	**82.2%**	2.58	2.1	**75.4%**	**88.9%**
Front Range	420	**82.8%**	0.83	0.7	**81.1%**	**84.4%**
Western	168	**80.3%**	1.37	1.1	**77.4%**	**83.1%**
Weather						
Clear	755	**82.1%**	1.42	1.1	**80.7%**	**83.4%**
Other*	17	**83.4%**	5.42	4.0	**80.4%**	**86.5%**
Time						
Non-Peak Hours	656	**81.4%**	1.7	1.3	**80.1%**	**82.8%**
Peak Hours	116	**84.4%**	1.83	1.5	**82.3%**	**86.5%**
Day of the Week						
Weekday	556	**82.1%**	1.4	1.7	**80.6%**	**83.6%**
Weekend	218	**82.1%**	2.3	2.9	**79.1%**	**85.1%**
Speed						
0-30 mph	316	**73.7%**	4.62	3.3	**70.2%**	**77.2%**
31-50 mph	275	**81.4%**	2.47	1.9	**79.1%**	**83.7%**
50+ mph	181	**83.7%**	0.96	0.8	**82.0%**	**85.4%**
Road Class						
Local	367	**79.8%**	3.48	2.6	**75.9%**	**83.7%**
Major	405	**82.5%**	1.38	1.1	**81.1%**	**83.9%**

* Based on a very small number of observations.

Table 5: 2010 Weighted Estimates of Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Number of Observation Sites	Estimate	CV	Standard Error	95 Percent Confidence Limits Lower Limit	Upper Limit
Total	770	**82.9%**	0.99	0.8	**81.2%**	**84.6%**
Region						
Eastern	184	**79.8%**	5.74	4.6	**65.3%**	**94.4%**
Front Range	418	**83.9%**	1.26	1.1	**81.4%**	**86.4%**
Western	168	**81.7%**	1.79	1.5	**77.9%**	**85.4%**
Weather						
Clear	696	**82.9%**	1.00	0.8	**81.1%**	**84.6%**
Other*	74	**82.7%**	2.14	1.8	**78.8%**	**86.7%**
Time						
Non-Peak Hours	635	**81.7%**	0.94	0.8	**80.1%**	**83.3%**
Peak Hours	135	**86.2%**	1.39	1.2	**83.6%**	**88.8%**
Day of the Week						
Weekday	565	**82.9%**	1.11	0.9	**80.9%**	**84.8%**
Weekend	205	**82.9%**	1.70	1.4	**79.8%**	**86.1%**
Speed						
0-30 mph	296	**72.4%**	2.82	2.0	**68.0%**	**76.7%**
31-50 mph	305	**81.2%**	1.2	1.0	**79.2%**	**83.3%**
50+ mph	169	**85.1%**	1.46	1.2	**82.5%**	**87.7%**
Road Class						
Local	366	**79.0%**	1.85	1.5	**75.9%**	**82.0%**
Major	404	**83.5%**	1.09	0.9	**81.6%**	**85.4%**

* Based on a small number of observations.

Table 6: 2009 Weighted Estimates of Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Number of Observation Sites	Estimate	CF	Standard Error	95 Percent Confidence Limits Lower Limit	Upper Limit
Total	772	**81.1%**	1.02	0.8	**79.4%**	**82.9%**
Region						
Eastern	184	**78.1%**	6.27	4.9	**62.6%**	**93.7%**
Front Range	420	**83.4%**	1.02	0.9	**81.4%**	**85.4%**
Western	168	**77.7%**	2.52	2.0	**72.7%**	**82.7%**
Weather						
Clear	684	**81.0%**	1.00	0.8	**79.3%**	**82.7%**
Other*	88	**82.2%**	2.77	2.3	**77.2%**	**87.3%**
Time						
Non-Peak Hours	618	**80.2%**	1.09	0.9	**78.3%**	**82.0%**
Peak Hours	154	**83.8%**	1.43	1.2	**81.3%**	**86.4%**
Day of the Week						
Weekday	592	**80.5%**	1.15	0.9	**78.9%**	**88.1%**
Weekend	180	**83.5%**	2.48	2.1	**77.9%**	**83.2%**
Speed						
0-30 mph	324	**75.9%**	3.27	2.5	**70.7%**	**81.1%**
31-50 mph	271	**79.3%**	1.51	1.2	**76.8%**	**81.8%**
50+ mph	177	**83.6%**	1.26	1.1	**81.4%**	**85.9%**
Road Class						
Local	368	**78.3%**	2.03	1.6	**75.0%**	**81.7%**
Major	404	**81.7%**	1.09	0.9	**79.8%**	**83.6%**

*Based on a small number of observations.

Table 7: 2008 Weighted Estimates of Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Number of Observation Sites	Estimate	CV	Standard Error	95 Percent Confidence Limits Lower Limit	Upper Limit
Total	772	**81.7%**	1.15	1.15	**79.7%**	**83.6%**
Region						
Eastern	184	**77.4%**	7.36	5.7	**59.3%**	**95.5%**
Front Range	420	**83.6%**	1.28	1.1	**81.0%**	**86.1%**
Western	168	**79.4%**	2.21	1.8	**74.9%**	**83.9%**
Weather						
Clear	727	**81.7%**	1.15	0.9	**79.7%**	**83.7%**
Other*	45	**80.6%**	3.32	2.7	**74.3%**	**86.9%**
Time						
Non-Peak Hours	619	**80.6%**	1.36	1.1	**78.3%**	**82.9%**
Peak Hours	153	**84.5%**	1.22	1.0	**82.3%**	**86.7%**
Day of the Week						
Weekday	553	**81.2%**	1.31	1.1	**79.0%**	**83.5%**
Weekend	219	**83.0%**	2.16	1.8	**79.0%**	**86.9%**
Speed						
0-30 mph	309	**75.5%**	4.03	3.0	**69.1%**	**82.1%**
31-50 mph	285	**79.4%**	1.81	1.4	**76.3%**	**82.4%**
50+ mph	178	**84.1%**	1.37	1.1	**81.7%**	**86.6%**
Road Class						
Local	368	**76.4%**	2.92	2.2	**71.7%**	**81.1%**
Major	404	**82.5%**	1.09	0.9	**80.6%**	**84.5%**

* Based on a small number of observations.

Table 8: 2007 Weighted Estimates of Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Number of Observation Sites	Estimate	CV	Standard Error	95 Percent Confidence Limits Lower Limit	Upper Limit
Total	772	**81.1%**	1.42	1.1	**78.6%**	**83.5%**
Region						
Eastern	184	**77.3%**	8.14	6.3	**57.3%**	**97.4%**
Front Range	420	**82.9%**	1.45	1.2	**80.0%**	**85.7%**
Western	168	**79.3%**	2.02	1.6	**75.2%**	**83.5%**
Weather						
Clear	753	**81.0%**	1.46	1.2	**78.5%**	**83.5%**
Other*	19	**84.3%**	3.08	2.6	**77.6%**	**91.0%**
Time						
Non-Peak Hours	612	**80.5%**	1.63	1.3	**77.7%**	**83.2%**
Peak Hours	150	**82.8%**	1.69	1.4	**79.9%**	**85.8%**
Day of the Week						
Weekday	547	**81.0%**	1.72	1.4	**78.0%**	**83.9%**
Weekend	225	**81.3%**	2.20	1.8	**77.3%**	**85.3%**
Speed						
0-30 mph	295	**72.4%**	5.47	4.0	**64.0%**	**80.7%**
31-50 mph	282	**78.2%**	1.95	1.5	**75.0%**	**81.5%**
50+ mph	195	**84.7%**	1.33	1.1	**82.3%**	**87.1%**
Road Class						
Local	368	**76.0%**	2.86	2.2	**71.5%**	**80.6%**
Major	404	**82.1%**	1.46	1.2	**79.6%**	**84.7%**

* Based on a small number of observations.

Table 9: Comparison of 2011 and 2010 Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Adult 2011 Survey				Adult 2010 Survey			
			95 Percent Confidence Limits				95 Percent Confidence Limits	
	# of Observation Sites	Estimate	Lower Limit	Upper Limit	# of Observation Sites	Estimate	Lower Limit	Upper Limit
Total	**772**	**82.1%**	**80.8%**	**83.5%**	**770**	**82.9%**	**81.2%**	**84.6%**
Region								
Eastern	**184**	**82.2%**	**75.4%**	**88.9%**	**184**	**79.8%**	**65.3%**	**94.4%**
Front Range	**420**	**82.8%**	**81.1%**	**84.4%**	**418**	**83.9%**	**81.4%**	**86.4%**
Western	**168**	**80.3%**	**77.4%**	**83.1%**	**168**	**81.7%**	**77.9%**	**85.4%**
Weather								
Clear	**755**	**82.1%**	**80.7%**	**83.4%**	**696**	**82.9%**	**81.1%**	**84.6%**
Not Clear*	**17**	**83.4%**	**80.4%**	**86.5%**	**74**	**82.7%**	**78.8%**	**86.7%**
Time								
Non-Peak	**656**	**81.4%**	**80.1%**	**82.8%**	**635**	**81.7%**	**80.1%**	**83.3%**
Peak	**116**	**84.4%**	**82.3%**	**86.5%**	**135**	**86.2%**	**83.6%**	**88.8%**
Day of the Week								
Weekday	**556**	**82.1%**	**80.6%**	**83.6%**	**565**	**82.9%**	**80.9%**	**84.8%**
Weekend	**218**	**82.1%**	**79.1%**	**85.1%**	**205**	**82.9%**	**79.8%**	**86.1%**
Speed								
0-30 mph	**316**	**73.7%**	**70.2%**	**77.2%**	**296**	**72.4%**	**68.0%**	**76.7%**
31-50 mph	**275**	**81.4%**	**79.1%**	**83.7%**	**305**	**81.2%**	**79.2%**	**83.3%**
<50 mph	**181**	**83.7%**	**82.0%**	**85.4%**	**169**	**85.1%**	**82.5%**	**87.7%**
Road Class								
Local	**367**	**79.8%**	**75.9%**	**83.7%**	**366**	**79.0%**	**75.9%**	**82.0%**
Major	**405**	**82.5%**	**81.1%**	**83.9%**	**404**	**83.5%**	**81.6%**	**85.4%**

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Table 10: Comparison of 2009 and 2008 Seat Belt Usage for Colorado

(Cars, Vans, SUVs, and Trucks Combined)

	Adult 2009 Survey				Adult 2008 Survey			
			95 Percent Confidence Limits				95 Percent Confidence Limits	
	# of Observation Sites	Estimate	Lower Limit	Upper Limit	# of Observation Sites	Estimate	Lower Limit	Upper Limit
Total	**772**	**81.1%**	**79.4%**	**82.9%**	**772**	**81.7%**	**79.7%**	**83.6%**
Region								
Eastern	**184**	**78.1%**	**62.6%**	**93.7%**	**184**	**77.4%**	**59.3%**	**95.5%**
Front Range	**420**	**83.4%**	**81.4%**	**85.4%**	**420**	**83.6%**	**81.0%**	**86.1%**
Western	**168**	**77.7%**	**72.7%**	**82.7%**	**168**	**79.4%**	**74.9%**	**83.9%**
Weather								
Clear	**684**	**81.0%**	**79.3%**	**82.7%**	**727**	**81.7%**	**79.7%**	**83.7%**
Other*	**88**	**82.2%**	**77.2%**	**87.3%**	**45**	**80.6%**	**74.3%**	**86.9%**
Time								
Non-Peak	**618**	**80.2%**	**78.3%**	**82.0%**	**619**	**80.6%**	**78.3%**	**82.9%**
Peak	**154**	**83.8%**	**81.3%**	**86.4%**	**153**	**84.5%**	**82.3%**	**86.7%**
Day of the Week								
Weekday	**592**	**80.5%**	**78.9%**	**88.1%**	**553**	**81.2%**	**79.0%**	**83.5%**
Weekend	**180**	**83.5%**	**77.9%**	**83.2%**	**219**	**83.0%**	**79.0%**	**86.9%**
Speed								
0-30 mph	**324**	**75.9%**	**70.7%**	**81.1%**	**309**	**75.5%**	**69.1%**	**82.1%**
31-50 mph	**271**	**79.3%**	**76.8%**	**81.8%**	**285**	**79.4%**	**76.3%**	**82.4%**
<50 mph	**177**	**83.6%**	**81.4%**	**85.9%**	**178**	**84.1%**	**81.7%**	**86.6%**
Road Class								
Local	**368**	**78.3%**	**75.0%**	**81.7%**	**368**	**76.4%**	**71.7%**	**81.1%**
Major	**404**	**81.7%**	**79.8%**	**83.6%**	**404**	**82.5%**	**80.6%**	**84.5%**

*Based on a very small number of observations.

Table 11: County Results for 2011 Colorado Statewide Seat Belt Survey

County	Sites	Seat Belt Usage Estimate	Standard Error	Lower 95% Conf Int	Upper 95% Conf Int	
Adams	48	78.8	1.4	75.9	81.7	
Arapahoe	38	81.7	0.5	80.7	82.8	
Boulder	40	87.8	1.2	85.4	90.2	
Clear Creek	12	89.2	1.4	86.0	92.3	
Denver	68	80.8	0.8	79.3	82.4	
Douglas	32	83.2	0.6	82.0	84.4	
Eagle	22	85.1	1.0	83.0	87.2	
El Paso	60	83.4	1.1	81.2	85.7	
Garfield	14	83.3	1.1	80.8	87.7	
Gunnison	22	76.1	1.9	72.1	80.0	
Huerfano	30	80.2	2.3	75.5	84.8	
Jefferson	60	84.5	0.7	83.2	85.9	
Kit Carson	20	50.9	4.8	40.9	61.0	
Larimer	30	89.7	0.7	88.3	91.1	
Lincoln	12	86.4	2.2	81.6	91.1	
Logan	32	72.9	1.4	70.1	75.8	
Mesa	20	76.4	1.1	74.2	78.6	
Montezuma	24	71.1	2.6	65.6	76.5	
Montrose	20	72.5	1.2	70.0	75.1	
Morgan	30	81.6	1.2	79.1	84.0	
Pueblo	20	76.8	3.8	68.8	84.8	
Routt	22	87.1	1.3	84.4	89.8	
Sedgwick	30	75.8	5.8	64.0	87.6	Note 1
Summit	24	84.5	1.1	82.2	86.8	
Weld	40	87.4	1.6	84.1	90.7	

Note 1. Sedgwick County's estimate of seat belt usage, while useful, can be questioned because of the magnitude of the Standard Error. A Standard Error over 5 is generally suspect; the sample of seat belt usage was too small.

CONCLUSIONS

The 386 observation sites were surveyed twice during the two-week period from June 5 through June 18, 2011. Total observations of 172,900 vehicles from the 772 sites (386 x 2) yielded a statewide estimate of 82.1%. Statistically, this finding is essentially the same as last year's usage rate of 82.9%. Over a five-year period the movement from 81.1% in 2007 to 82.1% in 2011 does not seem like a major improvement; however, it should be noted that this improvement has come as a result of significant effort and investment by the Occupant Safety and Protection Program of the Office of Transportation Safety. The relative stability over the past five years of the overall State seat belt usage rate may reinforce the possibility that Colorado is near a "ceiling" which will likely require greater investment to achieve even small gains or the passage of a primary seat belt law to experience greater gains.

During the last five years, the usage rate for the Western Slope has moved upward from 79.3% to 80.3%. The Eastern Plains has shown an even greater improvement from 77.3% in 2007 to 82.2% in 2011. Both regions are still below the 82.8% of the Front Range. As mentioned earlier in the report, a higher percentage of trucks on the Western Slope and Eastern Plans results in lower usage rates than on the Front Range.

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

APPENDICES

APPENDIX 1: Statewide Survey Design

Introduction

This study was designed to achieve the objective of optimizing the amount and quality of information at a lower cost than could be accomplished through traditional experimentation. The aim in designing surveys and experiments is to meet a desired degree of reliability at the lowest possible investment given the existing budgetary, administrative and physical limitations within which the work must be conducted. Thus, the goal is to maximize *efficiency* in the process of gathering the most information with the smallest error for the time and money invested.

Through the use of statistical theory, the aim is to find a balance between two types of errors:

1. The plan could yield more precision than is needed and may thus be too costly, too slow, and perhaps excessively burdensome for the public.

2. The plan could yield insufficient precision, in which case significant results would not be attained, and the efforts and expense of the survey would, for the most part, be wasted.

A third type of error that has even greater negative impact is to design a plan that elicits irrelevant information. Therefore, the first step is to accurately define the problem: *what is wanted/needed?* By examining what is needed (a statewide overall estimate of seat belt usage in all vehicles), with the application of statistical theory, an economic balance can be achieved which will minimize the occurrence of the above-stated errors. Also, enough data will be obtained with the necessary precision to prevent losses in carrying out meaningless surveys, data gathering, and analyses.

In the following sections of this report, the survey design is discussed and the data with accompanying analyses are presented.

Survey Design

The sample design for the Statewide Colorado Seat Belt Survey is a statewide, multistage area, probability-based sample of road segments. The steps involved in drawing the sample sites where observations were conducted were as follows:

1. Region (Eastern Region, Front Range, and Western Region)

2. Sample County
    a. Selection probability-based on 2000 Census data

3. Selection of Major Roads and Local Roads
    a. Major Roads selection: probability-based – Sample Road Segments
    b. Local Roads selection: probability-based – Census Tracts

For the purposes of this survey, an observational site is a specific road intersection or freeway ramp where observations take place; an observation time period is a 40-minute time period in which seat belt usage is observed at a specific site. Each site was observed twice over the two weeks of data collection.

The survey was designed to produce an overall state estimate of seat belt usage, and also to provide regional and county estimates. The Western Slope Region consists of nine counties, the Front Range Region contains of ten counties, and the Eastern Plains Region includes six counties. The Western Slope Region covers an area from the western border of the State to the Continental Divide; the Front Range includes the counties through which Interstate 25 makes its way from the northern border to the southern border of Colorado. The Eastern Region consists of the counties bordering the Front Range to the Eastern state line.

The population of Colorado grew from 4,301,261 in 2000 to 4,550,688 in 2010. This growth was mostly along Interstate Highway corridors of I-25, I-70 and I-76. In each region counties were randomly selected from those bordering the Interstate Highways. Sampling in this manner included areas wherein at least 85 percent of the population of the State is located.

The selection of county groupings formed the primary strata. These strata were then used to select the individual counties used in the next sampling stage. The counties were then chosen based upon the percentage of the State's population. Within these counties, sites were selected where the actual observations took place.

Prior to sampling, roads were grouped based upon the State's classifications of Major Roads and Local Roads. The Major Roads were included taking into account the road's length and volume of traffic, as reported in the State's CORIS database. All road segments in the sample counties were identified and samples of segments were selected for observation. The local roads were chosen within sample tracts and the number of tracts selected was proportional to the population of the county. It was determined that there would be 386 sites (road segments) on major roads and local roads from which the sample would be drawn. For each site where the observations are conducted, a traffic direction was assigned. The traffic was always observed from inside the sample road segment at or near (for safety reasons) the point where the traffic was leaving the segment. It has been estimated that approximately 30 percent of the State's Daily Vehicle Miles Traveled (DVMT) are on local roads. Nearly 40 percent of observation time is allocated to local roads due to the variability in seat belt usage noted in prior State surveys. Statistically, it is wise to allocate more observation time to those areas in which more variability potentially exists due to strata selection, thereby minimizing some of the sampling error.

The 2011 Colorado Statewide 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 are probability based on population and vehicle miles; therefore estimates are representative of seat belt usage for the State's driver and front outboard passenger population.

2. The sample data are collected through direct observation of seat belt usage on selected roadways by qualified and trained observers (mostly former Colorado State Patrol Troopers). Observation times are assigned and rescheduled if weather interferes. Likewise, if there is construction on an assigned site, a safer site is selected for the observation within the road segment.

3. Training occurs one week to ten days prior to the actual survey and includes observation of traffic flow, time periods for the observations, counting seat belt usage, and filling out forms.

4. The population of interest for the survey is the driver and outboard front seat passenger of cars, light trucks (non commercial), vans, and SUVs.

5. Observations are made in daylight hours during the month of June immediately following the enforcement wave.

6. Observational data are recorded on counting sheets, summarized and reported to Colorado State University, Institute of Transportation Management (CSU/ITM), whereupon a digital record is created. The digital record serves as input into SAS programs for data reduction. The reduced data are then returned to CSU/ITM for analysis and interpretation by Dr. Walter Hivner.

Sample Size Determination

Sample size determination was, in large measure, governed by the resources made available for field observations, the time constraints placed on the survey and the precision requirements of the study (the relative error: standard error divided by the parameter estimate <= 0.05). The survey was to be completed and reported by August 31, 2011. 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, suggests that the number of roadway locations be as large as possible. However, there is a practical need to select a small enough number of road segments for study so that observers will not spend too much time traveling from site to site. With these conditions in mind, as well as the precision requirements and the time and cost constraints, it was established that a total sample of 772 observational time periods and sites would be used (386 individual sites to be observed on two different occasions). The Front Range was allotted 420 of these time periods since the vast majority of DVMTs are on the Front Range. The Eastern Region was assigned 184 observational time periods and 168 for the Western Region.

Stratification of Roadways

All roads in Colorado were eligible as sites for selection and observation. Detailed tract maps provided by the Census Bureau were used to identify local roadways. State highway maps and traffic maps were used to list and sample major roadways. Roadways dropped from consideration included:

1. Private streets and driveways
2. Unnamed streets
3. Roads named as courts, circles, and cul-de-sacs

Prior to determining the sample from the eligible roadways, a classification system was adopted so that all roadways were assigned to one of the two primary strata: 1) major roads and 2) local roads. This produced a more efficient sample design than simple random sampling. The major roads consisted of State-maintained roads such as Interstate highways, U.S. highways and state routes. All other roads were assigned to the local roads stratum. The traffic volume on roads in this latter class varies considerably with many being quiet residential streets or rural roads that serve low numbers of vehicles per day.

The sampling plan was designed to select the roadways from the two strata using differential selection probabilities. The objective was to produce a design that is efficient in the production of a large number of vehicle occupants for observation and provides a comprehensive coverage of the State's travel so that reliable estimates of the seat belt usage rate could be derived. The stratification and differential selection of roadways was a compromise between two extreme approaches to the sampling of roadways. In one extreme, it would be desirable to observe only on high-volume roads so that the greatest number of vehicles could be counted and the observers are never idle. This would require sampling as many high-volume interstate highways as possible. The other extreme is sampling all roads with equal probability, which would bring into the sample a large number of rural roads or neighborhood roads where the traffic load would be light.

Multistage Selection of Roadways

While most roads in Colorado were eligible for inclusion in the survey, it was neither feasible nor necessary to compile a list of all roads in the State for use as a sampling frame. Instead, a three-stage selection approach was used to designate the final sample of roads. The selection procedure was designed to achieve two important advantages of cluster sampling. First, in constructing the sampling frame it was desirable to include only geographically compact areas rather than list all roads in the State. Second, it was important to cluster the sample roads so that field observers would not incur substantial travel time in going from one observation location to another. The first stage in the sampling procedure for both major roads and local roads involved the selection of twenty-five counties, six in the Eastern Region, ten in the Front Range and the remainder (nine) in the Western Region. The sampling of local roads was further confined to a smaller geographic cluster – Census Tact (CT) or Enumeration District (ED) – since it would be impractical to list all local roads in a county. Thus, within the sample counties, the second-stage units, CTs/EDs, were selected. The third stage of sampling for local roads was the selection of roads within the sample tracts. For major roads the second stage was the selection of road segments within the sample counties. This approach allowed a better representation of major roads than if they had been clustered at the Census Tract level.

Selection of First and Second Stage Units

In the Eastern Region, Lincoln, Logan, Kit Carson, Morgan, Sedgwick, and Weld Counties were included in the sample. Larimer, Boulder, Clear Creek, Denver, Douglas, Adams, Arapahoe, El Paso, Jefferson, and Pueblo were selected for the Front Range survey. For the Western Region, Eagle, Garfield, Gunnison, Huerfano, Mesa, Montezuma, Montrose, Routt, and Summit Counties were chosen. Some of these counties were selected with certainty in that these counties were included as self-representing because of their populations and their corresponding average DVMT. To achieve implicit geographic stratification, the remaining counties were structured, before sampling, in order of their population and in a geographic fashion. Three strata of approximately equal population, and by correlation with DVMT, were defined within each region. The exception was the Eastern Region where two strata were defined. This was done because of the sparse population in this region. Counties were selected from each stratum with probability proportional to population (2000 Census) in the county.

Next, Census tracts were allocated to each of the regions through the eight strata. To quote Josefina Lago, Washington Consulting Group regarding the allocation of Census tracts, "tracts were allocated … approximately in proportion to the squared root of the total average DVMT in the region." Based on the 2000 Census, a fixed number of tracts were allocated to each county. This number was determined by the number of local roads to be allocated to the county, with a minimum of two tracts per county. Tracts were then selected with probability proportional to the square root of population (as a representative for vehicle miles of travel in the tract). Prior to actual sampling, the list was ordered by tract number within the county to provide implicit geographic stratification of the sample tracts.

The allocation between major roads and local roads was then made based on the estimated annual VMT for the State of Colorado. A comparison was made of the proportion of population of counties in 1990 and 2000. From this comparison it was determined that the proportion of major roads to local roads would remain the same. As in previous surveys it has been found that there is more variability in seat belt usage on local roads than on major roads. Under these conditions it is desirable, from a sampling efficiency point of view, to allocate more observations to the stratum with greater variability than would be proposed with strictly proportional allocation.

Selection of Roads

The sampling frame of major roads was constructed by segmenting the roads appearing on the State of Colorado Road Maps. County and city maps were used where the level of detail on large-scale maps was not sufficient to carry out the road segmentation. For each sample county the road segments, their length and average daily traffic of each segment were recorded. The road segments were sampled systematically with probability proportional to average daily VMT.

To construct the sampling frame for local roads, all local roads in sample tracts were listed, excluding major roads. Within each county an equal probability sample of local roads was selected. The sample size was determined by the allocation process described in the previous section.

It is noted that sample allocation of roadways and road selection in the 2011 survey was based on a methodology originally designed by the Washington Consulting Group, Josafina Lago, and examined, modified, and updated by CSU/ITM to conform to the 2000 Census information.

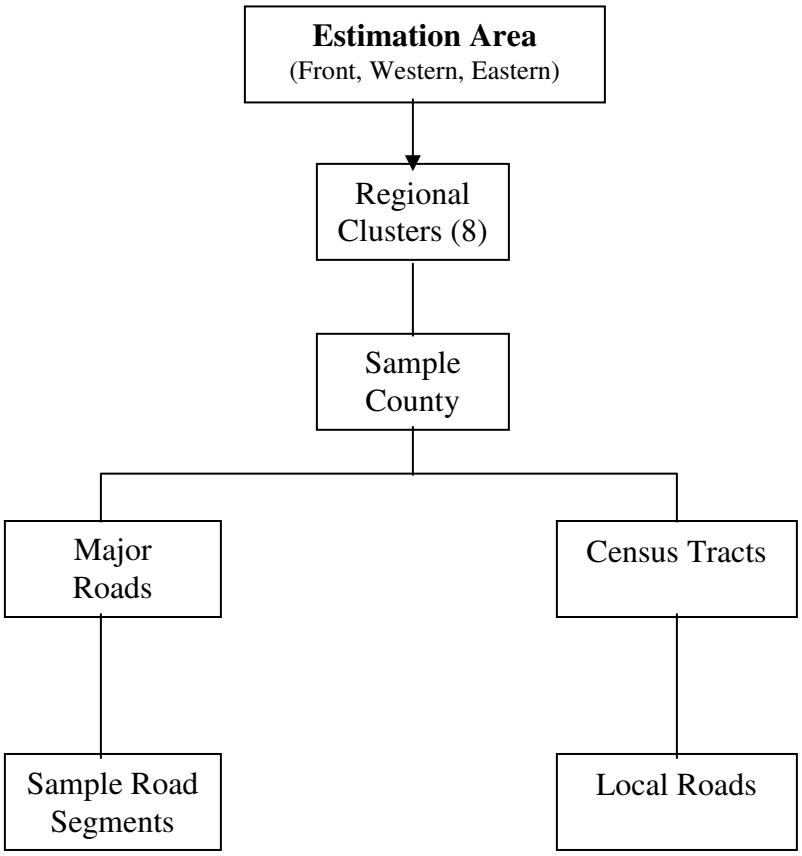
APPENDIX 2: Site Selection

Once a random sample of counties was selected, the selection of the sample sites was then determined. For purposes of sample selection, roads were grouped into two strata: 1) major roads (State, U.S. and Interstates) and 2) local roads. As depicted in Figure 1, the major roads were sampled across an entire county, while the local roads were selected from within small geographic areas: Census Tracts/Enumeration Districts.

The sample of major roads was selected taking into account a road's length and volume of traffic. Based on the CORIS database, all road segments in the sample counties were identified and then a sample of segments was selected for observation. The local roads were selected within sample tracts and the number of tracts selected was proportional to the population of the county. A total of 386 sites (road segments) on major roads and local roads were chosen to determine the final sample.

For each observation site a specific traffic direction was assigned. The traffic was always observed leaving from inside the sample road segment at or near the point where the traffic was leaving the segment.

Figure 1: Sample Design Summary



APPENDIX 3: Methodology

ITM makes use of a statistical system provide by SAS Institute that has been available since the mid 1970s and is widely used and respected throughout the survey statistician community. Within SAS there exists a procedure called PROC SURVEYREG. The SURVEYREG procedure performs statistical analysis for survey data. This analytical procedure takes into account the design used to select the sample. The sample design can be a complex sample design such as Clustering and unequal weighting. In order to employ this methodology, the design of the survey was specified; the first stage stratum consisted of three strata in the Western Region, three in the Front Range, and two in the Eastern Region. Next were the county clusters from each stratum followed by the observational data. Sampling weights were also included as an integral part of the process.

The procedure SURVEYREG 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.

Variance Estimation

The SURVEYREG procedure uses the Taylor Expansion Method to estimate sampling errors in complex designs. This method obtains a linear approximation for the estimator and then uses the variance estimate for this approximation to estimate the variance of the estimate itself. When there are clusters in the sample design, the procedure estimates the differences in the variation among the clusters. For a multistage design such as this, the variance estimation depends only on the first stage stratum (the eight strata of counties).

Analysis

Using the procedures discussed in the previous sections, estimates of usage rates were computed along with estimates of the standard errors. The Colorado survey was designed to produce an overall State estimate and estimates for the three regions: 1) Eastern Plains Region, 2) Front Range, and 3) Western Slope Region (refer to Table 2). The overall State estimate of seat belt usage rate in Colorado for 2011 is 82.1 percent. This estimate may vary by 0.6 percent due to sampling error, as not all roads were observed. A 95 percent confidence interval of the estimated usage establishes a range from 80.8 to 83.5 percent usage.

The usage rate for the Eastern Plains Region was 82.2 percent, the Front Range was 82.8 percent and the Western Slope Region was 80.3 percent. Notice that the sampling error was 4.6 percent in the Eastern Plains Region and 0.7 percent and 1.1 percent for the Front Range and the Western Slope Region, respectively. This indicates a greater degree of variability in the usage rate in the Eastern Plains Region versus the other two regions.

APPENDIX 4: Field Work

This section identifies the observation sites and provides maps showing the exact location of each site as well as the traffic direction to be observed.

Site Description Sheets

The description for an observation location gives the intersection at or near where the observation is to be conducted. An example of a description sheet is shown in Figure 2. The first road named indicates the road segment of interest, that is, the road on which seat belt usage will be observed. The second road named is the intersecting road which marks the end of the segment. For example, in the description of site E112, seat belt usage is to be observed in vehicles traveling on State Highway 96 at the intersection with County Road 27. Figure 3 explains abbreviations used in the county site descriptor tables.

Figure 2: County Site Descriptor Example

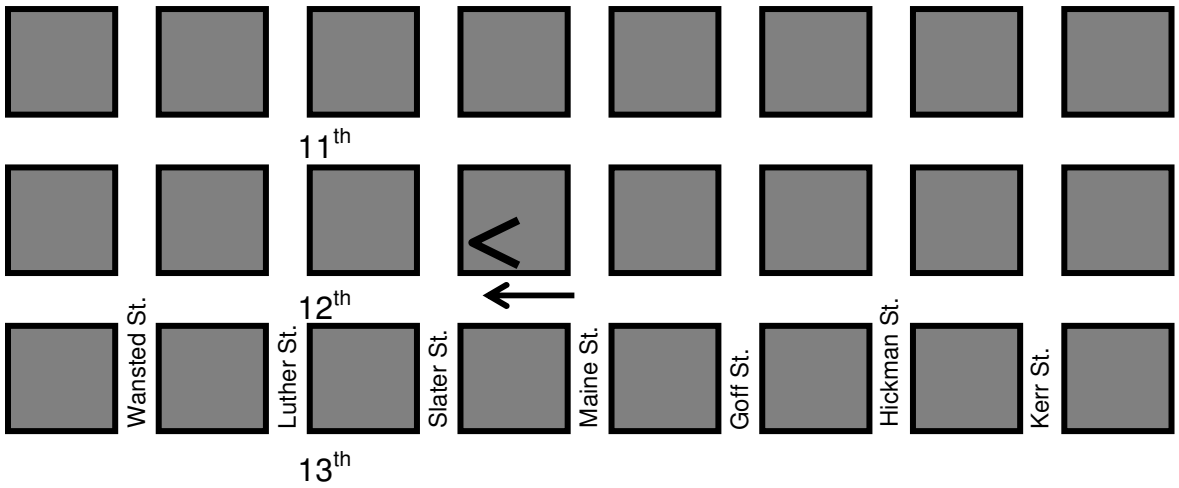
KIOWA COUNTY		
VOL	ROAD ID	DESCRIPTION
L	E112	SH 96 at CO RD 27
L	E113	SH 96 at Rush Creek
L	E114	SH 96 at Enter Sheridan Lake
L	E115	SH 96 at Jct SH 385 (Colorado Ave)
L	E116	SH 96 at CO RD 78.5 (Towner)
L	E117	SH 287 at Kiowa Cty Rd A
L	E118	SH 287 at Ramp On Jct SH 96
L	E119	SH 287 at Maine St
L	E120	SH 287 at JCT SH 96 (Wansted St)
L	E121	SH 28 at Rush Creek
L	E122	SH 385 at Prowers Cty Rd W
L	E205	11th St at Kerr St
L	E206	Wansted St at l0th St
L	E207	14th St at Kerr St
L	E208	Lowell Ave at Maine St

Figure 3: Major Road Descriptor Abbreviations

Abbreviation	Meaning
CL	City Limits
CO or Cty	County
Jct	Junction
STR	Structure, (i.e., bridge, overpass or underpass)
SH	State Highway
(D-16-C)	Parenthesis containing this similar sequence refers to the points of reference on the Colorado State Map.
IR	Indian Reserve
NF	National Forest
RRF	Railroad Crossing
SH 2 NE RD SE	The RD SE indicates there is an intersecting road other than the first one listed (SH 2 NE). The name of the second intersecting road is usually given in parenthesis at the end of the description.

The direction of the traffic is not explicitly specified in the description, but it is indicated on the map by the direction of the arrow marking the intersection. Referring to Figure 4, a road segment is the segment of road between two intersecting streets. Seat belt usage will be observed for eligible vehicles on 12th Street and the observer will stand at the corner of 12th and Slater Street. The arrows indicate both the side of the road on which the observer is to stand and the direction of the traffic to be observed. Standing at this point enables the observer to record or count seat belt usage in vehicles coming from inside the segment at or near the point where the vehicles are leaving that segment.

Figure 4: Direction of Observation



Maps for Major Roads

Major roads are identified on county level maps. Each map displays a sample county. As shown in Figure 5, each site on the map is identified with an arrow and a site number. The arrow indicates the traffic direction to be observed. The site number is a four-digit identifier that ties the observation points to the region and site description. The first character of the site number identifies the region (Front, Western, and Eastern) and the other three characters are assigned sequentially within a road type. Major roads are assigned sequence numbers from 101 to 199.

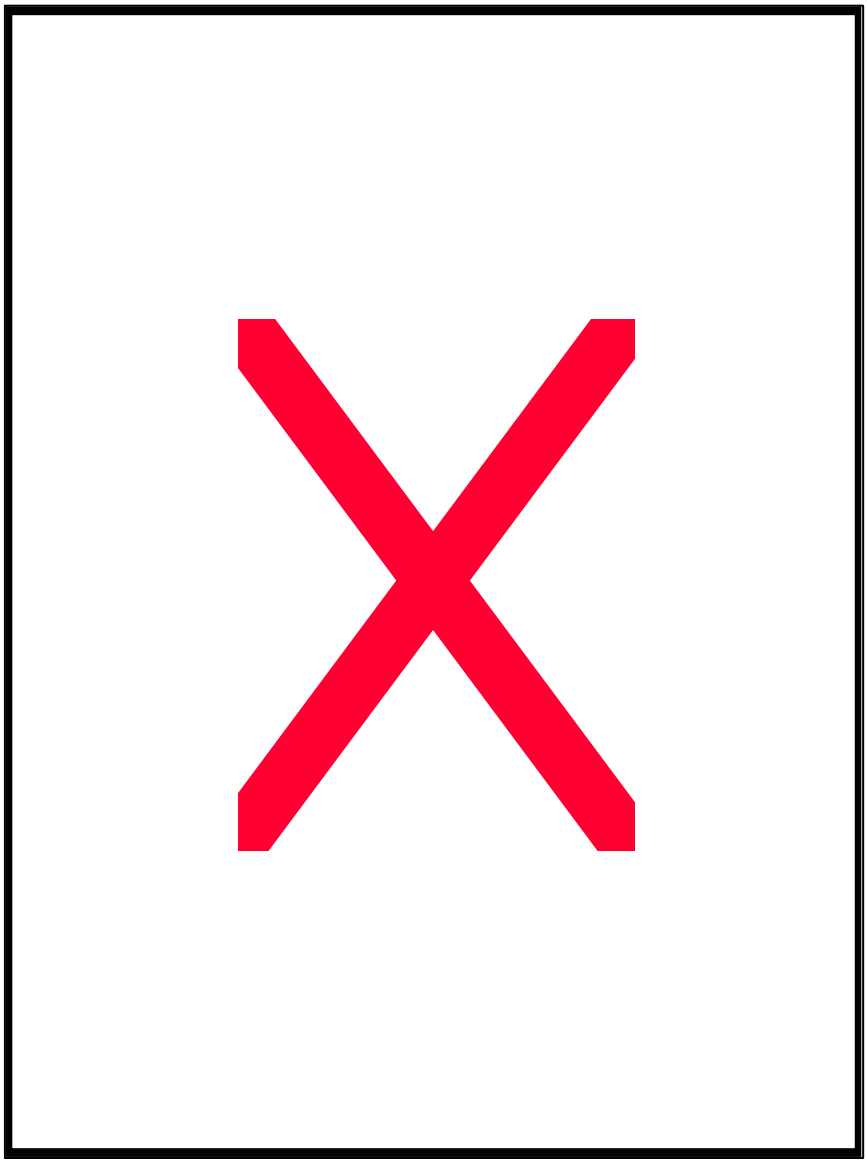
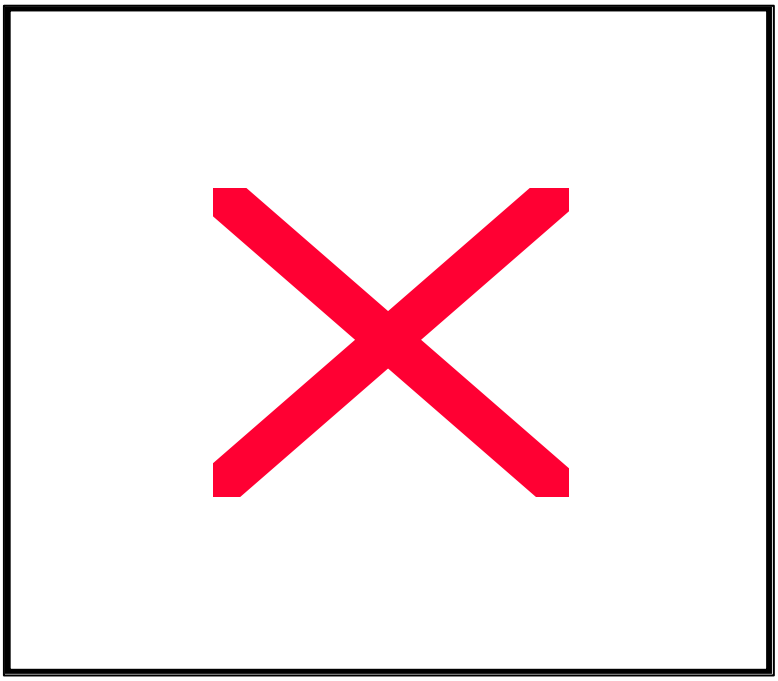


Figure 5: Map for Major Roads

Census Tract Maps for Local Roads

As indicated earlier, local roads were sampled within sample Census Tracts (CTs) and Enumeration Districts (EDs). On each map the tract or ED is highlighted in yellow. The arrow again indicates the traffic direction to be observed. Sites on local roads were assigned a sequential number from 201 to 299 within the region. A typical census tract map is shown in Figure 6.

Figure 6: Map for Local Roads



Observation Schedule Sheet

Based on the number of observations in an assigned county, a schedule was prepared that indicates the day, time and site number of observation assignments (see Figure 7). Substitutions – observing traffic on a different road than that specified – were not acceptable as sites were selected and assigned to days of the week and times of the day by probability methods (see notes below).

Figure 7: Observation Schedule Sheet Example

Observer Name: Michael Smith Observer Code: 12 County Name: Kiowa
County Code: 45

Date	8:00 am - 8:40 am	9:00 am - 9:40 am	10:00 am - 10:40 am	11:00 am - 11:40 am	12:00 am - 12:40 pm	1:00 pm - 1:40 pm	2:00 pm - 2:40 pm	3:00 pm - 3:40 pm	4:00 pm - 4:40 pm
8 / 8 /00	E113	E119	E210	E116	E211	LUNCH	E122	E115	E117
8 / 9 /00	E212	E114	E118	E112	LUNCH	E121	E209	E120	
/ /									
/ /									
/ /									
/ /									
/ /									

Remarks: _____

NOTES:

1. This schedule is designed to allow for the required 40 minutes of observation at each site and 20 minutes for paperwork and travel to the next site.
2. All high volume sites should be scheduled on the same day. A supervisor or high volume assistant will be assigned to work with you.
3. If for a given road it is not possible to observe at the intersection indicated on the Site Description Sheet — because of construction or because it is not safe — you may conduct the observation at a nearby location on that road. Please indicate exceptions on the back of the Traffic Recording Sheet with a brief explanation. Make corrections to street names, milepost markers, etc. on the Site Description Lists.
4. If on a one-way street the direction indicated by the arrow contradicts the traffic flow, ignore the direction specified by the arrow.

Instructions for Conducting the Observations for Seat Belt Usage

The Traffic Recording Sheet shown in Figure 8 will be used to record total counts of drivers and outboard front seat passengers using and not using shoulder belts.

Vehicle Eligibility

In counting belted and unbelted drivers and outboard front seat passengers, please follow the eligibility rules specified below:

- Eligible vehicles include private automobiles, vans, SUVs, and trucks; exclude buses, commercial trailers, police vehicles, ambulances, postal delivery vehicles, and all other delivery vehicles.
- Belt usage will be observed for front-seat occupants only.
- If there is more than one front seat passenger observe only the "outside" passenger, and if a child in a child restraint seat is present in the front seat, do not record anything. However, children riding in the front seat, regardless of age, who are not in child restraint seats, should be observed as any other front-seat passenger.

Procedures

The following procedures will be used in conducting observations of seat belt use at high volume sites:

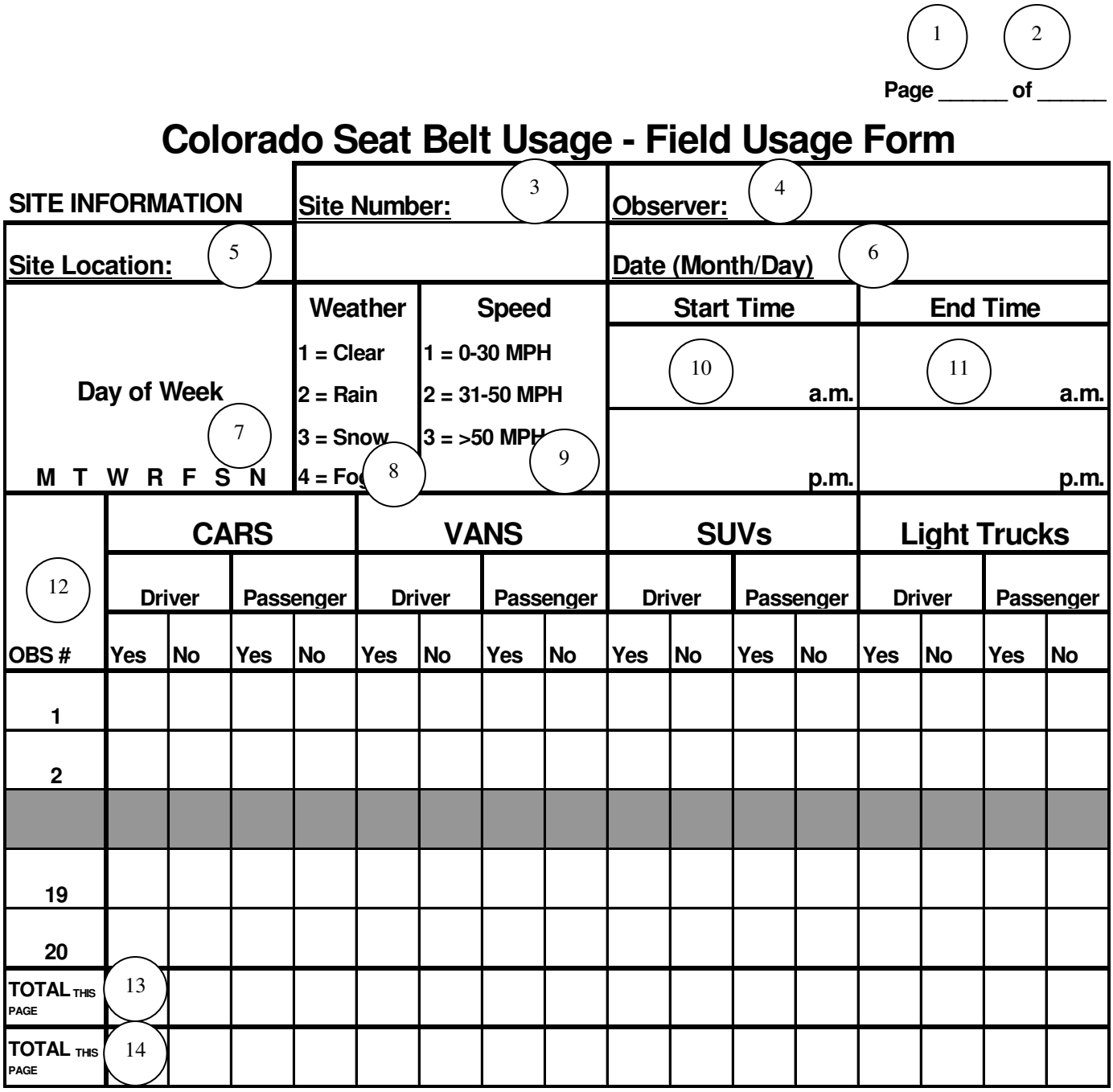
- If a vehicle is equipped with shoulder belts and the person has the belt buckled but has the shoulder strap under his/her arm, this person is not considered to be wearing a shoulder belt.
- If a vehicle is so old that it is not equipped with shoulder straps it should not be included as an “eligible” vehicle in the survey.
- Determine how many lanes of traffic in the assigned direction you can observe. Observe traffic only on these lanes throughout the observation time period. If you can observe only one lane, designate the lane closest to you as the observation lane.
- For safety reasons, you should observe belt use on interstates from an exit ramp or overpass.
- In most situations it should be possible to observe every vehicle in the designated lane. However, if traffic is moving too fast to observe every vehicle, you should determine which vehicle can be observed, i.e. every second car, every third card, etc. This pattern must be followed for the entire observation period and noted in the comments section of the form.
- At the end of the observation period record the number of persons observed using shoulder belts and the number observed not using shoulder belts on the Traffic Summary Sheet. If no eligible vehicles were observed during the 40-minute observation time period, record zero for "using" and zero for "not using shoulder belt." Also record zero for the speed but record the other information specific to that observation site and time period.

Seat belt Usage Field Survey Form Information

Use the Seat Belt Usage Field Survey Form (see Figure 8) at observation sites where speeds are low enough (<45 mph) to record seat belt usage.

Figure 9 provides instructions on how to properly use the Field Survey Form.

Figure 8: Seat Belt Usage Field Survey Form Example



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Page _____ of _____

Colorado Seat Belt Usage - Field Usage Form

SITE INFORMATION	Site Number: 3	Observer: 4
Site Location: 5		Date (Month/Day) 6

Day of Week 7 M T W R F S N	Weather 1 = Clear 2 = Rain 3 = Snow 4 = Fog 8	Speed 9 1 = 0-30 MPH 2 = 31-50 MPH 3 = >50 MPH	Start Time 10 a.m. p.m.	End Time 11 a.m. p.m.

12	CARS				VANS				SUVs				Light Trucks			
	Driver		Passenger		Driver		Passenger		Driver		Passenger		Driver		Passenger	
OBS #	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1																
2																
19																
20																
TOTAL THIS PAGE 13																
TOTAL THIS PAGE 14																

Figure 9: Seat Belt Usage Field Survey Form Instructions

Item #	Item Description
1	**Page _____:** Enter the page number of the sheet you are completing for the current observation site.
2	**of _____:** Enter the total number the sheets used for the current site after observation is complete.
3	**Site Number:** Transfer the site number from your survey schedule sheet and indicate the direction of the traffic you are observing. N = north E = east S = south W = west (i.e. if the traffic is coming from the east you would mark an "E" in the Site Number cell adjacent to the specific site number)
4	**Observer Name:** Enter your last name.
5	**Site Location:** Enter the site description from the Site Description Sheet.
6	**Date:** The date the observation is being conducted using MM/DD (i.e., on August 7th you would enter 08/07).
7	**Day of Week:** Circle the letter that indicates what day of the week you are making the observation (R = Thursday and N = Sunday).
8	**Weather:** Circle the number that best indicates the weather conditions during the observation period.
9	**Speed:** Circle the number that best indicates approximate average speed you think the vehicles along this road are traveling. DO NOT record the speed limit since this can be obtained from other sources. In recording speed for an interstate you should record the speed of vehicles on the interstate not that of vehicles on the exit ramp.
10	**Start Time:** Record the time you begin the observation. Follow the format HH:MM. Do not use military time (i.e., 2:00 pm is recorded as 2:00 pm versus 1400 hrs). Circle either a.m. or p.m.
11	**End Time:** Record the time you begin the observation. Follow the format HH:MM. Do not use military time (i.e., 2:00 pm is recorded as 2:00 pm versus 1400 hrs). Circle either a.m. or p.m.
12	**OBS#:** (Observation Number) Each vehicle observed will be documented on a separate line. a. Determine if the observed vehicle is a car, van, SUV or light truck. b. Place a mark in the column indicating whether the driver is (YES) or is not (NO) using a shoulder belt. c. Place a mark in the column indicating whether the passenger is (YES) or is not (NO) using a shoulder belt. If there is no passenger leave these columns blank.
13	**Total this Page:** At the conclusion of the observation, total each column on the survey form
14	**Total this Site:** Place the overall column totals for all sheets at the bottom of page 1 for each site.
15	**Summary:** Record the site information and seat belt usage totals on the traffic recording sheet.

Traffic Summary Sheet Information

The Traffic Summary Sheet (Figure 10) summarizes observations for an entire day. However, if you work in more than one county on a given day, a separate recording sheet for each is required. Use this form to record results from high volume sites. Also transfer site totals from Field Survey Forms to this form. Step-by-step instructions for completing the form are provided in Figure 11.

Figure 10: Colorado Seat Belt Usage - Traffic Summary Sheet Example

Colorado Seat belt Usage — Traffic Summary Sheet 2011

WCG Use	County Name: (1)					County Code: (2)		OBSERVATION SUMMARY							
	Observer Name: (3)					Code: (4)		CAR		TRUCK		VAN		SUV	
Date (MM/DD)	# Lanes Avail / # Observed	Site Number	Weather (1,2,3,4)	Speed (1,2,3)	Time Began	Road Name	Intersecting Street	Yes	No	Yes	No	Yes	No	Yes	No
1. / (5)	(6) / (7)	(8)	(9)	(10)	(11) a.m. p.m.	(12)	(13)	D P (14)	D P (15)	D P (14)	D P (15)	D P (14)	D P (15)	D P (14)	D P (15)
2. /					a.m. p.m.			D P	D P	D P	D P	D P	D P	D P	D P
6. /					a.m. p.m.			D P	D P	D P	D P	D P	D P	D P	D P
7. /					a.m. p.m.			D P	D P	D P	D P	D P	D P	D P	D P
8. /					a.m. p.m.			D P	D P	D P	D P	D P	D P	D P	D P

Date: Record date as MM/DD
e.g. Nov. 17 = 11/17

Weather Condition Codes:
1 = Clear 2 = Rain 3 = Snow
4 = Fog

Speed Codes:
1 = 0-30 MPH 2 = 31-50 MPH
3 = >50 MPH

Time: Record time using 12-hour clock, DO NOT use 24-hour clock
e.g. 2 PM = 2:00 PM, NOT 14:00

Please place any comments on the back of this form. Traffic-Recording-Sheet-2005.doc (6/01)

(16)

Figure 11: Colorado Seat Belt Usage - Traffic Summary Sheet Instructions

Item #	Item Description
1	**County Name:** Enter the county name (from the description sheet). Remember that all results recorded on a given sheet should relate to the same county
2	**County Code:** Enter the county code (from the description sheet). Remember that all results recorded on a given sheet should relate to the same county
3	**Observer Name:** Enter your last name.
4	**Observer Code:** Enter your assigned observer code. The code is located on your survey schedule sheet in parenthesis next to your name.
5	**Date:** The date the observation is being conducted using MM/DD (i.e., on August 7th = 08/07).
6	**# of Lanes:** Record the total number of lanes with traffic traveling in the direction you are observing.
7	**# Observed:** Enter the total number of lanes observed at this observation site. Note that this number must be smaller or equal to the number of lanes with traffic traveling in the direction you are observing. In most cases this entry will be one (1) lane.
8	**Site Number:** Transfer the site number from your survey schedule sheet.
9	**Weather Conditions:** Record the weather conditions during the observation period using the codes shown at the bottom of the sheet. You may enter different weather conditions on the same sheet if the weather changes between observation periods.
10	**Road Speed:** Record the appropriate code, shown at the bottom of the sheet, to indicate approximate average speed you think the vehicles along this road are traveling. DO NOT record the speed limit since this can be obtained from other sources. In recording speed for an interstate you should record the speed of vehicles on the interstate not that of vehicles on the exit ramp.
11	**Time Began:** Record the time you begin the observation. Follow the format HH:MM. Do not use military time (i.e., 2:00 pm is recorded as 2:00 pm versus 1400 hrs). Circle either a.m. or p.m.
12	**Road Name:** Record the name of the road or street on which you are observing belt use (from the site descriptor sheet).
13	**Intersecting Street Name:** Record the name of the intersecting street,(from the site descriptor sheet).
14	**Observation Summary – Car – Van – SUV – Truck - Yes:** Record the number from the field usage form on which you have been recording car occupants using a shoulder belt.
15	**Observation Summary – Car – Van – SUV – Truck - No:** Record the number for truck occupants NOT using a shoulder belt.
16	**Remarks:** Should be included on the back of the form (i.e., reason for changing an observation location due to construction, incorrect site description, etc.).

APPENDIX 5: Weighting and Analyses

This section discusses weighting, estimation, and analyses. As described in the previous sections, the sample design for the Colorado Seat Belt Usage Survey is a probability sample of counties, tracts, and road segments. With probability sampling, the weight associated with a particular observation is the reciprocal of its probability of selection. Details on weighting are discussed below.

The estimate of interest from the Colorado Survey is the estimate of seat belt usage for all drivers and front-seat occupants of vans, sport utility vehicles (SUVs), and light trucks.

Weighting

The sample design for the Colorado Seat Belt Usage Survey is a probability sample of counties, tracts and road segments. With probability sampling, the weight associated with a particular observation (site) is the reciprocal of its probability of selection.

The base weight associated with an observed road segment for the Colorado survey is the inverse of its probability of selection. The expression for the probability of selection of a road segment on major roads is similar to that for local roads, except that the latter includes an additional component, the census tract selection probability.

Major roads were selected with probability proportional to their average daily VMT within sample counties. Local roads were first selected by tracts within sample county and then by roads within the sample tracts. All local roads within a sample tract were listed and a subsample was selected with equal probability within the tract.

Let

h --- identify a sample county;
i --- identify a sample census tract (when applicable);
j --- identify a sample road or road segment;
$\mathbf{P_h}$ = probability of selecting the county h
$\mathbf{P_{i \mid h}}$ = within-county probability of selecting tract i (when applicable; 1 otherwise)
$\mathbf{P_{j \mid hi}}$ = Probability of selecting road or read segment j, conditioned on the tract and county.

The overall probability of selecting road segment j in county h is given by

$$\mathbf{P_{hij} = P_h \cdot P_{i \mid h} \cdot P_{j \mid hi}}$$

Hence, the corresponding base weight, $\mathbf{W_{hij}}$, is given by

$$\mathbf{W_{hij} = 1/P_{hij}}$$

Weights for the Colorado State Seat Belt Usage Observational Survey

County	Weight	Probability (P_{hij})
Adams	1.41856	0.70494
Arapahoe	1.8	0.55556
Boulder	1.86983	0.53481
Clear Creek	3	0.33333
Denver	1	1
Douglas	2.02257	0.49442
Eagle	2.9	0.34483
El Paso	1	1
Garfield	4.5	0.22222
Gunnison	4.3	0.23256
Huerfano	4.733890	0.21124
Jefferson	1	1
Kit Carson	2.53	0.40
Larimer	1.75	0.57143
Lincoln	8.75	0.11429
Logan	3.95	0.25316
Mesa	3.75	0.26667
Montezuma	3.5	0.28571
Montrose	2.33	0.43
Morgan	5.23	0.19
Pueblo	2	0.5
Routt	5.2	0.19231
Sedgwick	6.67556	0.1498
Summit	3.28605	0.30432
Weld	1.63913	0.61008

Estimation

The basic estimate from the Colorado survey is the estimate of seat belt usage for all drivers and outboard front seat passengers of cars, vans, sport utility vehicles (SUVs), and light trucks. This estimate is the rate of observed front seat occupants (driver and passenger) who are using seat belts in eligible vehicles in the State of Colorado.

The Seat Belt Usage Rate for Colorado in 2011 was determined by using a survey sampling methodology to obtain information about a large population of Colorado, adult vehicle drivers (16 years old or older), by selecting and measuring a sample for that population. By applying scientific probability-based designs to select the sample, the risk of a distorted view of the population is reduced and statistically valid inferences can be made from the sample. The preceding sections explained the procedures that CSU/ITM used to select a probability-based sample from the study population.

Analyses

The fundamental basis for the analyses of this survey lies in the concept of Cluster Analysis. Cluster Analysis is a loose collection of statistical methods that can be used to assign cases to groups (clusters). Group members will share certain properties in common and it is hoped that the resultant classification will provide some insight into the research topic. The classification has the effect of reducing the dimensionality of the data by reducing the number of cases. In the Seat Belt Study, the cases referred to above are the vehicles that were observed and the classification in clusters is the grouped counties which were surveyed.

The SAS System was employed to reduce the observed data into usable information. SAS is the most widely used statistical for analysis of survey data. While several SAS procedures are used in the estimation of the seat belt usage, the primary proc used is SURVEYREG. The SURVEYREG procedure performs regression analysis for sample survey data such as the seat belt usage data. The current seat belt study, as with the past years' statistical design, includes stratification, clustering and unequal weighting of county and region data. SURVEYREG is ideal for this application. The procedure can take the stratified, regional data and provide interval estimates (95% Confidence Intervals for this experiment) and can compute predicted seat belt usage from the sample seat belt survey data.