2018 ARIZONA STATEWIDE SEAT BELT USE SURVEY

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Director
Doug Ducey, Governor


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2018 ARIZONA STATEWIDE SEAT BELT USE STUDY

Governor's Office of Highway Safety
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I. Introduction

This study was commissioned by the Arizona Governor's Office of Highway Safety (GOHS) as part of the State and Community Highway Safety Grant Program. The purpose of this study was to determine the 2018 statewide seat belt use rate. In addition, this research also collected data on drivers' use of hand-held cell phones.

The information reported here is based on a random probability sample of road segments in Arizona. The survey design is one that was first used in 2013, developed in response to NHTSA's updated 23 CFR Part 1340 Uniform Criteria for State Observational Surveys of Seat Belt Use (Federal Register Vol. 76 No. 63, April 1, 2011, pp. 18042-18059). For the 2018 survey NHTSA required a resample of the sites using methodology from the original design. The design includes 140 observation sites in the eight counties with the largest numbers of passenger vehicle occupant fatalities between 2010 and 2014, distributed across five roadway functional strata. For a detailed description of the development of the observational survey design, see the Methodology Overview section and Appendix D of this report or Seat Belt Use Estimate for Arizona, May 10, 2012, AZ Governor's Office of Highway Safety and Preusser Research Group (plan approved by NHTSA June 21, 2012).

Each of the site observations lasted for 60 minutes and was conducted during daytime hours. All of the observations for this project were conducted by Preusser Research Group, Inc., recruited by the Behavior Research Center, Inc., during November and early December 2018.

This report includes a summary of all relevant data and findings from the 2018 observational survey. Prior to this final report, a spreadsheet containing all raw data, all weighted tallies summarized here, and a submission form which allowed the Governor's Office of Highway Safety to report the 2018 statewide belt use rate to NHTSA as required. Should the GOHS require additional data retrieval or interpretation, we are prepared to provide such input.

The results have been reviewed by the named Survey Statistician, William A. Leaf, Ph.D., and found to satisfy NHTSA's requirements.

II. Summary of Findings

Data collection occurred in November 2018. Across the 140 sites, belt use was observed for 20,838 passenger vehicle drivers (along with their use of hand-held cell phones) and 4,682 of their passengers.

Statewide seat belt use was 85.9 percent, a decrease of 0.2 percentage points from 2017. The difference was not statistically significant. The standard error of measurement was calculated to be 1.556 percent, with a 95 percent belt use confidence interval of 82.8 percent to 88.9 percent. Belt use was unknown for just 0.01 percent of all drivers and passengers.

Results are compared with previous years in Table 1. The 2018 seat belt use rate of 85.9 percent represented a decrease of 0.2 percentage points from 2017. Driver belt use is just 2.4 percentage points lower than passenger belt use, which is the decline in the use rate among drivers in recent years.

TABLE 1
Overall Use of Safety Devices by Year

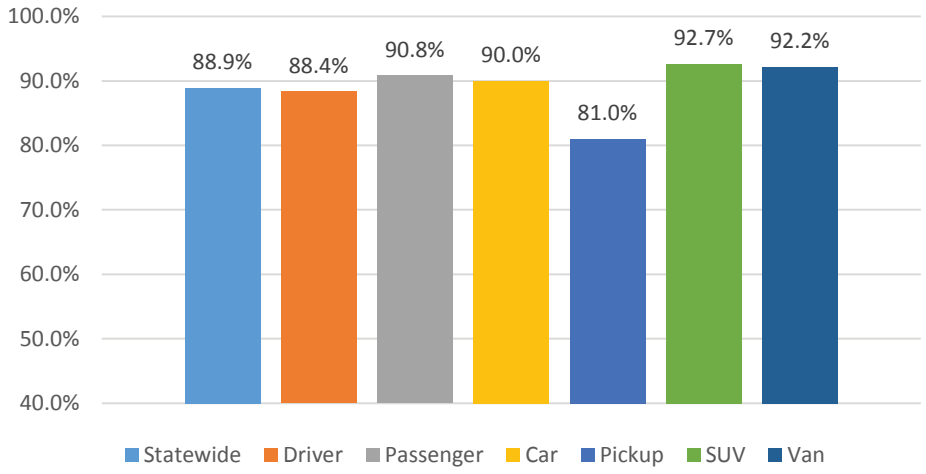
Study Year	Seat Belt use			Child Safety Restraint Use	Motorcycle Helmet Use	Cell Phone Use
	Total*	Drivers	Passengers			
2018	85.9%	88.4%	90.8%	N/A	N/A	6.2%
2017	86.1%	86.1%	86.0%	N/A	69.8%	6.7%
2016	88.0%	88.2%	87.3%	N/A	61.9%	9.1%
2015	86.6%	87.1%	84.8%	N/A	59.6%	8.0%
2014	87.2%	87.1%	87.7%	N/A	61.5%	6.7%
2013	84.7%	84.7%	84.0%	N/A	73.9%	7.4%
2012	82.2%	82.6%	80.2%	75.0%	58.4%	6.2%
2011	82.9%	83.5%	80.6%	79.1%	58.0%	8.3%
2010	81.8%	82.3%	79.9%	78.0%	56.4%	6.6%
2009	80.8%	82.0%	75.4%	87.2%	69.3%	8.3%
2008	79.9%	81.4%	73.3%	80.1%	67.3%	8.1%
2007	80.9%	82.5%	72.7%	86.2%	74.6%	14.6%
2006	78.9%	79.4%	76.4%	88.4%	59.0%	N/A
2005	93.3%	93.3%	93.3%	95.2%	36.5%	N/A
2004	95.3%	95.1%	95.3%	97.6%	35.9%	N/A
2003Post	85.8%	86.0%	85.8%	89.7%	44.9%	N/A
2003Pre	79.5%	79.5%	79.5%	82.2%	35.8%	N/A
2002	73.7%	74.0%	73.7%	71.6%	43.5%	N/A
2001	74.4%	74.3%	74.4%	72.0%	41.7%	N/A

**Weighted value*

In addition to the values shown in Table 1, Figure 1 provides a breakdown by type of vehicle. Observations were made on 7,694 cars, 4,868 pickup trucks, 6,907 SUVs, and 1,369 vans. Occupants of pickup trucks are least likely to use seat belts (81.0 percent), with other vehicle types more likely: passenger car occupants (90.0 percent), SUV occupants (92.7 percent), and van occupants (92.2 percent).

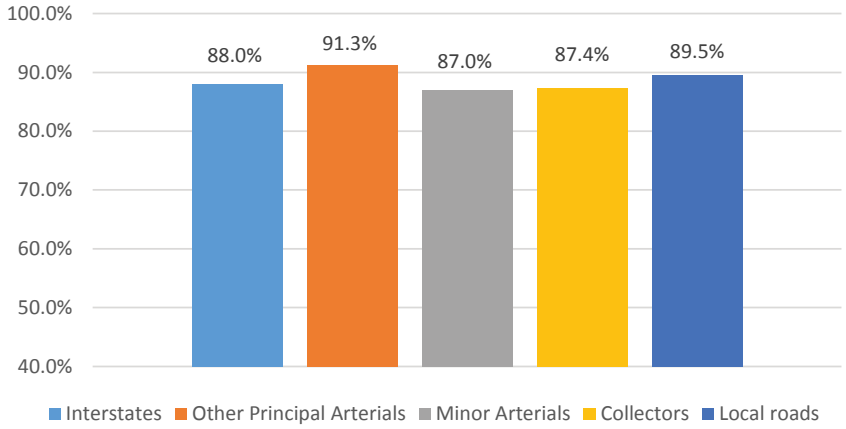
Note that vehicles observed are passenger vehicles or passenger-like vehicles, including commercial or government vehicles as long as they meet the physical category requirements of cars, pickup trucks, SUVs, and vans (including minivans).

FIGURE 1
Overall Seat Belt Use Rate, 2018



This study design allocated observation sites across roadway functional classes. Known belt use was coded for 3,808 occupants on interstates/expressways, 7,676 on other primary arterials, 5,827 on minor arterials, 2,602 on collectors, and 925 on local roads. Belt use values by roadway type are shown in Figure 2. Belt use is generally consistent across roadway types, ranging from 87.4 percent on collectors to 89.5 percent on local roads and 91.3 percent on other primary arterials.

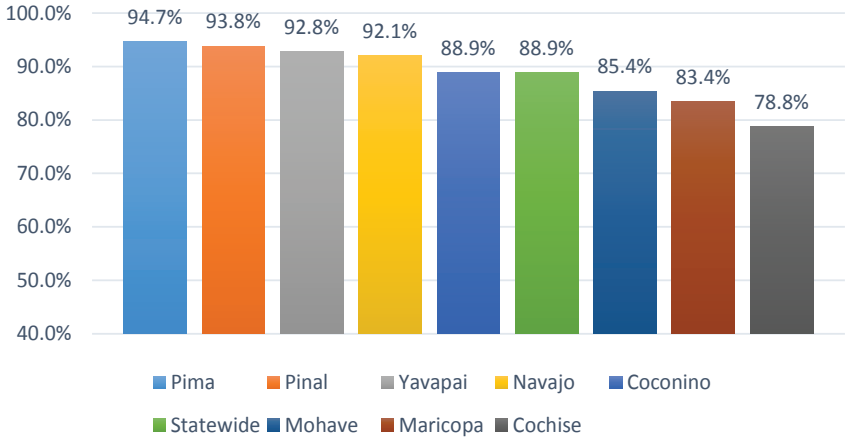
FIGURE 2
Seat Belt Use Across Roadway Types, 2018



The next two figures show distinctions across the studied counties. There were 1,307 known-use belt use observations in Cochise County, 1,800 in Coconino County, 5,418 in Maricopa County, 1,717 in Mohave County, 1,847 in Navajo County, 3,422 in Pima County, 2,536 in Pinal County, and 2,791 in Yavapai County.

In Figure 3, counties are ordered by descending seat belt use rates. Belt use was highest in Pima County and lowest in Cochise, followed by Maricopa and Mohave. Pima County, the second largest, had belt use rates higher than the statewide rate.

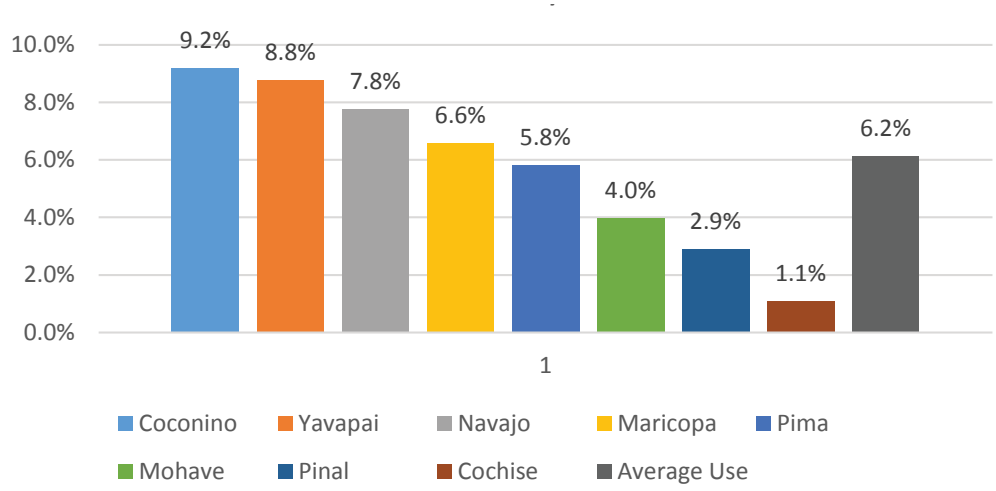
FIGURE 3
Seat Belt Use by County, 2018



Hand-held cell phone use was coded for 988 drivers in Cochise County, 1,374 in Coconino County, 4,540 in Maricopa County, 1,126 in Mohave County, 1,435 in Navajo County, 2,683 in Pima County, 1,813 in Pinal County, and 2,197 in Yavapai County.

In Figure 4, counties are ordered by descending hand-held cell phone use rates and average use rate in the state of Arizona. Hand-held cell phone use, by 6.2 percent of drivers in the state of Arizona, was relatively low, similar to 2014 after higher use rates in 2015 and 2016. Cell phone use was highest in Coconino County (9.2 percent) and Yavapai County (8.8 percent). Cell phone use was lowest in Cochise (1.1 percent) and Pinal County (2.9 percent). Among the county-by-county cell phone use rates, there is little consistency from year to year; a county that has a high cell phone use one-year can have a middle or low rate the next.

FIGURE 4
Hand-Held Cell Phone Use by Drivers Across County, 2018



Starting in 2017, driver and passenger gender was coded for the first time. Overall, female occupants were more often belted (92.5 percent) than male (84.9 percent). This difference was consistent for drivers (92.5 percent vs. 85.3 percent) and for passengers (92.4 percent vs. 82.0 percent). By gender and vehicle type, highest belt use was seen for female drivers of vans (94.7 percent) and lowest for male passengers in pickup trucks (77.5 percent).

III. Methodology Overview

The current study design was developed to meet NHTSA's 2011 updates to the 23 CFR Part 1340 Uniform Criteria for State Observational Surveys of Seat Belt Use (Federal Register Vol. 76 No. 63, April 1, 2011, pp. 18042-18059). Design development proceeded in five steps:

1. Eight counties were selected for observations from Arizona's 15 counties such that their passenger vehicle occupant fatalities totaled more than 85 percent of the State's total passenger vehicle occupant fatalities in 2006-2010. The selected counties were, in order of occupant fatalities: Maricopa, Pima, Pinal, Yavapai, Coconino, Mojave, Navajo, and Cochise.

2. Roads were grouped into five strata by combining related functional use classes within each county. The five strata are Interstate or Freeway, Other Principal Arterials, Minor Arterials, Collectors, and Local Roads. Numbers of measurement sites were allocated as evenly as possible across the roadway strata in each county. More measurement sites were allocated in Maricopa and Pima counties, which have much more traffic and passenger vehicle occupant fatalities than other counties, and enough sites were provided in the remaining counties to provide reliable estimates of their belt use. The result was a design with 140 sites overall.

3. Specific road segments were selected, within stratum within county, by randomly selecting from all segments in the county-stratum. The list of all segments for all strata except Local Roads was provided by the State. Those data included segment DVMT, and segments were selected with probabilities proportional to their DVMT. The list of Local Roads was provided by NHTSA from the Tiger database, class S1400, described as local neighborhood roads, rural roads, and city streets and excluding all primary and secondary roads. These did not have DVMT values; segments for surveying were selected with probabilities proportional to their segment length. In all cases, we selected segments to survey and alternate segments to be used in case the primary segments were unsuitable.

4. Belt use estimation procedures and computations were developed which reflected the design and NHTSA reliability requirements; the result was an Excel spreadsheet.

5. Procedures were developed for data collection, validation, and quality control that are consistent with NHTSA requirements and similar to past practices in the State.

See Appendix D for a more in-depth explanation of the design and its development. Two tables are included here and in the appendix. Table 2 provides key information about Arizona counties, the number of passenger vehicle occupant fatalities (as opposed to all traffic fatalities) on which county selection was based, the daily vehicle miles traveled (DVMT), the amount of travel in the counties, and key elements in the formulas for computing statewide belt use.

TABLE 2
15 Counties, Ordered by Passenger Vehicle Occupant Fatalities, 2010-2014

County Number	County	MSA?	M Fatal	% all AZ	Cum %	Total DVMT	% all AZ
13	Maricopa	Yes	348	43.20%	43.20%	99,168,433	56%
19	Pima	Yes	99	12.30%	55.50%	22,891,483	13%
21	Pinal	Yes	60.8	7.50%	63.00%	8,825,923	5%
25	Yavapai	Yes	43.8	5.40%	68.40%	8,964,034	4%
5	Coconino	Yes	46.6	5.80%	74.20%	7,172,949	4%
15	Mohave	Yes	43.2	5.40%	79.60%	8,321,294	5%
17	Navajo	No	32.8	4.10%	83.70%	4,386,749	2%
3	Cochise	No	20	2.50%	86.20%	3,840,790	22%
Total, 8 Sample Counties			**2,621**	**86.20%**	**86.20%**	163,571,655	**92%**
1	Apache	No	36.2	3.40%	89.60%	3,039,812	2%
27	Yuma	Yes	23.6	3.30%	92.90%	3,039,812	3%
12	La Paz	No	15.4	2.60%	95.40%	3,039,812	1%
7	Gila	No	18.6	1.70%	97.10%	3,039,812	1%
23	Santa Cruz	No	7.2	1.60%	98.70%	3,039,812	1%
9	Graham	No	5.2	0.90%	99.60%	3,039,812	1%
11	Greenlee	No	3.6	0.40%	100.00%	3,039,812	0%
Total, 7 Excluded Counties				**13.90%**	**100.00%**	**13,639,000**	**8%**
Total, Statewide						**178,271,109**	

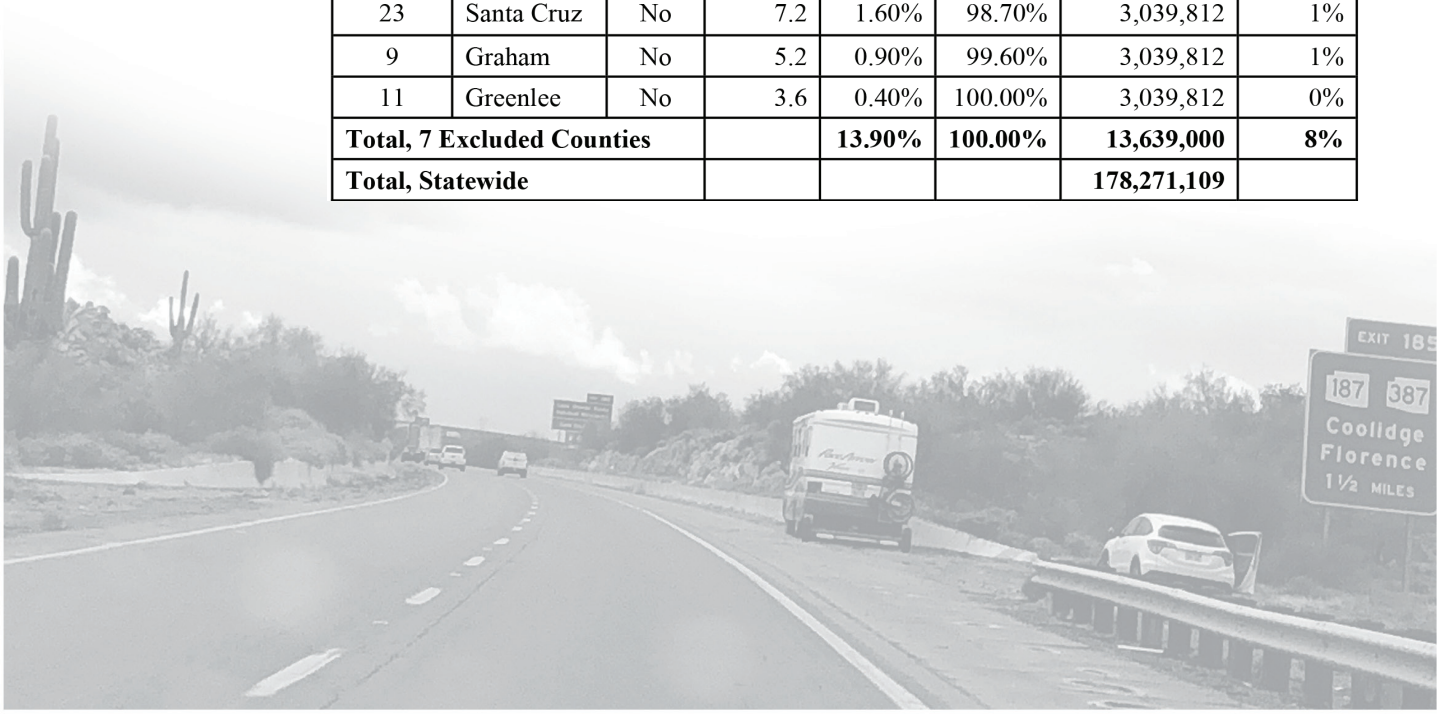


Table 3 summarizes the following:

- Survey design;
- Listing for each of the eight survey counties and five road type strata;
- Total number of road segments in the county-stratum;
- DVMT, and
- Number of segments to be sampled for belt use observation.

TABLE 3
Roadway Functional Strata by County: Road Segments, DVMT, and Proposed Sample Size

		Roadway Functional Strata					
County		**Interstate/ Fwy/ Xway**	**PA - Other**	**Minor Arterials**	**Collectors**	**Locals Roads**	**Total**
Maricopa	# Segments	482	1,524	1,552	1,076	257,176	261,810
	DVMT	37,171,796	13,725,202	30,197,815	6,186,957	11,886,663	99,168,433
	Sample #	6	6	6	6	6	30
Pima	# Segments	115	467	544	894	67,396	69,416
	DVMT	5,993,579	5,209,884	5,771,047	2,795,175	3,121,798	22,891,483
	Sample #	4	4	4	4	4	20
Pinal	# Segments	54	66	362	374	52,547	53,403
	DVMT	3,709,457	1,012,483	2,391,424	1,301,379	411,180	8,825,923
	Sample #	3	3	3	3	3	15
Yavapai	# Segments	49	118	215	525	36,411	37,318
	DVMT	3,106,066	2,038,391	1,113,986	1,351,129	1,354,462	8,964,034
	Sample #	3	3	3	3	3	15
Coconino	# Segments	75	164	121	405	26,394	27,159
	DVMT	2,693,973	1,729,550	784,468	1,257,762	707,196	7,172,949
	Sample #	3	3	3	3	3	15
Mohave	# Segments	48	160	126	267	43,645	44,246
	DVMT	2,219,580	2,958,451	773,408	785,664	1,584,191	8,321,294
	Sample #	3	3	3	3	3	15
Navajo	# Segments	35	118	86	311	n.a.	550
	DVMT	982,932	1,292,772	405,652	1,053,955	651,438	4,386,749
	Sample #	4	4	3	4	-	15
Cochise	# Segments	47	102	118	336	n.a.	603
	DVMT	1,468,965	648,570	836,012	631,429	255,814	3,840,790
	Sample #	4	4	3	4	-	15
	# Segments	905	2,719	3,124	4,188	483,569	494,505
Total	DVMT	57,346,348	28,615,303	42,273,812	15,363,450	19,972,742	163,571,655
	Sample #	30	30	28	30	22	140

Segment Selection

The segments to be used as seat belt use observation sites were selected using a probability proportional to size (PPS) procedure, with segment DVMT as the "size" for all road types except for Local Roads, which lacked DVMT measures (actual length was the designated "size" for these segments).

Twice the required numbers of Collectors and larger road strata were selected in order to provide for the necessary sample and an equal number of alternates, or "spares". Because of limitations in the Tiger database, for Local Roads, 20 segments per county were selected to allow additional screening.

The result of this effort was a preliminary list of 140 segments to be observed and an additional 238 "spare" segments available for use should a primary segment be unsuitable. For the 2013 survey, the first conducted with this design, a total of 20 of the primary segments needed replacement. The 140 segments used in that survey have been used in the 2014, 2015, 2016, and 2017 surveys. In 2018, resampling of the sites were done in eight counties which included 140 new sites. The final list of the new 140 segments (sites) is provided in Appendix A.

Site Selection

Prior to actual data collection in 2018, specific locations for data observations were selected and the direction of traffic flow to be observed was randomly determined.

Sites were selected for both observer and overall traffic safety, such that the observer would have a clear view of the vehicles to be coded.

Observers

Observers were experienced in conducting seat belt observations and were trained by PRG. Each observer had conducted hundreds of observations prior to observing in Arizona. These observers performed all field data collection. Prior to any data collection, they received approximately one day of training on the specifics related to Arizona's data collection, a combination of classroom instruction and roadside practice.

Scheduling

Observations were conducted on all days of the week during daylight hours between 7:00 a.m. and 6:00 p.m. Clusters of five or six sites from a single county were scheduled daily for each observer. Clusters were selected and scheduled to provide balance across time of day and day of week for counties and road functional strata. Observation time periods were exactly 60 minutes long.

Data Collection

Data collection was done according to the instructions in Appendix B using the observation data collection form in Appendix C. A field coordinator from PRG answered any questions observers raised during their data collection. Additionally, there was one supervisor/monitor who conducted at least eight random, unannounced observation site visits to ensure that each observer was at the right location and observing at the scheduled time.

Data Review

Data was reviewed as received and entered into an Excel spreadsheet for analysis. Approximately 0.1 percent of observations were of "unknown" belt use, well within NHTSA's 10 percent criterion.

All sites were observed according to the schedule, resulting in successful data collection at all 140 sites.

Calculation of Overall Seat Belt Usage Rate

Belt use was calculated according to the formulas shown in Appendix D. Four steps were involved:

1. Calculate the belt use rate for each site, i.e., the number of belted occupants divided by the total number of occupants for whom belt use was coded.
2. Combine belt use rates for the sites within each county-road stratum combination to obtain an overall belt use rate for the county-stratum.
3. For each county, combine the belt use rates across the four or five road strata to obtain an overall county belt use rate.
4. Combine the belt use rates for the eight counties to obtain the statewide belt use rate.

Estimates of occupant subgroup belt use (drivers, passengers, drivers of pickup trucks, males/females, etc.) have been calculated in the same way. Those estimates are not required to be provided to NHTSA but are provided in this report, as they allow the State to assess the effectiveness of targeted belt use programs and identify subsets of the driving population who may benefit most from additional highway safety program efforts to increase belt use.

The standard error rate was estimated through a jackknife approach. The 95 percent confidence interval was also calculated and is reported for the overall statewide seat belt use rate.

Appendix A: Observation Sample Road Segments[1]

SiteID	County		RF Cl Stratum	City	Rd Fctn Class	Road Name	Length (Mi)	DVMT	Stratum DVMT	Prob (Select)	Seln Order
3101	3	Cochise	1	Willcox	1	I-10	3.28	46249.08	1468965	0.1982	1
3102	3	Cochise	1	San Simon	1	I-10	82.62	1349475.26	1468965	1	2
3103	3	Cochise	1	Bowie	1	I-10	3.93	52448.13	1468965	0.2248	3
3104	3	Cochise	1	Benson	1	I-10	5.81	95467.46	1468965	0.4092	4
3201	3	Cochise	2	Whetstone	2	SR-90	3.72	34136.47	648570	0.3221	1
3202	3	Cochise	2	Benson	2	SR-90	8.90	81611.76	648570	0.7700	2
3203	3	Cochise	2	Sierra Vista	14	SR-90	2.26	19927.70	648570	0.1880	3
3204	3	Cochise	2	Whetstone	2	SR-90	2.60	24604.13	648570	0.2321	4
3301	3	Cochise	3	Tombstone	6	SR-80	2.41	5897.67	836012	0.0422	1
3302	3	Cochise	3	Bowie	6	US-191	2.46	6989.64	836012	0.0500	2
3303	3	Cochise	3	St. David	6	SR-80	1.96	11275.78	836012	0.0807	3
3401	3	Cochise	4	Willcox	7	SR-186	5.78	2119.82	631429	0.0263	1
3402	3	Cochise	4	Willcox	7	SR-10B (4)	2.97	4569.20	631429	0.0568	2
3403	3	Cochise	4	Willcox	7	S Kansas Settlement Rd	7.72	9746.92	631429	0.1211	3
3404	3	Cochise	4	Huachuca City	7	SR-82	13.17	20802.69	631429	0.2585	4
5101	5	Coconino	1	Winslow	1	I-40	5.78	106480.87	2693973	0.2366	1
5102	5	Coconino	1	Parks	1	I-40	6.56	116756.36	2693973	0.2594	2
5103	5	Coconino	1	Winslow	1	I-40	5.41	101991.83	2693973	0.2266	3
5204	5	Coconino	2	Valle	2	SR-64	8.80	40629.23	1729550	0.1435	4
5205	5	Coconino	2	Flagstaff	14	SR-40B (4)	0.61	23605.69	1729550	0.0834	5
5206	5	Coconino	2	Williams	2	SR-64	15.25	93691.62	1729550	0.3309	6
5301	5	Coconino	3	Flagstaff	16	SR-89A	1.27	9703.34	784468	0.0761	1
5303	5	Coconino	3	Flagstaff	16	US-180 (1)	0.61	8748.52	784468	0.0686	3

[1]Probability of selection (PROG (Select)) is the probability of being included in either the Primary segments (the Appendix) or the alternate segments (Appendix B).

SiteID	County		RF Cl Stratum	City	Rd Fctn Class	Road Name	Length (Mi)	DVMT	Stratum DVMT	Prob (Select)	Seln Order
5304	5	Coconino	3	Flagstaff	16	S Beulah Blvd	0.22	3739.86	784468	0.0293	4
5402	5	Coconino	4	Doney Park	17	Slayton Ranch Rd	1.52	1438.39	1257762	0.0079	2
5404	5	Coconino	4	Happy Jack	7	SR-87	13.93	12870.12	1257762	0.0708	4
5405	5	Coconino	4	Flagstaff	17	SR-40B (4)	0.72	2532.49	1257762	0.0139	5
13101	13	Maricopa	1	Phoenix	11	I-17	1.01	195328.73	37171796	0.0628	1
13102	13	Maricopa	1	Phoenix	12	SR-101	0.99	169021.67	37171796	0.0543	2
13103	13	Maricopa	1	Goodyear	11	I-10	1.00	76655.98	37171796	0.0246	3
13104	13	Maricopa	1	Goodyear	11	I-10	0.98	172839.63	37171796	0.0556	4
13105	13	Maricopa	1	Mesa	12	US-60	0.51	65158.73	37171796	0.0209	5
13109	13	Maricopa	1	Phoenix	11	I-17	0.88	94520.53	37171796	0.0304	9
13201	13	Maricopa	2	Glendale	14	Bell Rd	0.95	36925.86	13725202	0.0304	1
13202	13	Maricopa	2	Phoenix	14	44th St	1.00	56914.11	13725202	0.0469	2
13203	13	Maricopa	2	Scottsdale	14	Shea Blvd	1.00	47785.17	13725202	0.0393	3
13204	13	Maricopa	2	Phoenix	14	7th St	1.05	32706.25	13725202	0.0269	4
13206	13	Maricopa	2	Phoenix	14	Tatum Blvd	1.00	40956.42	13725202	0.0337	6
13207	13	Maricopa	2	Glendale	14	Northern Ave	0.50	20986.25	13725202	0.0173	7
13301	13	Maricopa	3	Phoenix	16	Thomas Rd	1.01	37826.31	30197815	0.0145	1
13302	13	Maricopa	3	Phoenix	16	35th Ave	0.69	38757.91	30197815	0.0148	2
13303	13	Maricopa	3	Phoenix	16	Broadway Rd	1.00	19728.11	30197815	0.0075	3
13304	13	Maricopa	3	Gilbert	16	Germann Rd	2.01	43096.67	30197815	0.0165	4
13305	13	Maricopa	3	Glendale	16	Thunderbird Rd	0.99	25478.71	30197815	0.0097	5
13306	13	Maricopa	3	Phoenix	16	19th Ave	0.50	12047.64	30197815	0.0046	6
13401	13	Maricopa	4	Mesa	17	Superstition Springs Blvd	1.10	18927.17	6186957	0.0311	1
13402	13	Maricopa	4	Phoenix	17	Lafayette Blvd	1.88	62978.24	6186957	0.1036	2
13403	13	Maricopa	4	Buckeye	7	Wickenburg Rd	9.15	91605.51	6186957	0.1507	3
13404	13	Maricopa	4	Buckeye	7	Sun Valley Pkwy	0.20	564.62	6186957	0.0009	4
13405	13	Maricopa	4	Glendale	17	55th Ave	0.99	23267.40	6186957	0.0383	5

SiteID	County		RF Cl Stratum	City	Rd Fctn Class	Road Name	Length (Mi)	DVMT	Stratum DVMT	Prob (Select)	Seln Order
13406	13	Maricopa	4	Phoenix	17	27th Ave	0.58	12940.03	6186957	0.0213	6
15101	15	Mohave	1	Yucca	1	I-40	6.98	89119.26	2219580	0.1980	1
15103	15	Mohave	1	Golden Valley	1	I-40	32.84	427222.05	2219580	0.9492	3
15104	15	Mohave	1	Topock	1	I-40	9.14	89739.26	2219580	0.1994	4
15201	15	Mohave	2	Golden Valley	2	US-93	2.00	28053.34	2958451	0.0430	1
15202	15	Mohave	2	Golden Valley	2	US-93	1.69	41428.48	2958451	0.0635	2
15203	15	Mohave	2	Dolan Spring	2	US-93	53.97	1309537.17	2958451	1.0000	3
15301	15	Mohave	3	Bullhead City	16	Hancock Rd	0.34	6257.70	773408	0.0495	1
15302	15	Mohave	3	Lake Havasu City	16	W Acoma Blvd	0.91	6343.66	773408	0.0502	2
15303	15	Mohave	3	Kingman	16	N Stockton Hill Rd	0.51	11518.23	773408	0.0911	3
15401	15	Mohave	4	Kingman	17	Airfield Ave	0.44	4677.31	785664	0.0342	1
15402	15	Mohave	4	Lake Havasu City	17	Riviera Dr	0.14	924.03	785664	0.0068	2
15403	15	Mohave	4	Kingman	17	E Northern Ave	0.90	2147.86	785664	0.0157	3
17101	17	Navajo	1	Holbrook	1	I-40	1.54	29397.80	982932	0.2361	1
17102	17	Navajo	1	Holbrook	1	I-40	2.62	41283.47	982932	0.3315	2
17103	17	Navajo	1	Winslow	11	I-40	0.65	11449.09	982932	0.0919	3
17104	17	Navajo	1	Joseph City	1	I-40	1.21	20846.61	982932	0.1674	4
17201	17	Navajo	2	Overgaard	2	SR-260	12.09	41007.47	1292772	0.2623	1
17205	17	Navajo	2	Show Low	2	SR-77	6.29	59641.33	1292772	0.3815	5
17207	17	Navajo	2	Show Low	14	US-60	0.83	17858.76	1292772	0.1142	7
17208	17	Navajo	2	Show Low	14	SR-260	3.02	89296.44	1292772	0.5711	8
17302	17	Navajo	3	Cibecue	6	US-60	18.55	51630.78	405652	0.7448	2
17308	17	Navajo	3	Show Low		S Central Ave	1.06		405652		8
17310	17	Navajo	3	Holbrook		US-40	1.54		405652		10
17402	17	Navajo	4	Lake of the Woods	17	Larson Rd	1.14	3026.52	1053955	0.0236	2
17404	17	Navajo	4	Holbrook	7	SR-377	33.63	87676.28	1053955	0.6838	4
17405	17	Navajo	4	Pinetop Country Club	17	Branding Iron Loop	1.48	2729.87	1053955	0.0213	5

SiteID	County		RF Cl Stratum	City	Rd Fctn Class	Road Name	Length (Mi)	DVMT	Stratum DVMT	Prob (Select)	Seln Order
17406	17	Navajo	4	Snowflake	7	Concho Hwy	10.52	24837.12	1053955	0.1937	6
19101	19	Pima	1	Tucson	11	I-10	0.97	54932.87	5993579	0.0577	1
19105	19	Pima	1	Tucson	11	I-10	0.92	63641.61	5993579	0.0669	5
19106	19	Pima	1	Tucson	11	I-10	0.46	48227.96	5993579	0.0507	6
19108	19	Pima	1	Tucson	11	I-10	1.07	84339.19	5993579	0.0886	8
19201	19	Pima	2	Tucson	14	Grant Rd	0.51	36124.27	5209884	0.0450	1
19202	19	Pima	2	Catalina Foothills	14	Craycroft Rd	0.28	7891.84	5209884	0.0098	2
19203	19	Pima	2	Catalina Foothills	14	Skyline Dr	0.62	17710.47	5209884	0.0221	3
19204	19	Pima	2	Tucson	14	Valencia Rd	0.75	41532.37	5209884	0.0518	4
19301	19	Pima	3	Drexel Heights	16	SR-86	3.41	107810.42	5771047	0.1305	1
19302	19	Pima	3	Casas Adobes	16	La Canada Dr	1.38	20066.24	5771047	0.0243	2
19303	19	Pima	3	Tucson	16	Palo Verde Rd	0.46	15384.51	5771047	0.0186	3
19304	19	Pima	3	Vail	16	Sahuarita Rd	1.94	7115.36	5771047	0.0086	4
19401	19	Pima	4	Tucson	17	Fairview Ave	0.50	4774.38	2795175	0.0125	1
19402	19	Pima	4	Oro Valley	17	Naranja Dr	1.17	8103.44	2795175	0.0213	2
19404	19	Pima	4	Tucson	17	Pantano Rd	1.10	12764.30	2795175	0.0335	4
19405	19	Pima	4	Vail	7	SR-83	1.01	3188.15	2795175	0.0084	5
21101	21	Pinal	1	Apache Junction	12	US-60	3.52	257485.18	3709457	0.3340	1
21102	21	Pinal	1	Eloy	1	I-10	5.71	284163.25	3709457	0.3686	2
21103	21	Pinal	1	Eloy	11	I-10	4.96	175677.47	3709457	0.2279	3
21201	21	Pinal	2	Gold Canyon	2	US-60	4.14	53002.79	1012483	0.2732	1
21202	21	Pinal	2	Maricopa	14	SR-347	0.54	16096.67	1012483	0.0830	2
21203	21	Pinal	2	Top-of-the-World	2	US-60	3.41	24123.73	1012483	0.1243	3
21301	21	Pinal	3	Maricopa	6	SR-347	1.82	11381.92	2391424	0.0264	1
21302	21	Pinal	3	Casa Grande	16	McCartney Rd	0.49	4663.10	2391424	0.0108	2
21303	21	Pinal	3	Casa Grande	16	Cottonwood Ln	0.50	7427.27	2391424	0.0172	3
21401	21	Pinal	4	Kearny	7	SR-177	5.20	9087.64	1301379	0.0429	1

SiteID	County		RF Cl Stratum	City	Rd Fctn Class	Road Name	Length (Mi)	DVMT	Stratum DVMT	Prob (Select)	Seln Order
21403	21	Pinal	4	Marana	7	Park Link Dr	5.74	2973.33	1301379	0.0140	3
21405	21	Pinal	4	San Tan Valley	17	Skyline Dr	1.57	3700.34	1301379	0.0175	5
25101	25	Yavapai	1	Mayer	1	I-17	5.16	135019.00	3106066	0.2159	1
25102	25	Yavapai	1	Seligman	1	I-40	10.66	140787.24	3106066	0.2251	2
25103	25	Yavapai	1	Mayer	1	I-17	3.36	120924.23	3106066	0.1933	3
25201	25	Yavapai	2	Prescott Valley	14	SR-69	1.24	32924.55	2038391	0.0917	1
25202	25	Yavapai	2	Sedona	2	SR-179	4.13	26651.97	2038391	0.0742	2
25203	25	Yavapai	2	Cornville	2	SR-89A	5.88	82370.38	2038391	0.2293	3
25301	25	Yavapai	3	Prescott	16	Willow Creek Rd	0.39	11805.43	1113986	0.0632	1
25302	25	Yavapai	3	Prescott Valley	16	N Robert Rd	0.47	3847.21	1113986	0.0206	2
25303	25	Yavapai	3	Dewey-Humboldt	16	SR-169	1.87	14119.99	1113986	0.0756	3
25401	25	Yavapai	4	Woods Ditch	17	S Salt Mine Rd	2.39	2369.88	1351129	0.0087	1
25402	25	Yavapai	4	Sedona	7	Verde Valley School Rd	1.04	6032.31	1351129	0.0221	2
25405	25	Yavapai	4	Williamson	17	N Williamson Valley Rd	4.19	34442.14	1351129	0.1262	5

Local Road Segments (Road Function Stratum = 5):

Site ID	County		MTFCC	City	Road Name	Length (Mi)	Prob (Select)	Latitude	Longitude	Seg Len	Seln Order
5510	5	Coconino	S1400	Williams		0.725601	35.29201	35.29201	-112.125	0.725601	10
5513	5	Coconino	S1400	Grand Canyon Village	FS Rd 302	0.004491	35.9683	35.9683	-112.119	0.004491	13
5521	5	Coconino	S1400	Ash Fork	N Double A Ranch Rd	0.096715	35.29527	35.29527	-112.479	0.096715	21
13501	13	Maricopa	S1400	Buckeye	Buckeye Canal Rd	0.004488	33.38942	33.38942	-112.524	0.004488	1
13502	13	Maricopa	S1400	Scottsdale	N 100th St	0.000482	33.62392	33.62392	-111.872	0.000482	2
13506	13	Maricopa	S1400	Fountain Hills	N Sumac Dr	0.000848	33.60094	33.60094	-111.743	0.000848	6
13507	13	Maricopa	S1400	Sun City	W Long Hills Dr	0.005508	33.6234	33.6234	-112.265	0.005508	7
13508	13	Maricopa	S1400	Phoenix	N 40th Ave	0.0015	33.47959	33.47959	-112.146	0.0015	8
13510	13	Maricopa	S1400	Phoenix	E Cathedral Rock Dr	0.00206	33.30968	33.30968	-111.991	0.00206	10
15502	15	Mohave	S1400	Mohave Valley		0.003535	34.84569	34.84569	-114.516	0.003535	2
15503	15	Mohave	S1400	Lake Havasu City	Sailing Hawks Dr	0.004056	34.51697	34.51697	-114.361	0.004056	3
15504	15	Mohave	S1400	Golden Valley	W Chino Dr	0.002221	35.22885	35.22885	-114.175	0.002221	4
19502	19	Pima	S1400	Tucson	E Benson Hwy	0.001869	32.17424	32.17424	-110.949	0.001869	2
19505	19	Pima	S1400	Avra Valley	W el Tiro Rd	0.024881	32.42933	32.42933	-111.359	0.024881	5
19507	19	Pima	S1400	Madera Canyon	S Madera Canyon Rd	0.013124	31.74708	31.74708	-110.888	0.013124	7
19508	19	Pima	S1400	Sahuarita	S Ruby Airpark Dr	0.003627	31.9046	31.9046	-111.118	0.003627	8
21504	21	Pinal	S1400	Reymert	E Ajax Mine Trl	0.010043	33.20714	33.20714	-111.189	0.010043	4
21505	21	Pinal	S1400	San Tan Valley	N Judys Rd	0.008573	33.17277	33.17277	-111.464	0.008573	5
21506	21	Pinal	S1400	Casa Grande	E Selma Hwy	0.005127	32.85042	32.85042	-111.7	0.005127	6
25502	25	Yavapai	S1400	Paulden		0.021297	34.94121	34.94121	-112.351	0.021297	2
25503	25	Yavapai	S1400	Cottonwood	S 18th St	0.000595	34.73197	34.73197	-112.006	0.000595	3
25505	25	Yavapai	S1400	Cottonwood	Alcantara Way	0.003699	34.67176	34.67176	-111.95	0.003699	5

Appendix B: Field Observer Instruction Manual

SEAT BELT/HELMET USE SURVEY – 2018

Background and Purpose

This study is being conducted for the Governor's Office of Highway Safety to determine the use of safety belts in Arizona and is being conducted as part of the State and Community Highway Safety Grant Program which was enacted by the Highway Safety Act of 1966.

During this study roadside observations will be collected at a total of 140 randomly pre-selected locations in Arizona. Among the areas where observations are being conducted are the following eight counties, which represent over 90 percent of the State's roadway traffic:

Cochise County	Coconino County
Maricopa County	Mohave County
Navajo County	Pima County
Pinal County	Yavapai County

During this study the following information will collected about the passenger vehicles which are observed at the 140 pre-selected locations.

- Passenger Motor Vehicles – For the purpose of this study passenger motor vehicles are defined as passenger cars, pickup trucks, sport utility vehicles, and vans less than 10,000 lbs GVWR. They may be private, public, or commercial. The information which will be recorded on passenger motor vehicles is:
    1. The use of seat belts by drivers and front seat outboard passengers,
    2. The use of a (hand-held or hands-free) telephone by the driver.

Each of the 140 sites will be observed for a period of one hour, and all the observations will be collected between 7 a.m. and 6 p.m. when there is sufficient natural light to permit clear vision into vehicles. Data collection will be conducted according to a pre-set schedule which specifies where, what roadway and direction of traffic, time of day, and day of week.

The data collection segment of this project will be conducted in September and October 2018.

Field Observer Responsibilities

All field observers on this project will be thoroughly trained on all the specific activities they are required to conduct. Each observer will have the following responsibilities:

1. Attending and successfully completing an initial training session
2. Accurately following the prescribed procedures to complete all necessary observations for each vehicle
3. Maintaining daily time reports and other administrative documents required by the survey supervisor
4. Maintaining data collection records in an accurate and complete manner
5. Meeting all established quality control and performance standards
6. Committing your time and effort for the duration of the project
7. Reporting your daily site counts to your supervisor on a daily basis
8. Being safety conscious– safety first, for yourself and passing traffic.

All field observers will report to the Field Coordinator who will work closely with them throughout the survey. Whenever a field observer is unsure about a procedure or action to be taken, and adequate instructions cannot be found in this manual, the issue is to be discussed with the coordinator immediately.

Observer Materials

Each observer will have the following materials for use of this project:

- Two cover letters. A copy of a letter which was sent to police and sheriff's departments in the communities where the observations are being conducted, and a letter of authorization explaining the study and its purpose to anyone interested in knowing.
- Daily observation packets. An assignment sheet detailing the locations where the observations will be conducted each day accompanied by Observation Forms for each selected site and a map for each selected site. The Observation Forms for each site contain enough space to record data on 210 vehicles. Should the number of vehicles observed at a site exceed 210 and time has not expired, continue to observe, recording on blank Observation Forms which are also in your packet.
- A safety vest to be worn at all times while conducting observations
- A wide-brimmed hat
- Bottled water
- A tote bag
- A name tag
- A clipboard
- Pencils

Field Observation Techniques

This section provides a review of basic field observation techniques. All field observers must be proficient in the application of these techniques.

1. If for some unexpected reason you are not able to be at your assigned observation site at the assigned time, you must immediately contact your supervisor to alert them of the situation. Observe-the-observer spot checks will be conducted throughout this project so it is very important that you report this occurrence to your supervisor.
2. If observations cannot be conducted at an assigned site at the assigned time due to inclement weather, construction, an accident, or other safety or traffic problem you must immediately contact your supervisor to alert them of the situation.

- The following items are pre-coded on each Observation Form – site code, specific observation site, direction of traffic to be observed, and observation number. The specific date and start time of the observation are specified on your schedule and must be filled in by the field observer – date (day/month), day of week, and start time.

- Qualifying vehicles include passenger automobiles, pickup trucks, recreational vehicles, jeeps, and vans (private, public and commercial) less than 10,000 lbs GVWR. Pickup trucks should be coded as "trucks". Jeeps, Broncos, Blazers and other vehicles of that type should be coded as sport utility vehicles (SUVs). Small recreational vehicles that are pickup or van "conversions" should be coded as a pickup or van. Do not include large trucks or buses. Eligible vehicles should be observed regardless of the state in which they are registered.

- Belt use will be observed for front seat occupants only. Observe and record data for the driver and passenger in the right front seat. If there is more than one front seat passenger, observe only the "outside" passenger. Do not record belt use for passengers in the back seat or for a passenger riding in the middle of the front seat.

- If a child is present in the right front seat in a Child Safety Seat, do not record belt use. However, children riding in the right front seat, regardless of age, who are not in Child Safety Seats should be observed as any other right front seat passenger. Belt use for children in booster seats should be recorded.

- Each observation period will last for exactly 1 hour.

The following procedures will be used in conducting observations of seat belt use:

1. As you observe a qualifying vehicle, record the type of vehicle (car, truck, SUV, van), and shoulder restraint use (yes, no, unknown) of the front seat occupants (driver and front seat "outside" passenger only). If there is no qualified passenger (a child in a CSS is not a qualified passenger for belt use observations), leave the passenger fields blank. The final piece of information collected is whether or not the vehicle driver is talking on a cell phone at the time of the observation. Code yes if a cell phone is in use and no if a cell phone is not in use.

2. Code yes if you observe the shoulder belt properly positioned over the shoulder. If you notice a lap belt in use without a shoulder belt, it should be recorded as no. Only shoulder belts are to be counted. Even if the vehicle likely has no shoulder belts, code the occupant(s) as no.

3. If the person is using the shoulder belt improperly, e.g., has the shoulder strap under his/her arm or behind the back, this should be recorded as no. If you can't tell shoulder belt use at all, code unknown.

4. Code motorcycle helmet use, vehicle type "M", when you can do so without interfering with seat belt use observations. Code yes if a helmet is in place. Code no if there is no helmet or if it is not a motorcycle helmet. Code the motorcycle driver and a passenger, either riding behind the driver or in a sidecar. Code motorcycles in both directions if you can do so without interfering with belt use observation.
5 In many situations, it will be possible to observe every approaching vehicle. However, if there is too much traffic for you to observe every vehicle, you should determine a reference point up the road. After you have completed coding a vehicle, the next vehicle you should observe is the next vehicle to pass the reference point.
6. Do not observe if rain, fog, or other inclement weather makes it impossible to do so safely or accurately. If you arrive at a site and it begins to rain, do not collect data in the rain. Find a dry place and wait up to 15 minutes to see if the rain stops. If the rain does stop, begin observing again and extend the observation period to make up for the time missed. Otherwise, you will have to contact your supervisor to reschedule the site. (Note: You may continue observations in light fog, drizzle, or mist.)
7. If more than one data sheet is used, staple the sheets together at the end of the observation period and note the number of sheets used at the top of the first data page.
8. It may happen that the site you are assigned is seriously compromised due to construction or special activity. If this occurs, you may move one block in either direction on the same street such that you are observing the same stream of traffic that would have normally been observed had there been no obstruction. If moving one block will not solve the problem, then do not conduct the observation. Notify your supervisor; an alternate site will be selected and observed at a future time.

Traffic volume recording on local road sites:

At sites located on local roads, you will need to tally every vehicle passing during the observation period. For vehicles whose occupants you are coding for belt or helmet use, they are already noted. For all other vehicles, traveling in either direction, including trucks, buses, and all other vehicles not qualifying for belt use observation, make a mark in the box at the bottom of the coding sheet.

The following procedures will be used in rescheduling observations of seat belt use:

1. If the site is temporarily unusable, e.g., due to bad weather or temporary traffic congestion or blockage:
    a. Inform your supervisor of the problem as soon as practical.
    b. With your supervisor's assistance, reschedule the same site to be observed at the same time of day and day of the week.

2. If the site cannot be used during this observation schedule, e.g., due to construction:
    a. Inform your supervisor of the problem as soon as practical.
    b. With your supervisor's assistance, schedule an equivalent alternate site to be observed at the same time of day and day of the week. The alternate site must be in the same county and of the same roadway type. Your supervisor will provide a specific alternate site to be observed; you may not simply pick any other roadway to observe.

Appendix C: Arizona Seat Belt/ Helmet Observation Form

SITE CODE:_____ **SITE:**_____

NOTES:_____

DATE: _____ – _____ – _____ **DAY OF WEEK:** _____

DIRECTION OF TRAFFIC FLOW OBSERVED (Circle one): N S E W

START TIME:_____ **(Observation period will last exactly 1 hour)**

WEATHER CONDITIONS

1 Clear / Sunny **4 Fog**
2 Light Rain **5 Wet but Not**
3 Cloudy **6 Raining**

		DRIVER			PASSENGER	
Veh. #	**Vehicle** C = Car T = Pickup truck S = SUV V = Van M = Motorcycle	**Sex** M = Male F = Female U = Unsure	**Belt/MC Helmet Use** Y = Yes N = No U = Unsure	**Cell Phone Use** Y = Yes N = No	**Sex** M = Male F = Female U = Unsure	**Belt/Helmet Use** Y = Yes N = No U = Unsure
1						
2						
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LOCAL ROADS ONLY:
Enter Check Marks for
All Vehicles not coded
(Both directions)

Page:_____ of_____

ARIZONA SEAT BELT SURVEYFORM 2018

Appendix D: Belt Use Survey Design and Procedures[2]

The new design was developed to meet NHTSA's 2011 updates to the 23 CFR Part 1340 Uniform Criteria for State Observational Surveys of Seat Belt Use (Federal Register Vol. 76 No. 63, April 1, 2011, pp. 18042-18059). Design development proceeded in five steps:

1. Eight counties were selected for observations from Arizona's 15 counties such that their passenger vehicle occupant fatalities totaled more than 85 percent of the State's total passenger vehicle occupant fatalities in 2006-2010. The selected counties were, in order of occupant fatalities, Maricopa, Pima, Pinal, Yavapai, Coconino, Mojave, Navajo, and Cochise.

2. Roads were grouped into five strata by combining related functional use classes within each county. The five strata are Interstate or Freeway; Other Principal Arterials; Minor Arterials; Collectors; and Local Roads. Numbers of measurement sites were allocated as evenly as possible across the roadway strata in each county. More measurement sites were allocated in Maricopa and Pima counties, which have much more traffic and passenger vehicle occupant fatalities than other counties, and enough sites were provided in the remaining counties to provide reliable estimates of their belt use. The result was a design with 140 sites overall.

3. Specific road segments were selected, within stratum within county, by randomly selecting from all segments in the county-stratum. The list of all segments for all strata except Local Roads was provided by the State. Those data included segment DVMT, and segments were selected with probabilities proportional to their DVMT. The list of Local Roads was provided by NHTSA from the Tiger database, class S1400, described as local neighborhood roads, rural roads, and city streets and excluding all primary and secondary roads. These did not have DVMT values; segments for surveying were selected with probabilities proportional to their segment length. In all cases, we selected segments to survey and alternate segments to be used in case the primary segments were unsuitable.

4. Belt use estimation procedures and computations were developed which reflected the design and NHTSA reliability requirements.

5. Procedures were developed for data collection, validation, and quality control that are consistent with NHTSA requirements and similar to past practices in the State.

[2]For more detail, see Seat Belt Use Estimate for Arizona, May 10, 2012, AZ Governor's Office of Highway Safety and Preusser Research Group (approved by NHTSA June 21, 2012).

Some details are provided below.

1. County Selection

Table D-1 below lists Arizona counties, ordered by passenger vehicle fatalities for 2006 – 2010. The first eight counties account for 86.1 percent of the passenger vehicle occupant fatalities and were selected for observation. Seven of those counties made up the previous seven-county design.

TABLE D-1
15 Counties, Ordered by Passenger Vehicle Occupant Fatalities, 2006-2010

County Number	County	MSA?	N Fatal [1]	% all AZ	Cum %	Total DVMT [2]	% all AZ	Cum %
13	Maricopa	Yes	1,134	37.3%	37.3%	89,448,000	54.5%	54.5%
19	Pima	Yes	392	12.9%	50.1%	22,553,000	13.7%	68.2%
21	Pinal	Yes	323	10.6%	60.7%	8,830,000	5.4%	73.6%
25	Yavapai	Yes	187	6.1%	66.9%	7,778,000	4.7%	78.4%
5	Coconino	Yes	182	6.0%	72.9%	6,322,000	3.9%	82.2%
15	Mohave	Yes	165	5.4%	78.3%	7,393,000	4.5%	86.7%
17	Navajo	No	133	4.4%	82.7%	3,829,000	2.3%	89.0%
3	Cochise	No	105	3.4%	86.1%	4,334,000	2.6%	91.7%
Total, 8 Sample Counties			**2,621**	**86.1%**	**86.1%**	**150,487,000**	**91.7%**	**91.7%**
1	Apache	No	105	3.4%	89.6%	2,590,000	1.6%	93.3%
27	Yuma	Yes	101	3.3%	92.9%	4,287,000	2.6%	95.9%
12	La Paz	No	78	2.6%	95.4%	2,368,000	1.4%	97.3%
7	Gila	No	52	1.7%	97.1%	1,773,000	1.1%	98.4%
23	Santa Cruz	No	48	1.6%	98.7%	1,462,000	0.9%	99.3%
9	Graham	No	27	0.9%	99.6%	938,000	0.6%	99.9%
11	Greenlee	No	12	0.4%	100.0%	221,000	0.1%	100.0%
Total, 7 Excluded Counties			**423**	**13.9%**	**100.0%**	**13,639,000**	**8.3%**	**100.0%**
Total, Statewide			**3,044**			**164,126,000**		

[1] *FARS State Data website, accessed 12/16/2011*

[2] AZ DOT Multimodal Planning Division, HPMS data for 2008

2. Road Strata Definition and Distribution

The next step was to determine the distribution of the number of observation sites across counties. The prior design called for 170 total sites. In other States, designs with as few as 100-120 sites readily meet the new criterion of a standard error of 2.5 percent or less. It was estimated that if the new design included 140 observation locations it would be extremely likely to also meet the new reliability criterion. In addition, the slightly smaller design size would be correspondingly less expensive for the State to implement. Procedures are described below to address the possibility of an initial standard error above the new limit.

Within the state's comprehensive road segment data, roadways are divided into the 12 FHWA functional classes, based on rural/urban area and roadway size and traffic function. All except the local road categories are exhaustive listings of Arizona roadways and were used for observation segment selection.

The local roads in the database were not used as they were a very small sample of all possible local roads. Rather, the source of the local road stratum was the NHTSA-supplied Tiger S1400 road segment databases.

Consistent with NHTSA guidelines, local roads in non-MSA (Metropolitan Statistical Area) counties, Cochise and Navajo, were excluded.

The results are shown in Table D-2. Listed for each sample county and road stratum are the numbers of road segments, the total DVMT for those strata, and the number of those segments to include in the seat belt use survey.

TABLE D-2
Roadway Functional Strata by County: Road Segments, DVMT, and Proposed Sample Size

County		Roadway Functional Strata					
		Interstate or Freeway	Other Principal Arterials	Minor Arterials	Collectors	Local Roads [1]	Total [1]
Maricopa	# Segments	482	1,524	1,552	1,076	257,176	261,810
	DVMT	33,922,015	23,943,244	15,590,291	6,752,006	2,358,886	82,566,441
	Sample #	6	6	6	6	6	30
Pima	# Segments	115	467	544	894	67,396	69,416
	DVMT	5,654,106	7,753,630	4,708,963	2,151,377	3,477,090	23,745,166
	Sample #	4	4	4	4	4	20
Pinal	# Segments	54	66	362	374	52,547	53,403
	DVMT	3,097,016	650,667	2,701,584	723,649	922,604	8,095,520
	Sample #	3	3	3	3	3	15
Yavapai	# Segments	49	118	215	525	36,411	37,318
	DVMT	2,203,528	1,360,800	1,938,096	1,274,096	3,270,846	10,047,367
	Sample #	3	3	3	3	3	15
Coconino	# Segments	75	164	121	405	26,394	27,159
	DVMT	2,271,050	1,524,362	720,368	755,638	1,084,968	6,356,387
	Sample #	3	3	3	3	3	15
Mohave	# Segments	48	160	126	267	43,645	44,246
	DVMT	2,155,739	2,327,154	139,932	343,140	2,744,971	7,710,938
	Sample #	3	3	3	3	3	15
Navajo	# Segments	35	118	86	311	n.a.	550
	DVMT	874,149	1,080,810	299,260	1,522,403	4,608,973	8,385,594
	Sample #	4	4	3	4	0	15
Cochise	# Segments	47	102	118	336	n.a.	603
	DVMT	1,461,552	841,238	455,372	762,313	1,409,353	4,929,827
	Sample #	4	4	3	4	0	15
Total	# Segments	905	2,719	3,124	4,188	483,569	494,505
	DVMT	51,639,155	39,481,905	26,553,865	14,284,622	19,877,692	151,837,240
	Sample #	30	30	28	30	22	140

[1] *Excludes Local Roads in non-MSA counties. Local road segment counts are from the Tiger S1400 road segment database; all DVMT values are from the HPMS08 state summary table.*

Six survey road segments per stratum were included for Maricopa County, which has more than ⅓ of passenger vehicle occupant fatalities and more than half the DVMT for the state, along with four segments per stratum for Pima County, with more than ⅛ of passenger vehicle occupant fatalities and DVMT for the state. For the remaining MSA counties, three segments per stratum, or 15 segments in all, were allocated. For Navajo and Cochise counties, four segments to the strata with the greatest DVMT and three segments to the Minor Arterial stratum were allocated, again a total of 15 segments in all.

3. Segment and Site Selection

Segment Selection

A sample of roadway segments to be used as seat belt use observation sites was selected. The approach, described in detail below, used a probability proportional to size (PPS) procedure, with segment DVMT the "size" for all except Local Roads, lacking DVMT measures, for which segment length is the "size".

For Collectors and larger road strata, twice the required number of road segments were selected, in order to provide for the necessary sample and an equal number of alternates, or "spares". For Local Roads, 20 segments were selected per county, allowing for the extra step of screening them to keep only valid local roads and still leaving enough valid segments for twice the number to be observed.

The detailed steps involved were described in Seat Belt Use Estimate for Arizona, May 10, 2012, AZ Governor's Office of Highway Safety and Preusser Research Group (approved by NHTSA June 21, 2012).

The order of selection was preserved, and the 140 segments first selected were the first targets for use. In preparation for the 2013 survey, all sites were inspected; 20 sites were found to be unsuitable for data collection and were replaced from the list of alternates. The full list of segments used, in 2013 and subsequently, is shown in Appendix B.

Site Selection

Prior to actual data collection, specific locations for data observations were selected, based on visits to the locations, maps, and/or on-line air and ground-level images. It was during this activity that ineligible road segments were identified. Also at this time, the direction of traffic travel to be observed was randomly chosen.

Sites were selected for observer and traffic safety and such that the observer would have a clear view of the vehicles to be coded. Where possible, sites were selected where traffic naturally slows, though that was not essential.

4. Seat Belt Rate and Standard Error Calculations

Calculation of Overall Seat Belt Usage Rate

First, estimated rates are calculated for each of the road type strata within each county.

The general formula for combining observed belt use rates from observation sites on individual segments, for a single county-road stratum, is shown in formula 1. It is used when the county-road stratum contains certainty segments or for Local Road strata, whose segments are selected based on segment length rather than DVMT. The contribution of each segment to the overall county-road stratum rate is proportional to the "size" of the segment's contribution to the entire county-road stratum traffic, i.e., its DVMT, adjusted by the inverse of the probability of the segment's being selected into the sample:

$$p_{ij} = \frac{\sum_k DVMT_{ijk} W_{ijk} p_{ijk}}{\sum_k DVMT_{ijk} W_{ijk}} \quad (1)$$

where $DVMT_{ijk}$ = DVMT for segment k in county-road stratum *ij*; p_{ijk} = the observed seat belt use rate at site *ijk* = B_{ijk}/O_{ijk}, where B_{ijk} = total number of belted occupants (drivers and outboard front-seat passengers) observed at the site and O_{ijk} = total number of occupants with known belt use observed at the site; and W_{ijk} = the inverse of the probability of segment *k*'s selection according to the procedures described above.

For all except Local Roads:

(certainty segments) W_{ijk} = 1.00 or (random segments) $W_{ijk} = \frac{\sum_{l=1}^{N} DVMT_{ijl}}{n * DVMT_{ijk}}$

where *N* = total number of segments in county-road stratum *ij* excluding the certainty segments and *n* = number of segments randomly selected after any certainty segments were identified. For Local Road segments, their DVMT is estimated from traffic counts conducted during the belt use observation periods.

For Local Roads:

(certainty segments) W_{ijk} = 1.00 or (random segments) $W_{ijk} = \frac{\sum_{l=1}^{N} SegLen_{ijl}}{n * SegLen_{ijk}}$

where *N* = total number of segments in county-road stratum ij excluding the certainty segments, *n* = number of segments randomly selected after any certainty segments were identified, and *SegLen* = length of segments in miles.

In the case where there are no certainty segments in the county-road stratum, formula 1 reduces to the simple formula 1a for all strata except Local Roads:

$$p_{ij} = \sum_{k=1}^{n_{ij}} p_{ijk} / n_{ij} \quad (1a)$$

where *i* = county, *j* =stratum, *k* = site within county-road stratum, n_{ij} = number of sites within the county-road stratum, and p_{ijk} = the observed seat belt use rate at site *ijk* = B_{ijk}/O_{ijk}, where B_{ijk} = total number of belted occupants (drivers and outboard front-seat passengers) observed at the site, and O_{ijk} = total number of occupants with known belt use observed at the site.

Next, county-road stratum seat belt use rates are combined within counties, weighted by the stratum's relative contribution to total county DVMT, to yield a county seat belt use rate p_i:

$$p_i = \frac{\sum_j DVMT_{ij} * p_{ij}}{\sum_j DVMT_{ij}} \quad (2)$$

where *i* = county, *j* = stratum, $DVMT_{ij}$ = DVMT of all roads in stratum *j* in county *i*, and *pij* = seat belt use rate for stratum *j* in county *i*.

Finally, rates from the eight counties will be combined by weighting them by their total DVMT values:

$$p = (\sum_i DVMT_i p_i)/(\sum_i DVMT_i) \quad (3)$$

where $DVMT_i$ = total DVMT for each county *i*. Note that all county-road stratum and county DVMT values were taken from the statewide HPMS table, HPMS08.

The result is a weighted combination of the individual site seat belt use rates.

Estimates of the belt use of subgroups of occupants, such as drivers, passengers, drivers of pickup trucks, etc., which are of particular interest to the state are calculated in the same way. Those estimates are not required to be provided to NHTSA.

Calculation of the Standard Error of the Overall Seat Belt Use Rate

Standard error of estimate values are estimated through a jackknife approach, based on the general formula:

$$\hat{\sigma}_{\hat{p}} = [\frac{n-1}{n}\sum_{i=1}^{n}(\hat{p}_i - \hat{p})^2]^{1/2} \quad (4)$$

where $\hat{\sigma}_{\hat{p}}$ = standard deviation (standard error) of the estimated statewide seat belt use proportion $\hat{p}$ (equivalent to *p* in the notation of formulas 1-3), *n* = the number of sites, i.e., 140, and $\hat{p}_i$ = the estimated statewide belt use proportion with site *i* excluded from the calculation.

The 95% confidence interval, i.e., $\hat{p} \pm 1.96\hat{\sigma}$, is also calculated and will be reported to NHTSA for the overall statewide seat belt use rate.

5. Other Design and Survey Elements

Observers and Observations

Observers are to be hired, trained, and supervised under the authority of the GOHS. These observers perform all field data collection under the direction of a supervisor. Prior to any data collection, observers must receive approximately one day of training, including classroom and field activities. Training is required for new observers and for experienced observers who have had more than 12 months since their last training.

Scheduling

Observations will be conducted on all days of the week during daylight hours between 7:00 a.m. and 6:00 p.m. Clusters of five or six sites will be scheduled for one observer on any day. The sites in each county are divided into three or more clusters, with road function strata balanced between clusters, and those clusters are scheduled for different days of the week, distributed across weekdays and weekend days. Actual day of week assignments will be randomly determined.

The first site in any cluster to be observed each day was randomly selected, and the additional sites were assigned in an order which provides balance by type of site and time of day while minimizing travel distance and time. For each site, the schedule will specify time of day, day of week, roadway to observe, and direction of traffic to observe.

In all cases, the period of actual seat belt use observation will last exactly 60 minutes and will be required to take place within the broader allowable time period.

Data Collection

Data collection is done according to the instructions in Appendix B. Survey information is recorded on an observation data collection form (Appendix C).

For each passenger vehicle observed, primary responsibility is to code belt use for the driver and outboard front seat passenger. Observers are also asked to code, where possible, whether the driver is talking on a cell phone (hand-held or hands-free). For local road segments, which were selected based on length, observers also capture total traffic volume (both directions) during their sessions. Observers capture belt/helmet use or non-use and also indicate attempted observations where use/non-use could not be determined.

6. Quality Control

Quality control monitors conduct random, unannounced visits to at least 10 observation sites for the purpose of quality control. The monitor ensures that the observer is in place and making observations during the observation period. Where possible, the monitor will remain undetected by the observer.

It is expected that the persons leading the observer training and providing field supervision of the observers also serve as quality control monitors.

Data Review

Data are reviewed as received, and anomalies are investigated to ensure that the data do not reflect anything other than proper on-site seat belt use observations. Possible issues and responses (all are extremely unlikely to occur, in our experience):

- Invalid data, such as data obtained at an incorrect location or fabricated, will be discarded and valid data collected.
- Overall (survey-wide) percentages of "unknown" belt use exceeding NHTSA's 10% threshold. Additional data will be collected until the appropriate "unknown" rate is within acceptable limits. We will begin by repeating data collection at the 20 percent of schedule clusters with the greatest percentage of unknowns, following the original schedule of time of day and day of week. New data will be added to existing valid data.
- Sites which produce no usable data. In order of preference: repeat data collection at the original sites unless they are unusable; collect data at suitable substitute sites; and drop the sites from the statewide belt use calculation formulas.

7. Calculation of Overall Seat Belt Usage Rate

Calculation of seat belt usage rates follows the formulas provided above, using an Excel spreadsheet which has been developed. The spreadsheet is used to record the individual vehicle observations, and it performs the calculations of the formulas in Section 4 above and also calculates the jackknife estimate of standard error.

The spreadsheet also computes seat belt usage rates for subsets of interest, e.g., drivers alone, passengers alone, drivers and/or passengers within vehicle type, roadway functional strata, and counties. These calculations form the basis of the results presented in this report.

Statistical Review

The review of the data collection efforts and results, noted above, includes a statistical review of the results before any results are reported to NHTSA. The statistical review must confirm that the results meet the criteria for the overall proportion of unknown belt use and standard error and ensure that proper adjustments were made in the case of data being completely absent for any site(s).

Standard Error Compliance

NHTSA requires that the standard error for the statewide belt use rate not exceed 2.5%. Should initial data collection yield a standard error in excess of the requirement (extremely unlikely), additional data would be collected beginning with a preselected number of sites having the fewest observations. New data would be added to existing valid data. Additional data would be collected until the criterion was met.

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2018 ARIZONA STATEWIDE SEAT BELT USE SURVEY

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