2014 ANNUAL DIRECT OBSERVATION SURVEY OF SAFETY BELT AND CELL PHONE USE

Prepared for:
Office of Highway Safety Planning
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Lansing, MI

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MICHIGAN OHSP Office of Highway Safety Planning

Date: September 2014

WAYNE STATE UNIVERSITY

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16. Abstract:
This report documents the results of the 2014 Annual Direct Observation Survey of Safety Belt Use in the State of Michigan. Safety belt use by drivers and front seat passengers was monitored at a total of 200 intersection/interchange sites throughout the state during September of 2014. In addition to belt use, data were collected for vehicle type and use, as well as the gender, age, and race for each observed occupant. Drivers were also observed to determine whether they were using an electronic device (i.e., cell phone). The results of this survey show the safety belt usage rate in the state of Michigan is 93.3 percent. This represents a marginal increase from the 93.0 percent use rate in 2013. Males and younger occupants, specifically those in pick-up trucks, continue to exhibit lower belt use rates. The observed rate of electronic device use by all vehicle drivers is 8.4 percent which represents a 0.6 percentage point increase from the use rate observed in 2010.

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1.0 INTRODUCTION

The use of safety belts is perhaps the single most effective means of reducing fatal and non-fatal injuries in motor vehicle crashes. In 2013, an estimated 32,850 people were killed in motor vehicle traffic crashes in the United States [1]. Past research indicates that the use of safety belts reduces the risk of fatal injury to front seat occupants by approximately 45 percent for passenger vehicles and 60 percent for light trucks. Moreover, the use of safety belts reduces the risk of moderate to critical injury by 50 percent for occupants of passenger vehicles and 65 percent for the occupants of light trucks. In 2012 alone, safety belts saved approximately 12,174 passenger vehicle occupants over the age of 5 [2]. A study in the *American Journal of Public Health* estimated that the use of safety belts would save "…more than $700 million a year in medical and emergency costs, lost productivity, insurance, rehabilitation costs, and legal costs" [3]. The Centers for Disease Control and Prevention estimate safety belts have saved approximately 255,000 lives since 1975 [4]. Therefore, even marginal increases in safety belt use rates have the potential to lead to important societal benefits.

In light of these facts, continuing efforts have been aimed at increasing the use of safety belts across the United States. According to a 2013 nationwide safety belt survey, 87 percent of drivers and right-front passengers use safety belts, which is a slight increase from the measured 86 percent in 2012 [5]. The Midwest region as a whole showed an 85 percent seat belt use rate in 2013, matching the 85 percent seat belt use rate calculated in 2012 [5]. In Michigan, past statewide safety belt use studies indicate the overall use among front seat occupants increased until 2009, prior to a series of gradual declines. Despite these declines, the 2013 use rate was 93.0 percent, making Michigan one of nineteen states with safety belt use rates higher than 90 percent [6]. It is important to recognize Michigan is one of the thirty-four "primary law" states (excluding the District of Columbia), which means a motorist can be stopped and cited for the sole reason of not wearing a safety belt while driving or riding as a front-seat passenger. In "secondary law" states, motorists must be stopped for another traffic-related offense in order to be ticketed for not wearing a safety belt [5]. Research has shown states with primary belt use laws experience, on average, a 10 percent increase in belt use compared to states with secondary laws [3].

As the non-use of safety belts is ultimately a behavioral issue, targeted programs aimed at changing occupant behavior related to the use of safety belts represent an important tool to increase use rates. Such programs should be targeted toward those occupants who are most prone to low use rates. Identification of such occupants is one of the principal goals of the statewide belt use surveys. Statewide safety belt use data can also be used for the following:

- To fulfill reporting requirements to NHTSA;
- To allocate statewide safety funding to specific program areas;

- To provide targeted funding to specific areas within the state where use rates are lower than the statewide average; and
- To provide targeted programs for certain segments of the population.

1.1 Study Purpose and Objectives

The purpose of this study was to perform the Annual Direct Observation Survey at 200 roadside locations to determine the percentage of drivers and front-seat passengers who were utilizing their safety belts correctly.

Additional objectives of this study were as follows:

- Develop a revised methodology, compliant with the Uniform Criteria for State Observational Surveys of Seat Belt Use, for estimating statewide belt use in an economically feasible manner;
- Provide training to all staff conducting the observation surveys and conduct quality assurance/quality control (QA/QC) of the data collection efforts;
- Conduct an observational survey of safety belt use for two weeks in the months of May and June;
- Summarize and cross-tabulate the observational data in a spreadsheet format indicating overall safety belt use, safety belt use by strata, safety belt use by time of day and day of week, and safety belt use by various demographic characteristics; and
- Continue to track changes in safety belt use and generate necessary comparative data and statistical analyses to assess the relevancy of the 2014 data and results to previous observational results.

1.2 Study Area

The study area for the statewide observational survey included those counties representing at least 85 percent of the passenger vehicle crash-related fatalities according to Fatality Analysis Reporting System (FARS) data averages for the years 2005 to 2009.

2.0 METHODOLOGY

The National Highway Traffic Safety Administration (NHTSA) issued new Uniform Criteria for State Observational Surveys of Seat Belt Use in *Federal Register Vol. 76, No. 63* (April 1, 2011, Rules and Regulations, pp. 18042 – 18059). The current survey plan represents Michigan's response to the requirement to submit to NHTSA a study and data collection protocol for an annual state survey to estimate passenger vehicle occupant restraint use. This plan is fully compliant with the Uniform Criteria and was utilized for the implementation of Michigan's 2014 safety belt survey.

2.1 Design of Study

Michigan is comprised of 83 counties; 33 of which account for about 85 percent of the passenger vehicle crash-related fatalities according to Fatality Analysis Reporting System (FARS) data averages for the years 2005 to 2009. Therefore, observation locations from within these 33 counties were selected for inclusion in the survey.

Using 2010 Topologically Integrated Geographic Encoding and Referencing (TIGER) data developed by the U.S. Census Bureau, a comprehensive list of road segments from within these 33 counties was created. Each of these road segments has been classified by the U.S. Census Bureau using the MAF/TIGER Feature Class Code (MTFCC). There are primarily three classifications: 1) Primary Roads, 2) Secondary Roads, and 3) Local Roads (See Table 1 for detailed definitions). In addition, the listings include segment length as determined by TIGER. This descriptive information allowed for stratification of road segments. A systematic probability proportional to size (PPS) sample was employed to select the road segments to be used as observation sites. This process is explained in further detail in Section 3 of this report.

Table 1. Michigan MTFCC Codes Included by Default in the Road Segment File

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

2.2 Data Collection Process

All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation. The cover sheet and data collection form are shown in Appendix I. The cover sheet was designed to allow for documentation of descriptive site information, including: date, site location, site number, alternate site data, assigned traffic flow, number of lanes available and observed, start and end times for observations, and weather conditions. This cover sheet was completed by the data collector at each site before any observations took place.

The observation form was used to record seat belt use by drivers and front seat passengers. Additional data to be collected included occupant age, gender, and ethnicity, as well as vehicle type and use (e.g. commercial or non-commercial) information. Data regarding the use of electronic communication devices was also collected. This included information how the device was used as well (e.g. talking, texting, or hands-free). The forms were labeled from 1 to the total number of forms utilized at each site to assist with data review and inventorying.

The data collectors were instructed to observe as many lanes of traffic as they could while obtaining data on 99 percent of eligible vehicles. Only one direction of traffic was observed at any given site. This direction of observation was pre-determined at each location as explained further in section 3.1.

Observations were made of all drivers and right-front seat occupants. This included children riding in booster seats. The only right-front seat occupants excluded from this study were child passengers who were traveling in child seats with harness straps. Table 2 lists all categories of safety belt use that were observed by the data collectors.

Table 2. Safety Belt Use Codes and Definitions

Code	Definition
Belted	The shoulder belt is in front of the person's shoulder and used correctly.
Unbelted	The shoulder belt is not in front of the person's shoulder or not used at all.
Unknown	It cannot reasonably be determined whether the driver or right front passenger is belted.

2.3 Alternate Sites and Rescheduling

If a site was temporarily unavailable due to a crash, construction activity, inclement weather, or any event that may hinder exact results, data collection was rescheduled for a similar time of day and type of day of the week. In the event the site was permanently unavailable, such as being located within a gated community, then an alternate site, selected as part of the reserve sample, was to be used as a permanent replacement.

2.4 Quality Control Procedures

The quality control (QC) monitor made unannounced visits to five percent of all data collection sites over the duration of the study. The purpose of these visits was to ensure data collectors were following all survey protocol including: being on time at assigned sites, completing the cover sheet and observation forms, and making accurate observations of seat belt use.

3.0 SELECTION OF OBSERVATIONAL LOCATIONS

This research design conforms to the requirements of the Uniform Criteria and allows for estimates of restraint use among front seat occupants in passenger vehicles. Michigan intends to update the sample of data collection sites every five years in order to have survey results that reflect geographic areas with more than 85 percent of crash-related fatalities. The sample design was provided to the Michigan Office of Highway Safety Planning under a consultant agreement with Wayne State University (see Appendix II for the resume of the Principal Investigator, Dr. Peter Savolainen). The design approach includes a stratified systematic PPS sample of data collection sites as described here:

1. All 83 counties in Michigan were listed in descending order of the average number of motor vehicle crash-related fatalities for the period from 2005 to 2009. Fatality Analysis Reporting System (FARS) data were used to determine the average number of crash-related fatalities per county. It was determined 33 counties accounted for at least 85 percent of Michigan's total crash-related fatalities during this period as shown in Table 3. These counties comprise the sample frame.

2. The counties were stratified according to historical safety belt use rates into four groups. These strata were constructed such that the annual vehicle miles of travel (VMT) were approximately balanced within each of the four groups. This represents the first stage of sample selection.

3. At the second stage, road segments were explicitly stratified by MTFCC (see Table 4). This resulted in a total of 12 strata (4 belt use groups, each with 3 MTFCC classes). The number of sites within each MTFCC class was determined proportionately based upon historical VMT, resulting in 30 percent primary roads, 60 percent secondary roads, and 10 percent local roads.

Table 3. Michigan Average Motor Vehicle Crash-Related Fatalities by County (2005-2009)

County	Average Fatality Counts (2005-2009)	Fatality Percentage Within Michigan	Cumulative Fatality Percentage
Wayne	172	16.5	16.5
Oakland	61.8	5.9	22.5
Kent	58.4	5.6	28.1
Genesee	48.6	4.7	32.7
Macomb	47.6	4.6	37.3
Washtenaw	31.4	3	40.3
Kalamazoo	25.4	2.4	42.8
Saginaw	24.4	2.3	45.1
Ottawa	23.6	2.3	47.4
Berrien	22.4	2.2	49.5
Monroe	20.6	2	51.5
Muskegon	19.2	1.8	53.3
Calhoun	18.8	1.8	55.1
Ingham	18.8	1.8	56.9
Livingston	18.6	1.8	58.7
Jackson	18.2	1.7	60.5
St. Clair	17.2	1.7	62.1
Allegan	16.6	1.6	63.7
Van Buren	15.8	1.5	65.2
Eaton	13.4	1.3	66.5
Lapeer	13.2	1.3	67.8
St. Joseph	13.2	1.3	69.1
Lenawee	12.4	1.2	70.2
Tuscola	11.4	1.1	71.3
Montcalm	10.6	1	72.4
Bay	10.4	1	73.4
Grand Traverse	10.2	1	74.3
Cass	10	1	75.3
Clinton	9.8	0.9	76.2
Sanilac	9.4	0.9	77.1
Shiawassee	9.4	0.9	78
Newaygo	9.2	0.9	78.9
Barry	8.8	0.8	79.8
Branch	8.8	0.8	80.6
Midland	8.8	0.8	81.5
Hillsdale	8	0.8	82.2
Ionia	7.8	0.7	83
Wexford	7.6	0.7	83.7
Clare	7	0.7	84.4
Gratiot	6.6	0.6	85.0

4. Road segments were then implicitly stratified by county and segment length. Specific segments were selected randomly with PPS from all segments within each stratum. A random, systematic sample of 50 road segments was selected PPS to road segment length within each belt use group. This process resulted in the selection of 200 road segments (4 belt use rate groups x 50 sites per belt use rate group, allocated proportionately among MTFCC classes). An additional 200 sites were also selected to use as alternates. Out of the 40 possible counties that comprised the sample frame, the final list of observation sites contained locations in 33 of the counties. Figure 1 shows a map displaying the 33-county statewide sample for the direct observation safety belt survey.

5. It was initially expected each site would result in a sample size of approximately 125 vehicles, resulting in approximately 25,000 vehicle observations overall based upon past experience with the Michigan Annual Seat Belt Use Study. Based on these figures, the standard error was expected to be less than 2.5 percent. In the event the calculated standard error should be greater than 2.5 percent, additional data would be collected from existing sites until this criterion was satisfied.

6. Additional stages of selection were used to determine travel direction, lane, and vehicles to be observed, at random and with known probability, as appropriate under the Uniform Criteria, as described in Section 3.1.

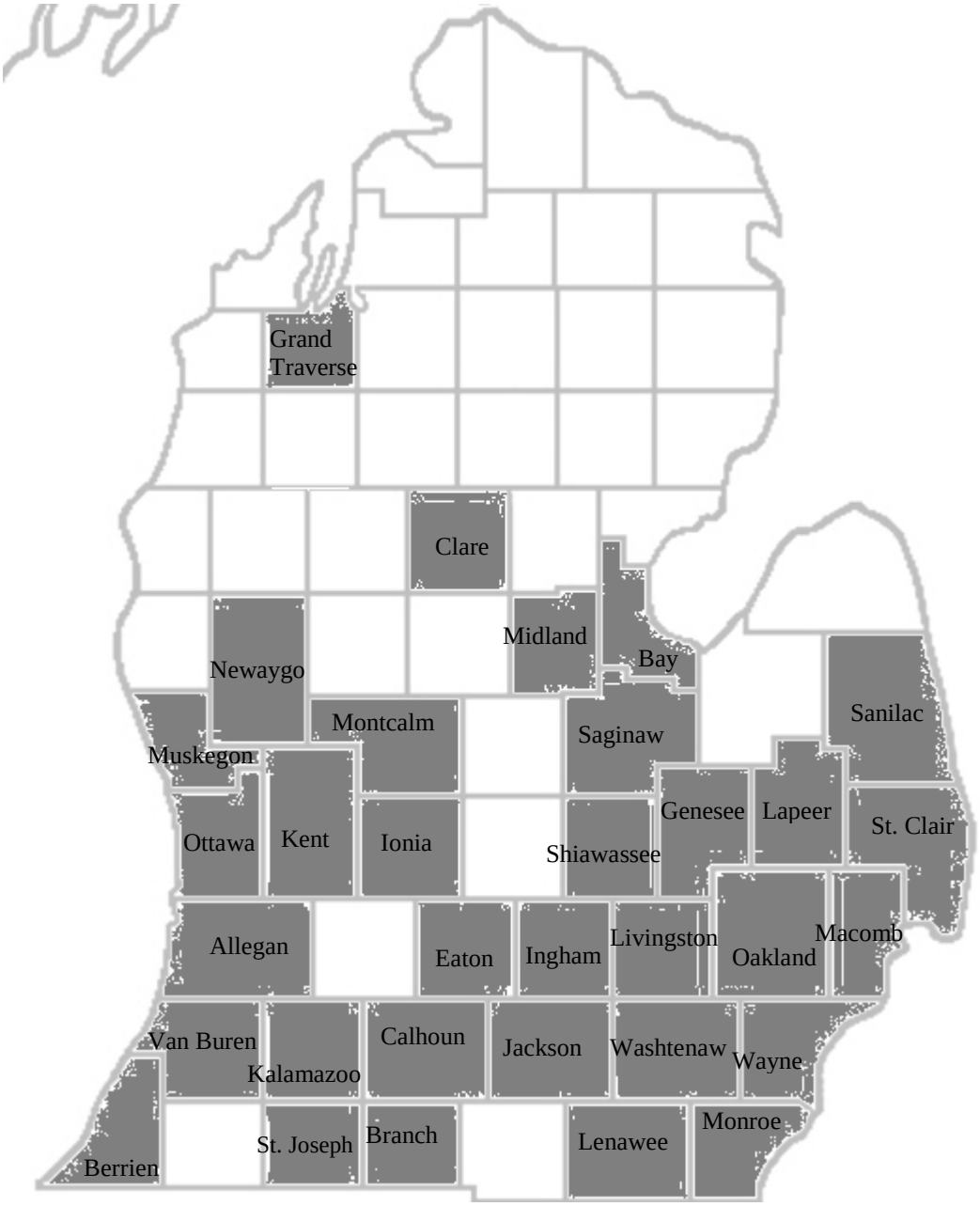

Figure 1: 33-County Statewide Sample for the Direct Observation Safety Belt Surveys

3.1 Sample Size and Precision

A standard error of less than 2.5 percent for the seat belt use estimates is required by the Final Rule. Since 1999, Michigan has conducted the Michigan Annual Seat Belt Use Study, and has historically obtained standard errors below this threshold (e.g. most recently 0.4 percent in 2013) via observed sample sizes of approximately 25,000 vehicles. Since the proposed design for the 2014 Annual survey was identical to the 2013 Annual survey, it was expected that the sample size for the 2014 Annual Survey would be similar to the 2013 Annual Survey and the precision objective was expected to be achieved. In

the event that the precision objective was not met, additional observations would be taken starting with those sites having the fewest observations. New data would be added to existing data until the desired precision was achieved.

Within each of these four belt use groups, a total of 50 road segments were selected. Michigan employed the Census TIGER data for the selection of road segments. Michigan exercised the available exclusion option and removed rural local roads in counties not within Metropolitan Statistical Areas (MSAs), and other non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles, and service drives from the dataset. The number of road segments selected within each MTFCC class was determined proportionately based upon total annual VMT within the three classes (Primary, Secondary, and Local). Thus, the segments selected ultimately included 15 Primary roads (20 percent of sample), 30 Secondary roads (60 percent of sample), and 5 Local roads (10 percent of sample).

Prior to selecting the specific observation locations, all road segments were explicitly stratified by MTFCC (primary, secondary and local) within each of the four belt use rate groups and implicitly stratified by county and by segment length to obtain an ordered list. Implicit stratification by county was done to ensure adequate geographic coverage was obtained as a part of the selection process. Similarly, the implicit stratification by length ensured representative coverage within each MTFCC class since higher-class roads tended to be longer than lower-class roads. Specific road segments were then selected with probability proportional to size (PPS) using segment length as the measure of selection (MOS).
As such, the inclusion probability for a specific road segment is:

$$\pi_{h|gc} = n_{gc} l_h / \Sigma_{\forall h} l_h,$$

where n_{gc} is the road segment sample size for MTFCC *c* in stratum g that was allocated, l_h is the length of road segment h, and

$$\Sigma_{\forall h} l_h$$

is the total length of all segments in stratum g and MTCFF *c*. If a segment was selected with certainty (i.e., its MOS was equal to or exceeded $\Sigma_{\forall h} l_h / n_{gc}$), it was set aside as a certainty selection and the probabilities of selection were recalculated for the remaining segments in the MTCFF class. This was repeated and the certainty selections were identified successively until no segment's MOS was equal to or exceeded the re-calculated $\Sigma_{\forall h} l_h / n_{gc}$. After each certainty segment was removed, the total segment length of the MTCFF class was then recalculated, as well as the probabilities of selection for the remaining segments, until no more segments were selected with certainty.

After all certainty segments were identified, a sampling interval (*I*) was calculated as the total length across all road segments within each MTFCC group divided by the number of road segments to select within each group (i.e., 15 primary, 30 secondary, and 5 local). A random start (RS) was selected between 0 and the calculated *I*, which determined the first road segment selected. Subsequent road segments selected were determined by adding multiples of *I* to the RS until the desired number of road segments were selected and/or the end of the sorted list was reached.

Table 4 presents summary statistics detailing the number of eligible road segments, the total length (miles) of these segments, and the number of road segments selected within each of the MTFCC classes by belt use group and county.

Appendix III presents the complete list of the final observation sites including belt use stratum, county, and road classification.

Table 4. Roadway Functional Strata by County, Road Segments Population (N), Length of Selected Segments (miles), and Number of Segments Selected (n)

Strata	County		MTFCC Strata			Total
			Primary	Secondary	Local	
1	Ingham	N	37	147	6162	6346
		Length	169	417	3111	3697
		n	3	7	1	11
	Kalamazoo	N	46	71	6611	6728
		Length	171	284	3433	3888
		n	4	5	0	9
	Oakland	N	40	172	29104	29316
		Length	349	556	10287	11192
		n	5	13	3	21
	Washtenaw	N	19	76	8183	8278
		Length	116	268	3841	4225
		n	3	5	1	9
2	Allegan	N	14	52	4416	4482
		Length	161	287	3656	4104
		n	1	3	1	5
	Bay	N	19	111	3580	3710
		Length	253	330	2568	3151
		n	2	3	0	5
	Calhoun	N	11	110	4937	5058
		Length	156	291	3200	3647
		n	2	2	1	5
	Eaton	N	11	88	3002	3101
		Length	182	368	2497	3047
		n	2	4	0	6
	Grand Traverse	N	0	55	5485	5540
		Length	0	236	2731	2967
		n	0	2	0	2
	Jackson	N	8	142	5203	5353
		Length	108	416	3104	3628
		n	1	4	1	6
	Kent	N	29	142	15063	15234
		Length	285	633	6841	7759
		n	4	5	1	10
	Livingston	N	17	41	7119	7177
		Length	101	211	3267	3579
		n	1	2	0	3
	Midland	N	3	28	3481	3512
		Length	1	106	2285	2392
		n	0	1	1	2
	Monroe	N	7	55	3531	3593
		Length	145	291	2760	3196
		n	2	3	0	5
	Ottawa	N	3	52	7080	7135
		Length	4	220	3417	3641
		n	0	1	0	1
3	Barry	N	1	132	2894	3027
		Length	0	237	2148	2385
		n	0	0	0	0
	Berrien	N	37	107	6495	6639
		Length	72	390	3121	3583
		n	3	0	0	3
	Branch	N	6	37	2231	2274
		Length	133	184	1844	2160
		n	1	0	0	1
	Cass	N	2	74	2850	2926
		Length	0	213	1844	2057
		n	0	0	0	0
	Clare	N	10	65	4408	4483
		Length	101	193	2532	2826
		n	2	0	0	2

Table 4 - Roadway Functional Strata by County, Road Segments Population (N), Length of Selected Segments (miles), and Number of Segments Selected (n) (Continued)

Strata	County		MTFCC Strata			Total
			Primary	Secondary	Local	
3	Clinton	N	28	78	2277	2383
		Length	71	185	2494	2750
		n	0	0	0	0
	Genesee	N	18	78	9622	9718
		Length	357	409	4674	5440
		n	2	0	0	2
	Gratiot	N	3	37	1641	1681
		Length	46	147	2205	2398
		n	0	0	0	0
	Hillsdale	N	0	76	2150	2226
		Length	0	346	2196	2541
		n	0	0	0	0
	Ionia	N	8	78	2376	2462
		Length	73	234	2205	2512
		n	0	0	1	1
	Lapeer	N	3	31	2883	2917
		Length	144	216	3129	3490
		n	0	1	0	1
	Lenawee	N	1	104	3398	3503
		Length	1	378	2666	3045
		n	0	3	1	4
	Montcalm	N	4	73	4095	4172
		Length	63	380	4041	4484
		n	0	4	0	4
	Muskegon	N	5	44	5660	5709
		Length	90	196	3033	3319
		n	0	1	1	2
	Newaygo	N	0	104	3441	3545
		Length	0	360	3042	3402
		n	0	4	0	4
	Saginaw	N	8	149	5252	5409
		Length	154	633	4327	5114
		n	2	5	1	8
	Sanilac	N	1	88	2208	2297
		Length	0	495	2912	3407
		n	0	5	0	5
	Shiawassee	N	6	32	2276	2314
		Length	50	206	2113	2369
		n	1	1	1	3
	St. Clair	N	22	121	4189	4332
		Length	182	329	2975	3486
		n	3	3	0	6
	St. Joseph	N	1	66	3147	3214
		Length	0	295	2550	2846
		n	0	3	0	3
	Tuscola	N	0	88	2061	2149
		Length	0	402	2971	3373
		n	0	0	0	0
	Van Buren	N	8	27	3512	3547
		Length	189	89	2843	3121
		n	1	0	0	1
	Wexford	N	0	65	3274	3339
		Length	0	299	2458	2757
		n	0	0	0	0
4	Macomb	N	14	203	16727	16944
		Length	67	427	5545	6039
		n	4	15	3	22
	Wayne	N	50	180	26982	27212
		Length	690	982	12387	14059
		n	11	15	2	28

In the event an original road segment was permanently unavailable, a reserve road segment was to be used. The reserve road segment sample consisted of one additional road segment per original road segment selected, resulting in a reserve sample of an additional 200 road segments. These reserve segments were identified and selected as the road segments immediately following the original road segment actually selected. Thus, these segments were also explicitly stratified by seat belt use and MTFCC group, as well as implicitly stratified by segment length and county. Each reserve segment corresponded to an original road segment actually selected. Thus, these are considered selected with PPS using road segment length as MOS by the same approach as described previously. As such, for the purposes of data weighting, the reserve road segment inherited all probabilities of selection and weighting components up to and including the road segment stage of selection from the original road segment actually selected. Probabilities and weights for any subsequent stages of selection (e.g., the sampling of vehicles) would be determined by the reserve road segment itself.

Road segments were mapped according to the latitude and longitude of their midpoints. The selected road segment was identified by an intersection or interchange that occurred within or just beyond the segment. Data collection sites were deterministically selected such that traffic would be moving during the observation period. Therefore, sites were assigned to locations within the segment that were 50 to 150 feet from any controlled intersections. For limited access roadways, data collection occurred on a ramp carrying traffic exiting the highway. The observed direction of travel was randomly assigned for each road segment. The locations of the data collection sites were described on site assignment sheets and maps were developed to aid the Data Collectors and QC Monitors in travelling to the assigned locations.

3.2 Outline for Data Collection

For each selected observation site, vehicles were observed for exactly 60 minutes. These observations were appropriately weighted, as explained in the Data Analysis Section of this report (Section 6.0). The data collected for the 200 observation sites provided a representative sample for each day of the week and each hour of the day for the safety belt use characteristics of the state.

The driver of each vehicle and the passenger in the front-right seat of the vehicle were observed for safety belt use, non-use, and misuse. The driver and passenger belt observation categories included ‘belted correctly’, ‘not belted correctly’, and ‘unknown belt use’ as previously described. An occupant was recorded as ‘belted correctly’ only if they were observed to be properly using the shoulder belt (i.e. shoulder belt was across chest; not under arm or behind back). The ‘unknown belt use’ category was marked if an observer was unable to determine the position of an occupant’s seat belt. These observations were not included in the final sample but a record was kept to calculate the non-response rate which is discussed in the data analysis section of this report. In the surveys, both the driver and front-seat passenger were separately identified based upon their gender, estimated age, and race. The

driver and passenger gender categories consisted of male, female, and unknown. The driver age categories included 16-29, 30-59, 60 and over, and unknown. The passenger age categories included 0-15, 16-29, 30-59, 60 and over, and unknown. The driver and passenger races were categorized as Caucasian, African American, other, or unknown. The vehicles were categorized into four groups: Passenger Cars, Sport Utility Vehicles, Vans or Minivans, and Pick-Up Trucks. The vehicles were also identified as being Commercial or Non-commercial vehicles. Furthermore, the driver was also observed for any indication of cell phone use. The categories included 'handheld (talking)', 'handheld (typing)', and 'hands-free'. For cases where a driver was observed to be using a 'hands-free' electronic device, observers also recorded whether an earpiece was visible or not.

Data collectors also counted every vehicle that passed through the lanes they were observing during the 60-minute observation using a hand counter. This volume count was then utilized during the belt use weighting procedure. Observations were manually recorded in the field on survey forms and returned back to the office within 24 hours of the data collection, or as soon as possible after multiple day trips to outstate locations. The data collected in the field were entered into a spreadsheet by the observer at the conclusion of the data collection activities for each day and verified for accuracy in the office by office staff.

4.0 OBSERVER TRAINING

The Principal Investigator and co-Investigators from WSU served as the QC Monitors, conducting site audits of the Data Collectors. Each Data Collector was monitored at least once by a QC Monitor. The Data Collectors were comprised of WSU staff, many of whom have participated in prior safety restraint use surveys. All data collectors were able to stand for long periods of time, work outdoors, and successfully complete the training program. The training program for Data Collectors was conducted at WSU, beginning approximately two weeks prior to the first data collection period and included both lecture and classroom and field exercises. The syllabus for the training program is shown as Figure 2.

At the conclusion of the classroom training, the Data Collectors conducted their first field practice at a location near the WSU campus. QC Monitors will be available during this period to respond to questions and offer assistance to Data Collectors as needed. Reliability and repeatability field data collection practice continued during the two weeks leading up to full-scale survey implementation.

Day 1 – In-Class Training Program and Field Practice

Welcome, introductions, and distribution of materials

Survey overview

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

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

Data collection techniques
- Definitions of belt/booster seat use, passenger vehicles
- Observation protocol: belt use, vehicle type/use, demographic characteristics
- Unobservable vehicles/occupants

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

Data entry procedures

Travel reports, lodging, and auto reservations

Field practice at ramps and surface streets

Days 2-10 Continued Field Practice

Field practice at ramps and surface streets

Figure 2. Training Syllabus

The reliability and repeatability studies were performed at various intersections near the Wayne State University campus, as well as additional locations in southeastern Michigan. These intersections represented various site characteristics that could be challenging for observational data collection. Over a period of several weeks, observers were randomly divided into groups and assigned to collect safety belt observational data independently. Also during this period, another exercise paired inexperienced observers with experienced observers, who noted which individual vehicle the entire group was to

evaluate. This allowed an analysis of the accuracy of the inexperienced data collectors in comparison to those who have participated in the study previously.

The data was then summarized and compared among the observers in each group to determine the accuracy of their observations. Upon completion of the training for the data collection, each member of the data collection team received a training manual composed of the information detailed during the training session, the schedule of data collection, and all necessary field supplies.

5.0 QUALITY CONTROL

The policies and procedures utilized during the conduct of the direct observation surveys of safety belt use were based upon the *Uniform Criteria for State Observational Surveys of Seat Belt Use* from Title 23, Part 1240.12 of the Code of Federal Regulations. The study design for the Annual Survey was consistent with these criteria, which established observations should be conducted on specific dates and times and in particular directions of travel, all of which were determined randomly in advance of the studies. Further, the criteria state policies should be in place in the event observations cannot be made due to unanticipated events, such as road construction. In such situations, data collectors were instructed to observe at the pre-assigned alternate location. Policies must also be established for the case where traffic flow is too heavy to observe all vehicles or traffic is moving too quickly for observation. In most instances, high traffic volumes prohibit data collectors from observing all vehicles. Consequently, data collectors were instructed to observe as many vehicles as is feasible for observation under such conditions for the required time period of 60 minutes.

All belt use observations were conducted during weekdays and weekends between 7 a.m. and 7 p.m. The schedule included rush hour (before 9:30 AM and after 3:30 PM) and non-rush hour observations. Data collection was conducted for 60 minutes at each site, and approximately five sites were scheduled each day for each Data Collector. Start times and days were staggered to ensure all days of the week and hours of the day (during daylight) were represented in the sample.

Maps showing the location of all observation sites and site assignment sheets were provided to the Data Collectors and QC Monitors. These indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, and assigned direction of travel. Sites within relatively close geographic proximity were assigned as data collection clusters. The first site within each cluster was assigned a random day and time for completion. All other sites within a cluster were assigned to the same day in order to minimize travel costs. The sites were scheduled by geographic proximity to minimize travel within the cluster.

During the full-scale data collection activities, independent auditors were sent out to the field to covertly observe the data collectors. These field audits were conducted to ensure compliance with the data collection procedures. No major violations of policies or procedure were observed as a part of these audits. The random checks were conducted at least once for each observer and a total of ten sites were audited, representing five percent of all observational sites.

6.0 DATA ANALYSIS

The data collected in the field were entered into a spreadsheet by the observer at the conclusion of the data collection activities for each day and verified for accuracy by office staff. Rates for safety belt and cell phone use were determined for each survey stratum, county, location, etc., as well as the statewide average. A 95-percent confidence interval for each use rate estimate was determined according to the NHTSA guidelines. The following sections outline the methods used to estimate the use rate and variance for safety belts. A similar procedure was utilized to estimate cell phone use rate and variance.

6.1 Imputation

No imputation was done on missing data.

6.2 Sampling Weights

The following is a summary of the notation used in this section.

g – Subscript for belt use group strata

h – Subscript for road segment strata

i – Subscript for road segment

j – Subscript for time segment

k – Subscript for road direction

l – Subscript for lane

m – Subscript for vehicle

n – Subscript for front-seat occupant

Under this stratified multistage sample design, the inclusion probability for each observed vehicle was the product of selection probabilities at all stages: π_g for belt use group (stratum-road class), $\pi_{hi|g}$ for road segment, $\pi_{j|ghi}$ for time segment, $\pi_{k|ghij}$ for direction, $\pi_{l|ghijk}$ for lane, and $\pi_{m|ghijkl}$ for vehicle. So the overall vehicle inclusion probability was:

$$\pi_{ghijklm} = \pi_g \pi_{hi|g} \pi_{j|ghi} \pi_{k|ghij} \pi_{l|ghijk} \pi_{m|ghijkl}.$$

The sampling weight (design weight) for vehicle *m* is:

$$w_{gchijklm} = \frac{1}{\pi_{gchijklm}}$$

6.3 Non-Responding Site Adjustment

There were no sites which required 'non-responding' adjustment in the 2014 Annual Direct Observation Survey of Safety Belt Use.

6.4 Estimators

Noting all front-seat occupants were observed, the driver/passenger seat belt use status was:

$$y_{ghijklmn} = \begin{cases} 1, if\ belt\ used \\ 0, otherwise \end{cases}$$

In order to most accurately estimate the weighted safety belt use rate for the entire state of Michigan, the estimator used in this analysis was weighted by segment length and stratum-level VMT to determine the overall statewide belt use rate. This estimation technique is detailed in *An Example of a Compliant State Seat Belt Use Survey Design* [7]. Under this estimator, the use rates within each stratum were first calculated using the road segment length based estimator:

$$p_{L_{gh}} = \frac{\sum_{all\ ijklmn\ in\ gh} w_{ijklm|gh} Length_{ghi} y_{ghijklmn}}{\sum_{all\ ijklmn\ in\ gh} w_{ijklm|gh}\ Length_{ghi}}$$

The twelve stratum-specific use rates were then weighted by the proportion of total statewide VMT (shown in Table 5) within each stratum, which resulted in the road class VMT-based estimator (p_{VMT}):

$$p_{VMT} = \frac{\sum_g w_g \sum_h VMT_{gh} p_{gh}}{\sum_g w_g \sum_h VMT_{gh}}$$

Table 5. Annual Vehicle Miles of Travel by Stratum (in 1,000s)

Belt Use Stratum	Road Class			Total
	Primary	Secondary	Local	
1	7,185,332	11,192,309	2,154,320	20,531,961
2	7,259,795	11,279,604	1,735,649	20,275,047
3	5,734,226	11,911,091	1,936,706	19,582,024
4	7,227,481	12,389,812	2,330,291	21,947,584
Statewide	**27,406,834**	**46,772,815**	**8,156,966**	**82,336,616**

The use of the VMT-based estimator (p_{VMT}) reduced the weighting bias towards local road observation sites by accounting for their relatively short length and low VMT as compared to primary and secondary roads.

6.5 Variance Estimation

The variance (and standard error) for each estimator was determined using the "Delete-1 Jackknife" variance estimation program in SUDAAN 11 software. Under this methodology, the variance was calculated by deleting one observation location and adjusting the weights of the remaining PSU's in the same stratum to account for the deleted PSU. The procedure was repeated, removing each location once. For the road class VMT based estimator (p_{VMT}), the "Delete-1 Jackknife" method was used to estimate the variances within each of the road class/belt use strata:

$$V(p_{gh}) = \left(\frac{n_{gh}-1}{n_{gh}}\right)\sum_{i=1}^{n_{gh}}(p_{ghi}-p_{gh})(p_{ghi}-p_{gh})'$$

where:

$V(p_{gh})$ = Estimated variance within each of the road class/belt use strata

p = Estimated statewide belt use rate

p_{ghi} = Estimated belt use rate at location *i* in road segment type *h* in belt use group *g*

p_{gh} = Estimated belt use rate in road segment type *h* in belt use group *g*

n_{gh} = Number of locations of road segment type *h* in belt use group *g*

The variance for the statewide use rate was then determined using the following equation:

$$V(p) = \frac{\sum_{\forall g,\forall h} VMT_{gh}^2 V(p_{gh})}{\left(\sum_{\forall g,\forall h} VMT_{gh}\right)^2}$$

where:

$V(p)$ = Estimated variance of statewide belt use rate

The standard error of the statewide use rate was found by simply taking the square root of the estimated variance. The 95 percent confidence interval of the statewide belt use was equal to the weighted safety belt use rate plus/minus 1.96 (for the Z-test at alpha = 0.05) multiplied by the standard error expressed as a percent.

6.6 Non-Response Rate

According to NHTSA's guidelines, the non-response rate for the annual safety belt survey cannot exceed 10 percent. A non-response occurs when the observer was not able to determine the safety belt use of a front seat vehicle occupant. This can occur due to a variety of reasons such as tinted windows, sun glare, high speeds of the vehicle in question, etc... Observers in the field marked either 'vehicle not observable' or 'unknown belt use' to keep a record of the non-response rate. There were a total of 308

non-response observations which represents 1.0 percent of the total number of observations. This non-response rate was below the allowable maximum of 10 percent established by the NHTSA.

7.0 RESULTS AND CONCLUSIONS

The Annual Direct Observation Survey was performed between Tuesday, September 2nd and Wednesday, September 17th of 2014. During this observation period, a total of 23,613 vehicles were observed resulting in 29,316 driver and right-front passenger observations at the 200 observation sites randomly selected to represent statewide safety belt use.

7.1 Safety Belt Survey

The overall weighted statewide safety belt use rate for Michigan was found to be 93.3 percent and is shown in Table 6. The overall weighted statewide safety belt use rate was calculated based upon the procedure described in the Data Analysis section (Section 6.0) of this report. When the safety belt usage rates were calculated, belted occupants included all drivers and front-seat passengers who were belted correctly. The "not belted" occupants included drivers and front-seat passengers who were not belted or who were wearing the belt incorrectly; either under their arm or behind their back. Details of the observations on an intersection level are provided in Appendix III. It should be noted that all of the observation sites were original sites, as there were no instances in which the original site was unobservable and the data collector had to move to an alternate site.

Table 6: Statewide Weighted Safety Belt Use Rate for Drivers and Front-Seat Passengers

Observational Wave	Safety Belt Use Rate*	Standard Error
Annual Observational Survey	93.3% ± 0.6%	0.3%

* Weighted Safety Belt Usage ± 95% Confidence Band

The overall statewide use rate is representative of all front seat occupants (drivers and right-front passengers), all times of the day (7:00 AM-7:00 PM) and all days of the week. Table 7 shows the raw (unweighted) safety belt use information separated by drivers and front-right passengers. Table 8 summarizes the descriptive statistics for the safety belt survey in terms of sampling statistics for day of the week and time of the day.

Table 7. Statewide Raw/Unweighted Safety Belt Use Summary

Belt Use	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Drivers	23,600	22,121	93.7%
Passengers	5,716	5,288	92.5%
Total	**29,316**	**27,409**	**93.5%**

Table 8. Statewide Safety Belt Use Day and Time Sampling Summary

Day of the Week	Annual Safety Belt Observations			
	No. of Sites Observed	**Percent of Sites in Day of Week**	**Actual Total No. of Observations (Occupants)**	**Percent of Observations in Day of Week (Occupants)**
Sunday	25	12.5%	4,002	13.7%
Monday	25	12.5%	3,895	13.3%
Tuesday	29	14.5%	3,194	10.9%
Wednesday	36	18.0%	3,858	13.2%
Thursday	29	14.5%	4,604	15.7%
Friday	34	17.0%	4,475	15.3%
Saturday	22	11.0%	5,288	18.0%
Total	**200**	**100.0%**	**29,316**	100.0%
Time of the Day	**Annual Safety Belt Observations**			
	No. of Sites Observed	**Percent of Sites in Time of Day**	**Actual Total No. of Observations (Occupants)**	**Percent of Observations in Time of Day (Occupants)**
7 am – 8 am	8	4.0%	1,283	4.4%
8 am – 9 am	15	7.5%	2,113	7.2%
9 am – 10 am	14	7.0%	1,696	5.8%
10 am – 11 am	23	11.5%	3,548	12.1%
11 am – 12 pm	20	10.0%	2,824	9.6%
12 pm – 1 pm	21	10.5%	3,109	10.6%
1 pm – 2 pm	22	11.0%	3,177	10.8%
2 pm – 3 pm	20	10.0%	2,265	7.7%
3 pm – 4 pm	16	8.0%	2,786	9.5%
4 pm – 5 pm	16	8.0%	2,633	9.0%
5 pm – 6 pm	16	8.0%	2,358	8.0%
6 pm – 7 pm	9	4.5%	1,524	5.2%
Total	**200**	**100.0%**	**29,316**	**100.0%**

The safety belt use rate can be described by the overall use rate, as well as by vehicle type and various demographics. It should be noted the overall safety belt use rates presented in Table 7 and Tables 9 through 15 represent the raw (un-weighted) safety belt use data and vary from the weighted statewide use rate presented in Table 6. Table 9 summarizes the statewide driver and front-seat passenger safety belt use rates by county and belt-use stratum. Because of the relatively low number of sites and/or observations in many counties, the safety belt use rates listed may not be fully representative of each county.

Table 9. Statewide Safety Belt Use Rates by Stratum and County

STRATUM 1	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Ingham County	1,391	1,327	95.4%
Kalamazoo County	1,308	1,263	96.6%
Oakland County	3,901	3,617	92.7%
Washtenaw County	1,465	1,362	93.0%
Total	**8,065**	**7,569**	**93.8%**
STRATUM 2	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Allegan County	600	575	95.8%
Bay County	341	304	89.1%
Calhoun County	518	485	93.6%
Eaton County	780	743	95.3%
Grand Traverse County	399	376	94.2%
Jackson County	1,010	957	94.8%
Kent County	1,027	987	96.1%
Livingston County	405	365	90.1%
Midland County	225	206	91.6%
Monroe County	460	437	95.0%
Ottawa County	354	336	94.9%
Total	**6,119**	**5,771**	**94.3%**
STRATUM 3	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Berrien County	366	352	96.2%
Branch County	179	175	97.8%
Clare County	221	212	95.9%
Genesee County	249	216	86.7%
Ionia County	30	21	70.0%
Lapeer County	61	57	93.4%
Lenawee County	402	387	96.3%
Montcalm County	684	608	88.9%
Muskegon County	382	352	92.1%
Newaygo County	494	454	91.9%
Saginaw County	979	885	90.4%
Sanilac County	628	603	96.0%
Shiawassee County	161	144	89.4%
St. Clair County	972	914	94.0%
St. Joseph County	452	438	96.9%
Van Buren County	27	25	92.6%
Total	**6,287**	**5,843**	**92.9%**
STRATUM 4	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Macomb County	4,059	3,833	94.4%
Wayne County	4,786	4,393	91.8%
Total	**8,845**	**8,226**	**93.0%**
Grand Total (Unweighted)	**29,316**	**27,409**	**93.5%**

Tables 10 through 14 summarize occupant safety belt use for drivers and front-seat passengers by vehicle type for each day of the week, time of the day, gender, age, and race for the Annual Observation Survey. The six occupants observed in unknown vehicle types are not included in Tables 11-14.

Table 10. All Vehicles Statewide Summary

Day of the Week	All Vehicle Safety Belt Use		
	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Sunday	4,002	3,758	93.9%
Monday	3,895	3,692	94.8%
Tuesday	3,194	2,934	91.9%
Wednesday	3,858	3,603	93.4%
Thursday	4,604	4,304	93.5%
Friday	4,475	4,132	92.3%
Saturday	5,288	4,986	94.3%
Total	**29,316**	**27,409**	**93.5%**
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	1,283	1,186	92.4%
8 am – 9 am	2,113	1,971	93.3%
9 am – 10 am	1,696	1,587	93.6%
10 am – 11 am	3,548	3,330	93.9%
11 am – 12 pm	2,824	2,677	94.8%
12 pm – 1 pm	3,109	2,931	94.3%
1 pm – 2 pm	3,177	2,943	92.6%
2 pm – 3 pm	2,265	2,113	93.3%
3 pm – 4 pm	2,786	2,626	94.3%
4 pm – 5 pm	2,633	2,411	91.6%
5 pm – 6 pm	2,358	2,219	94.1%
6 pm – 7 pm	1,524	1,415	92.8%
Total	**29,316**	**27,409**	**93.5%**
Vehicle Type	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Passenger Cars	13,390	12,563	93.8%
Sport Utility	8,432	7,944	94.2%
Vans/Minivans	3,119	2,948	94.5%
Pick-Up Trucks	4,369	3,949	90.4%
Unknown	6	5	83.3%
Total	**29,316**	**27,409**	**93.5%**
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	15,872	14,664	92.4%
Female	13,408	12,711	94.8%
Unknown	36	34	94.4%
Total	**29,316**	**27,409**	**93.5%**
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 - 15	457	431	94.3%
16 - 29	7,564	6,975	92.2%
30 - 59	17,660	16,532	93.6%
60+	3,621	3,457	95.5%
Unknown	14	14	100.0%
Total	**29,316**	**27,409**	**93.5%**
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	25,085	23,546	93.9%
African-American	3,347	3,035	90.7%
Other	824	774	93.9%
Unknown	60	54	90.0%
Total	**29,316**	**27,409**	**93.5%**

Table 11. Passenger Cars Statewide Summary

Passenger Cars Safety Belt Use			
Day of the Week	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Sunday	1,915	1,784	93.2%
Monday	1,753	1,685	96.1%
Tuesday	1,585	1,471	92.8%
Wednesday	1,784	1,668	93.5%
Thursday	2,123	2,004	94.4%
Friday	1,735	1,600	92.2%
Saturday	2,495	2,351	94.2%
Total	**13,390**	**12,563**	**93.8%**
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	721	674	93.5%
8 am – 9 am	973	903	92.8%
9 am – 10 am	708	673	95.1%
10 am – 11 am	1,551	1,462	94.3%
11 am – 12 pm	1,180	1,129	95.7%
12 pm – 1 pm	1,391	1,316	94.6%
1 pm – 2 pm	1,519	1,414	93.1%
2 pm – 3 pm	1,088	1,017	93.5%
3 pm – 4 pm	1,264	1,194	94.5%
4 pm – 5 pm	1,213	1,118	92.2%
5 pm – 6 pm	1,058	989	93.5%
6 pm – 7 pm	724	674	93.1%
Total	**13,390**	**12,563**	**93.8%**
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	6,867	6,400	93.2%
Female	6,505	6,147	94.5%
Unknown	18	16	88.9%
Total	**13,390**	**12,563**	**93.8%**
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 - 15	166	157	94.6%
16 - 29	4,375	4,066	92.9%
30 – 59	7,122	6,688	93.9%
60+	1,722	1,647	95.6%
Unknown	5	5	100.0%
Total	**13,390**	**12,563**	**93.8%**
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	10,989	10,369	94.4%
African-American	1,977	1,793	90.7%
Other	392	372	94.9%
Unknown	32	29	90.6%
Total	**13,390**	**12,563**	**93.8%**

Table 12. Sport Utility Vehicles Statewide Summary

Sport Utility Vehicles Safety Belt Use			
Day of the Week	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Sunday	1,287	1,220	94.8%
Monday	1,141	1,081	94.7%
Tuesday	772	712	92.2%
Wednesday	1,034	968	93.6%
Thursday	1,258	1,176	93.5%
Friday	1,288	1,210	93.9%
Saturday	1,652	1,577	95.5%
Total	**8,432**	**7,944**	**94.2%**
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	320	298	93.1%
8 am – 9 am	633	593	93.7%
9 am – 10 am	511	487	95.3%
10 am – 11 am	1,035	984	95.1%
11 am – 12 pm	804	767	95.4%
12 pm – 1 pm	930	879	94.5%
1 pm – 2 pm	918	857	93.4%
2 pm – 3 pm	578	547	94.6%
3 pm – 4 pm	833	792	95.1%
4 pm – 5 pm	691	637	92.2%
5 pm – 6 pm	748	707	94.5%
6 pm – 7 pm	431	396	91.9%
Total	**8,432**	**7,944**	**94.2%**
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	3,771	3,503	92.9%
Female	4,652	4,432	95.3%
Unknown	9	9	100.0%
Total	**8,432**	**7,944**	**94.2%**
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 - 15	135	128	94.8%
16 - 29	1,898	1,761	92.8%
30 – 59	5,388	5,090	94.5%
60+	1,008	962	95.4%
Unknown	3	3	100.0%
Total	**8,432**	**7,944**	**94.2%**
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	7,298	6,902	94.6%
African-American	886	809	91.3%
Other	236	221	93.6%
Unknown	12	12	100.0%
Total	**8,432**	**7,944**	**94.2%**

Table 13. Van/Minivan Statewide Summary

Van/Minivans Safety Belt Use			
Day of the Week	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Sunday	409	391	95.6%
Monday	443	420	94.8%
Tuesday	359	325	90.5%
Wednesday	410	390	95.1%
Thursday	465	437	94.0%
Friday	529	497	94.0%
Saturday	504	488	96.8%
Total	**3,119**	**2,948**	**94.5%**
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	98	90	91.8%
8 am – 9 am	214	205	95.8%
9 am – 10 am	187	175	93.6%
10 am – 11 am	411	386	93.9%
11 am – 12 pm	353	333	94.3%
12 pm – 1 pm	352	334	94.9%
1 pm – 2 pm	300	276	92.0%
2 pm – 3 pm	246	235	95.5%
3 pm – 4 pm	263	249	94.7%
4 pm – 5 pm	272	254	93.4%
5 pm – 6 pm	252	241	95.6%
6 pm – 7 pm	171	170	99.4%
Total	**3,119**	**2,948**	**94.5%**
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	1,717	1,607	93.6%
Female	1,396	1,335	95.6%
Unknown	6	6	100.0%
Total	**3,119**	**2,948**	**94.5%**
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 - 15	91	88	96.7%
16 - 29	485	453	93.4%
30 – 59	2,103	1,985	94.4%
60+	435	417	95.9%
Unknown	5	5	100.0%
Total	**3,119**	**2,948**	**94.5%**
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	2,691	2,551	94.8%
African-American	277	251	90.6%
Other	145	140	96.6%
Unknown	6	6	100.0%
Total	**3,119**	**2,948**	**94.5%**

Table 14. Pick-Up Trucks Statewide Summary

Pick-up Truck Safety Belt Use			
Day of the Week	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Sunday	389	361	92.8%
Monday	558	506	90.7%
Tuesday	478	426	89.1%
Wednesday	630	577	91.6%
Thursday	758	687	90.6%
Friday	922	824	89.4%
Saturday	634	568	89.6%
Total	**4,369**	**3,949**	**90.4%**
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	144	124	86.1%
8 am – 9 am	293	270	92.2%
9 am – 10 am	290	252	86.9%
10 am – 11 am	550	497	90.4%
11 am – 12 pm	487	448	92.0%
12 pm – 1 pm	435	402	92.4%
1 pm – 2 pm	440	396	90.0%
2 pm – 3 pm	353	314	89.0%
3 pm – 4 pm	422	387	91.7%
4 pm – 5 pm	457	402	88.0%
5 pm – 6 pm	300	282	94.0%
6 pm – 7 pm	198	175	88.4%
Total	**4,369**	**3,949**	**90.4%**
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	3,513	3,151	89.7%
Female	853	795	93.2%
Unknown	3	3	100.0%
Total	**4,369**	**3,949**	**90.4%**
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 - 15	65	58	89.2%
16 - 29	806	695	86.2%
30 – 59	3,042	2,764	90.9%
60+	455	431	94.7%
Unknown	1	1	100.0%
Total	**4,369**	**3,949**	**90.4%**
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	4,103	3,721	90.7%
African-American	205	180	87.8%
Other	51	41	80.4%
Unknown	10	7	70.0%
Total	**4,369**	**3,949**	**90.4%**

Occupants of vans and minivans exhibited the highest safety belt use rate among vehicle types at 94.5 percent. Occupants of sport utility vehicles exhibited a belt use rate of 94.2 percent, while occupants of passenger cars exhibited a use rate of 93.8 percent. Occupants of pick-up trucks exhibited the lowest use rate at 90.4 percent. The day of the week with the lowest safety belt usage rate was Tuesday with 91.9 percent use. Safety belt use rates were highest on Mondays with a rate of 94.8 percent. The time period of 4:00 PM to 5:00 PM exhibited a lower usage rate than all other times of the day (91.6 percent), while occupants were mostly likely to wear their safety belts between the hours of 11:00 AM to 12:00 PM (94.8 percent).

Female occupants had higher use rates than male occupants by 2.4 percent (94.8 percent use rate for females vs. 92.4 percent use rate for males). The safety belt usage rate was highest among occupants aged 60 and older at 95.5 percent and lowest for occupants between the ages of 16 to 29 (92.2 percent). The safety belt use rate for occupants aged 0 to 15 was 94.3 percent while the use rate was 93.6 percent among occupants between 30 and 59. Safety belt usage was lowest among African American occupants (90.7 percent) and highest for Caucasian individuals or individuals of other races (both 93.9 percent).

Table 15 summarizes occupant safety belt use rates by gender, age, and race. Vehicle occupants whose gender could not be identified were excluded from this demographic comparison (36 total observations). Young African American males aged 16-29 exhibited the lowest belt use rate of all demographic groups with a use rate of 86.0 percent. Caucasian females aged 60 and over exhibited the highest safety belt use rate at 96.4 percent. Overall, young male pick-up truck occupants exhibited the lowest safety belt use rates, consistent with past findings.

Table 15. All Vehicles Statewide Demographic Summary

Demographic Data			All Vehicles Safety Belt Use		
Gender	**Age**	**Race**	**Actual Total # of Obs.**	**Actual Belted # of Obs.**	**% Safety Belt Use**
Male	0 - 15	Caucasian	193	179	92.7%
		African-American	35	34	97.1%
		Other	8	8	100.0%
		Unknown	1	1	100.0%
		Total	**237**	**222**	**93.7%**
	16 - 29	Caucasian	3,110	2,846	91.5%
		African-American	487	419	86.0%
		Other	141	130	92.2%
		Unknown	7	5	71.4%
		Total	**3,745**	**3,400**	**90.8%**
	30 - 59	Caucasian	8,559	7,946	92.8%
		African-American	1,032	922	89.3%
		Other	311	292	93.9%
		Unknown	25	22	88.0%
		Total	**9,927**	**9,182**	**92.5%**
	60+	Caucasian	1,865	1,768	94.8%
		African-American	73	67	91.8%
		Other	14	14	100.0%
		Unknown	5	5	100.0%
		Total	**1,957**	**1,854**	**94.7%**
	Unknown	Caucasian	5	5	100.0%
		African-American	1	1	100.0%
		Other	N/A	N/A	N/A
		Unknown	N/A	N/A	N/A
		Total	**6**	**6**	**100.0%**
	TOTAL		**15,872**	**14,664**	**92.4%**

Table 15. All Vehicles Statewide Demographic Summary (Continued)

Demographic Data			All Vehicles Safety Belt Use		
Gender	**Age**	**Race**	**Actual Total # of Obs.**	**Actual Belted # of Obs.**	**% Safety Belt Use**
Female	0 - 15	Caucasian	174	166	95.4%
		African-American	32	29	90.6%
		Other	12	12	100.0%
		Unknown	N/A	N/A	N/A
		Total	**218**	**207**	**95.0%**
	16 - 29	Caucasian	3,096	2,908	93.9%
		African-American	589	540	91.7%
		Other	124	117	94.4%
		Unknown	1	1	100.0%
		Total	**3,810**	**3,566**	**93.6%**
	30 - 59	Caucasian	6,487	6,189	95.4%
		African-American	1,015	943	92.9%
		Other	200	189	94.5%
		Unknown	15	15	100.0%
		Total	**7,717**	**7,336**	**95.1%**
	60+	Caucasian	1,566	1,510	96.4%
		African-American	77	74	96.1%
		Other	13	12	92.3%
		Unknown	1	0	0.0%
		Total	**1,657**	**1,596**	**96.3%**
	Unknown	Caucasian	5	5	100.0%
		African-American	N/A	N/A	N/A
		Other	N/A	N/A	N/A
		Unknown	1	1	100.0%
		Total	**6**	**6**	**100.0%**
	TOTAL		**13,408**	**12,711**	**94.8%**

In comparison to 2013, the 2014 Annual survey revealed a marginal increase in safety belt usage from 93.0 percent to 93.3 percent. Continued public awareness and enforcement efforts are warranted to further increase safety belt use. The careful evaluation of these media and enforcement efforts will allow for the identification of at-risk vehicle occupants and geographic areas prone to low belt use rates. As shown in this study, males and pick-up truck drivers continue to exhibit lower safety belt use rates. Generally, belt use was also lower among high population urban counties (e.g., Wayne and Genesee) and low population rural counties (e.g., several counties in stratum 3). These areas may be emphasized in subsequent programs aimed at increasing belt use.

7.2 Electronic Device Use Survey

As a part of the 2014 Annual observational survey of seatbelt use, cell phone use was also recorded for drivers only (passengers were not observed for cell phone use). A total of 2,000 drivers were observed using cell phones in some way and the overall weighted cell phone use rate was found to be 8.4%. The weighted cell phone use rate (shown in Table 16) was calculated using the same procedure as the weighted seatbelt rate described in the "Overall Statewide Safety Belt Calculations" section of the report. This rate represents a 0.6% increase from the 7.8% cell phone use rate observed in 2010 (the last time cell phone use was observed in Michigan). Nationally, the overall cell phone use rate by drivers was found to be 9.0% in 2012 [8], which is the last year for which national data is available. This indicates Michigan's cell phone use rate is close to the national average. In addition to overall cell phone use, Table 17 presents driver cell phone use by device type and use type.

Table 16. Statewide Weighted Cell Phone Use Rate for Drivers

Use by Category	Use Rate*	Standard Error
Overall Cell Phone Use	**8.4% ± 0.6%**	**0.3%**

* Weighted Safety Belt Usage ± 95% Confidence Band

Table 17. Statewide Unweighted Cell Phone Use Rates by Use Type

Use by Category	Total # of Driver Observations	Total # of Drivers Observed Using Cell Phone	Percent of Cell Phone Use by Type (Drivers)
Talking – Handheld Device	23,600	1,365	5.8%
Talking – Hands-free Device (Earpiece Observed)	23,600	53	0.2%
Talking – Hands-free Device (Earpiece Not Observed)	23,600	36	0.2%
Typing - Handheld	23,600	546	2.3%
Overall Cell Phone Use	**23,600**	**2,000**	**8.5%**

Table 18 summarizes cell phone use for drivers in terms of day of the week, time of the day, vehicle type, gender, age and race. Females are more likely to use a cell phone while driving than males (9.8 percent and 7.6 percent, respectively). The electronic device use rate was found to be highest between 6pm and 7pm at 12.3 percent, while the cell phone use rate was lowest between 9am and 10am (6.9 percent). Cell phone use among drivers less than 30 years of age was greatest at 11.2 percent, in comparison to 8.5 percent among those between ages 30 and 59 and 2.4 percent for drivers age 60 and above. African American drivers tended to exhibit higher cell phone use rates while driving as compared to other demographics.

Table 18. Cell Phone Use Statewide Summary

Day of the Week	All Vehicles Cell Phone Use		
	Total # of Driver Observations	Total # of Drivers Observed Using Cell Phone	Percent of Cell Phone Use (Drivers)
Sunday	2,929	187	6.4%
Monday	3,352	300	8.9%
Tuesday	2,634	261	9.9%
Wednesday	3,280	344	10.5%
Thursday	3,970	339	8.5%
Friday	3,541	284	8.0%
Saturday	3,894	285	7.3%
Total	**23,600**	**2,000**	**8.5%**
Time of the Day	**All Vehicles Cell Phone Use**		
	Total # of Driver Observations	**Total # of Drivers Observed Using Cell Phone**	**Percent of Cell Phone Use (Drivers)**
7 am - 8 am	1,173	103	8.8%
8 am - 9 am	1,801	152	8.4%
9 am - 10 am	1,417	98	6.9%
10 am - 11 am	2,874	238	8.3%
11 am - 12 pm	2,248	187	8.3%
12 pm - 1 pm	2,469	187	7.6%
1 pm - 2 pm	2,510	192	7.6%
2 pm - 3 pm	1,801	157	8.7%
3 pm - 4 pm	2,246	193	8.6%
4 pm - 5 pm	2,110	194	9.2%
5 pm - 6 pm	1,768	153	8.7%
6 pm - 7 pm	1,183	146	12.3%
Total	**23,600**	**2,000**	**8.5%**

Table 18. Cell Phone Use Statewide Summary (Continued)

Vehicle Type	All Vehicles Cell Phone Use		
	Total # of Driver Observations	Total # of Drivers Observed Using Cell Phone	Percent of Cell Phone Use (Drivers)
Passenger Cars	10,972	895	8.2%
Sport Utility	6,679	604	9.0%
Vans/ Minivans	2,390	220	9.2%
Pick-Up Trucks	3,555	281	7.9%
Unknown	4	0	0.0%
Total	**23,600**	**2,000**	**8.5%**
Gender	**All Vehicles Cell Phone Use**		
	Total # of Driver Observations	**Total # of Drivers Observed Using Cell Phone**	**Percent of Cell Phone Use (Drivers)**
Male	13,851	1,047	7.6%
Female	9,724	950	9.8%
Unknown	25	3	12.0%
Total	**23,600**	**2,000**	**8.5%**
Age	**All Vehicles Cell Phone Use**		
	Total # of Driver Observations	**Total # of Drivers Observed Using Cell Phone**	**Percent of Cell Phone Use (Drivers)**
16-29	5,957	665	11.2%
30-59	14,958	1,271	8.5%
60+	2,675	64	2.4%
Unknown	10	0	0.0%
Total	**23,600**	**2,000**	**8.5%**
Race	**All Vehicles Cell Phone Use**		
	Total # of Driver Observations	**Total # of Drivers Observed Using Cell Phone**	**Percent of Cell Phone Use (Drivers)**
Caucasian	20,276	1,662	8.2%
African American	2,659	277	10.4%
Other	617	56	9.1%
Unknown	48	5	10.4%
Total	**23,600**	**2,000**	**8.5%**

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APPENDIX I
Michigan Safety Belt Survey Cover Sheet and Data Collection Form

DIRECT OBSERVATION SURVEY COVER SHEET

Date: _____ - _____ - 2014 Observers Name:_____

Site Identification:

Site Location: _____

Site Number:_____

City_____County:_____Stratum_____

Alternate Site Information:

Is this an alternate site? No Yes
(Circle one)

If yes, please provide a reason for using an alternate site from the reserve list:

_____

Site Description:

Assigned traffic flow: North South East West

Number of lanes observed: _____

Total number of lanes in this direction: _____

Weather Conditions: Clear Light Fog Light Rain

Site Start and End Time (total obs. period must last EXACTLY 60 min):

Start time: _____am/pm End time: _____am/pm

Sample Sizes

60 Minute Volume Count (for lanes being observed): _____Vehicles

Number of Observations Recorded in 60 min: _____Vehicles

OBSERVATION DATA COLLECTION SHEET

SITE #________ OBSERVATION No.'s____ - ____ PAGE #_______

VEHICLE TYPE:			
☐Passenger Car	☐SUV	☐Van/Minivan	☐Pickup Truck
OBSERVABLE?	VEHICLE USE:	DRIVER CELL PHONE USE	
☐Vehicle NOT Observable	☐Non-Commercial ☐Commercial	☐Handheld (Talking) ☐Handheld (Typing)	☐Hands-free (E.P.) ☐Hands-free (NO E.P.)
DRIVER			
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐16-29	☐Male	☐White
☐Not Belted	☐30-59	☐Female	☐Black
☐Unknown	☐60+	☐Unknown	☐Other
	☐Unknown		☐Unknown
☐No Passenger	PASSENGER		
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐0 to 15	☐Male	☐White
☐Not Belted	☐16-29	☐Female	☐Black
☐Unknown	☐30-59	☐Unknown	☐Other
	☐60+		☐Unknown
	☐Unknown		

VEHICLE TYPE:			
☐Passenger Car	☐SUV	☐Van/Minivan	☐Pickup Truck
OBSERVABLE?	VEHICLE USE:	DRIVER CELL PHONE USE	
☐Vehicle NOT Observable	☐Non-Commercial ☐Commercial	☐Handheld (Talking) ☐Handheld (Typing)	☐Hands-free (E.P.) ☐Hands-free (NO E.P.)
DRIVER			
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐16-29	☐Male	☐White
☐Not Belted	☐30-59	☐Female	☐Black
☐Unknown	☐60+	☐Unknown	☐Other
	☐Unknown		☐Unknown
☐No Passenger	PASSENGER		
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐0 to 15	☐Male	☐White
☐Not Belted	☐16-29	☐Female	☐Black
☐Unknown	☐30-59	☐Unknown	☐Other
	☐60+		☐Unknown
	☐Unknown		

VEHICLE TYPE:			
☐Passenger Car	☐SUV	☐Van/Minivan	☐Pickup Truck
OBSERVABLE?	VEHICLE USE:	DRIVER CELL PHONE USE	
☐Vehicle NOT Observable	☐Non-Commercial ☐Commercial	☐Handheld (Talking) ☐Handheld (Typing)	☐Hands-free (E.P.) ☐Hands-free (NO E.P.)
DRIVER			
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐16-29	☐Male	☐White
☐Not Belted	☐30-59	☐Female	☐Black
☐Unknown	☐60+	☐Unknown	☐Other
	☐Unknown		☐Unknown
☐No Passenger	PASSENGER		
BELT USE:	AGE:	GENDER:	RACE:
☐Belted	☐0 to 15	☐Male	☐White
☐Not Belted	☐16-29	☐Female	☐Black
☐Unknown	☐30-59	☐Unknown	☐Other
	☐60+		☐Unknown
	☐Unknown		

APPENDIX II
Resume of Peter T. Savolainen

Dr. Peter T. Savolainen

Summary

Dr. Peter T. Savolainen is an Associate Professor in the Wayne State University (WSU) Department of Civil and Environmental Engineering and part of the WSU-Transportation Research Group (WSU-TRG). As a member of the WSU-TRG, he has more than 6 years of experience with direct observation surveys of safety restraint use. This includes a diverse range of experiences in sample design and selection, data weighting, imputation, variance estimation, statistical systems development, and optimization techniques. He also has expertise in the areas of survey research methodology, data processing, and statistical quality control. Dr. Savolainen also teaches graduate level courses on civil engineering research methods and applications, as well as statistics and econometric methods of data analysis. He is a proficient user of various statistical analysis software packages, including LIMDEP, SAS, SPSS, and SUDAAN.

Education

Ph.D., Civil Engineering, Purdue University, 2006
M.A., Civil Engineering, Purdue University, 2004
B.S., Civil Engineering, Michigan Technological University, 2002

Professional Associations

American Society of Civil Engineers
American Statistical Association
Institute of Transportation Engineers

Computer Skills

Operation Systems: Windows, iOs
Software: LIMDEP, SAS, SPSS, SUDAAN, Microsoft PowerPoint, Excel and Word

Relevant Project Experience

Wayne State University (2006 to Present)

Direct Observation Surveys of Seat Belt Use –PI or co-PI on Michigan seat belt use survey, sponsored by funding through the Michigan Office of Highway Safety Planning (OHSP), from FY 2008 to 2010 and FY 2012 to present. Participated in proposal, planning, survey implementation, data collection, quality control, data analysis, and report preparation.

Direct Observation Surveys of Commercial Motor Vehicle Seat Belt Use – Co-PI on OHSP-sponsored Michigan seat belt use survey for commercial motor vehicle occupants during FY 2012.

Direct Observation Surveys of Booster Seat Use – PI on OHSP-sponsored Michigan booster seat use survey from FY 2009 to 2011 and in FY 2013.

Direct Observation Surveys of Child Restraint Device Use and Misuse – PI or co-PI on OHSP-sponsored child restraint device use/misuse survey in FY 2009, 2011, and 2013.

Direct Observation Surveys of Motorcycle Helmet Use – PI on OHSP-sponsored motorcycle helmet use survey in FY 2013.

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APPENDIX III

List of Observation Locations by County, Stratum, and Road Classification Including Belt Use Observation Data

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
1	Ingham	I- 96 Bus and N Martin Luther King Jr Blvd	Original	Primary	95	91	75133.5
1	Ingham	E Saginaw St and Hagadorn Rd	Original	Primary	148	147	213579.9
1	Ingham	US Hwy 127 and N Cedar St	Original	Primary	121	117	72801.8
1	Kalamazoo	W Kalamazoo Ave and N Rose St	Original	Primary	167	162	87263.4
1	Kalamazoo	E Michigan Ave and N Edwards St	Original	Primary	163	160	253020.1
1	Kalamazoo	I- 94 and E Cork St	Original	Primary	121	113	38064.6
1	Kalamazoo	I- 94 and S Kalamazoo St	Original	Primary	248	237	89381.5
1	Oakland	I- 96 and 8 Mile Rd	Original	Primary	177	144	76168.6
1	Oakland	I- 96 and Milford Rd	Original	Primary	136	127	38722.0
1	Oakland	I- 696 and Orchard Lake Rd	Original	Primary	237	211	194298.3
1	Oakland	I- 75 and Joslyn Rd	Original	Primary	238	227	136718.3
1	Washtenaw	I- 94 and Kalmbach Rd.	Original	Primary	21	19	30381.9
1	Washtenaw	US Hwy 12 and S Huron St	Original	Primary	162	152	120507.9
1	Washtenaw	US Hwy 12 and S Huron St	Original	Primary	260	245	100888.3
1	Washtenaw	I- 94 Bus and N Maple Rd	Original	Primary	177	158	83798.3
1	Ingham	State Hwy 99 and W Holmes Rd	Original	Secondary	130	117	113245.6
1	Ingham	Lansing Rd and W Mt Hope Hwy	Original	Secondary	73	69	178244.2
1	Ingham	E Saginaw St and N Larch St	Original	Secondary	135	125	276710.2
1	Ingham	State Hwy 43 and Marsh Rd	Original	Secondary	185	183	113776.5
1	Ingham	S Martin Luther King Jr Blvd and W Jolly Rd	Original	Secondary	174	165	91995.7
1	Ingham	Eaton Rapids Rd and Bishop Rd	Original	Secondary	170	163	77928.4
1	Ingham	State Hwy 52 and N Clinton St	Original	Secondary	121	112	62633.0
1	Kalamazoo	State Hwy 43 and Solon St	Original	Secondary	213	211	140639.6
1	Kalamazoo	US Hwy 131 and W Centre Ave	Original	Secondary	76	74	45373.3
1	Kalamazoo	State Hwy 43 and M 40	Original	Secondary	152	150	51752.6
1	Kalamazoo	E Michigan Ave and 35th St N	Original	Secondary	129	121	137577.2
1	Kalamazoo	E C Ave and 32nd St N	Original	Secondary	39	35	36061.4
1	Oakland	Woodward Ave and W Big Beaver Rd	Original	Secondary	277	266	365243.5
1	Oakland	State Hwy 10 and W 13 Mile Rd	Original	Secondary	177	166	189748.7
1	Oakland	Northwestern Hwy and Orchard Lake Rd	Original	Secondary	205	191	86600.4
1	Oakland	State Hwy 15 and E Seymour Lake Rd	Original	Secondary	176	148	141069.5
1	Oakland	State Hwy 5 and W 8 Mile Rd	Original	Secondary	163	159	219033.8
1	Oakland	Telegraph Rd and W Maple Rd	Original	Secondary	197	190	256226.0
1	Oakland	Dixie Hwy and Williams Lake Rd	Original	Secondary	205	189	125887.2
1	Oakland	S Main St and E University Dr	Original	Secondary	293	276	139746.8
1	Oakland	State Hwy 150 and E Avon Road	Original	Secondary	245	230	245155.8
1	Oakland	Lapeer Rd and Dutton Rd	Original	Secondary	200	183	187207.9
1	Oakland	State Hwy 59 and Hickory Ridge Rd	Original	Secondary	192	184	193671.5
1	Oakland	State Hwy 5 and W 13 Mile Rd	Original	Secondary	220	208	280229.7
1	Oakland	Woodward Ave and W 12 Mile Rd	Original	Secondary	285	261	363952.5
1	Washtenaw	US Hwy 23 and Washtenaw Ave	Original	Secondary	116	114	85086.4
1	Washtenaw	W Michigan Ave and N Ann Arbor St	Original	Secondary	110	107	38649.6
1	Washtenaw	Ann Arbor Hill and E Main St	Original	Secondary	143	134	42849.1
1	Washtenaw	W Michigan Ave and Platt Rd	Original	Secondary	150	135	242434.1
1	Washtenaw	State Hwy 52 and E Old US-12	Original	Secondary	237	219	123560.8
1	Ingham	N Waverly Rd and Columbia Hwy	Original	Local	39	38	1429994.0
1	Oakland	Heslip Dr and W 9 Mile Rd	Original	Local	52	49	1389137.0
1	Oakland	N Glenwood Ave. and N Perry Street	Original	Local	195	182	4150873.6
1	Oakland	White Pines Dr and Beck Road	Original	Local	31	26	1389137.0
1	Washtenaw	E Arkona Rd and Dexter St	Original	Local	89	79	1571318.9

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
2	Allegan	US Hwy 31 and M 89	Original	Primary	70	70	62514.6
2	Bay	I- 75 and E Pinconning Rd	Original	Primary	46	44	64251.1
2	Bay	US Hwy 10 and W Midland Rd	Original	Primary	54	53	67088.9
2	Calhoun	I- 69 and M 60 E	Original	Primary	50	45	62514.6
2	Calhoun	I- 194 and E Columbia Ave	Original	Primary	157	150	228735.7
2	Eaton	I- 96 and W Saginaw Hwy	Original	Primary	141	138	76237.3
2	Eaton	I- 69 and E Clinton Trail	Original	Primary	93	91	62514.6
2	Jackson	I- 94 and 28 Mile Rd	Original	Primary	78	74	74578.9
2	Kent	I- 96 and E Beltline Ave NE	Original	Primary	217	210	227147.4
2	Kent	I- 96 and 28th St SE	Original	Primary	173	172	216266.8
2	Kent	I- 96 and Walker Ave NW	Original	Primary	133	128	212549.7
2	Livingston	I- 96 and Fowlerville Rd	Original	Primary	102	97	82097.5
2	Monroe	Detroit-Toledo Expy and Luna Pier Rd	Original	Primary	41	40	66192.0
2	Monroe	I- 75 and S Otter Creek Rd	Original	Primary	42	36	74341.7
2	Ottawa	I- 196 and Adams St	Original	Primary	130	123	72733.4
2	Allegan	Viaduct Rd and Cenrtal Ave	Original	Secondary	206	195	167536.8
2	Allegan	Lincoln Rd and Monroe Rd	Original	Secondary	24	23	235325.1
2	Allegan	US Hwy 131 and W Superior St	Original	Secondary	293	280	133580.4
2	Bay	Bay Glad Rd and W Neuman Rd	Original	Secondary	7	6	37955.7
2	Bay	State Hwy 13 and W Thomas St	Original	Secondary	227	196	367784.3
2	Bay	State Hwy 138 and S Tuscola Rd	Original	Secondary	7	5	75911.3
2	Calhoun	W Dickman Rd and Hill Brady Rd N	Original	Secondary	143	135	194644.4
2	Calhoun	M 66 and E Burr Oak Rd	Original	Secondary	152	143	130638.1
2	Eaton	N Michigan Rd and Holt Hwy	Original	Secondary	116	110	131555.1
2	Eaton	State Hwy 50 and E Lawrence Ave	Original	Secondary	145	141	94889.2
2	Eaton	W Capital Ave and S Main St	Original	Secondary	218	200	107962.8
2	Eaton	W Grand Ledge Hwy and Charlotte St	Original	Secondary	67	63	75911.3
2	Grand Traverse	State Hwy 72 and N Division St	Original	Secondary	224	211	295163.6
2	Grand Traverse	US Hwy 31 and M 72	Original	Secondary	175	165	341601.0
2	Jackson	US Hwy 127 Bus and Washington St	Original	Secondary	167	159	153588.0
2	Jackson	State Hwy 50 and US-127	Original	Secondary	221	215	162115.7
2	Jackson	S Meridian Rd and Jefferson Rd	Original	Secondary	288	272	508644.4
2	Jackson	N Main St and Chicago St	Original	Secondary	249	233	131502.9
2	Kent	17 Mile Rd NE and Algoma Ave NE	Original	Secondary	130	123	110613.6
2	Kent	Wilson Ave SW and Burton St SW	Original	Secondary	116	113	241791.6
2	Kent	State Hwy 11 and 3 Mile Rd NW	Original	Secondary	160	148	118447.8
2	Kent	State Hwy 6 and Broadmore Ave SE	Original	Secondary	94	90	115017.2
2	Livingston	US Hwy 23 and White Lake Rd	Original	Secondary	87	82	112167.5
2	Livingston	E State Hwy 36 and Chilson Rd	Original	Secondary	216	186	246603.4
2	Midland	Isabella Rd and S Meridian Rd	Original	Secondary	178	168	231502.6
2	Monroe	W Monroe St and Riley St/Main St	Original	Secondary	166	158	230691.6
2	Monroe	US Hwy 23 and Tecumseh St	Original	Secondary	115	111	168603.0
2	Monroe	State Hwy 50 and Ridge Hwy	Original	Secondary	96	92	157977.6
2	Ottawa	State Hwy 45 and W Olive Rd	Original	Secondary	71	67	87690.7
2	Ottawa	Chicago Dr and Balsam Dr	Original	Secondary	153	146	250507.4
2	Allegan	34th St and 128th Ave	Original	Local	7	7	4882102.8
2	Calhoun	E Dr N and 9 Mile Rd	Original	Local	16	12	2441051.4
2	Jackson	Springport Rd and Parma Rd	Original	Local	7	4	4882102.8
2	Kent	Whistlevale Dr and 76th St SW	Original	Local	4	3	2441051.4
2	Midland	Foster Rd and E Wheeler St	Original	Local	47	38	2560052.7

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
3	Berrien	I- 94 and Sawyer Rd	Original	Primary	104	103	90645.2
3	Berrien	US Hwy 31 and E Napier Ave	Original	Primary	209	200	322691.1
3	Berrien	I- 196 and Hagar Shore Rd	Original	Primary	53	49	79416.3
3	Branch	I- 69 and Chicago St	Original	Primary	179	175	102141.6
3	Clare	US Hwy 127 and Clare Rd	Original	Primary	44	40	79876.1
3	Clare	US Hwy 127 and E Colonville Rd	Original	Primary	177	172	133370.4
3	Genesee	I- 69 and Grand River Rd	Original	Primary	35	33	80048.3
3	Genesee	I- 75 and W Pierson Rd	Original	Primary	214	183	326715.6
3	Saginaw	US Hwy 23 and Dixie Highway	Original	Primary	91	77	82626.1
3	Saginaw	US Hwy 23 and Dixie Highway	Original	Primary	235	209	224442.6
3	Shiawassee	I- 69 and State Hwy 71	Original	Primary	80	71	105416.3
3	St. Clair	I- 94 and Fred W Moore Highway	Original	Primary	73	71	162371.2
3	St. Clair	I- 94 and Gratiot Rd	Original	Primary	147	138	189151.1
3	St. Clair	I- 94 and Gratiot Rd	Original	Primary	120	116	87541.0
3	Van Buren	I- 196 and 32nd Ave	Original	Primary	27	25	77380.0
3	Lapeer	N Branch Rd and N Van Dyke	Original	Secondary	61	57	76343.8
3	Lenawee	US Hwy 12 and M-52	Original	Secondary	182	176	209945.5
3	Lenawee	State Hwy 52 and W Monroe Rd	Original	Secondary	126	125	285722.4
3	Lenawee	State Hwy 156 and W Carleton Rd	Original	Secondary	83	76	155366.4
3	Montcalm	N Greenville Rd and W Howard City Edmore Rd	Original	Secondary	123	110	207333.7
3	Montcalm	State Hwy 46 and Holland Rd	Original	Secondary	181	166	241848.3
3	Montcalm	State Hwy 66 and W Stanton Rd	Original	Secondary	162	140	186088.1
3	Montcalm	Greenville Rd and E Vandeinse Rd	Original	Secondary	218	192	467850.6
3	Muskegon	E Apple Ave and S Maple Island Rd	Original	Secondary	169	155	312646.1
3	Newaygo	S Charles St and E Baseline Rd	Original	Secondary	106	95	172682.4
3	Newaygo	State Hwy 20 and N Evergreen Dr	Original	Secondary	132	121	193196.6
3	Newaygo	State Hwy 82 and Mason Dr	Original	Secondary	150	137	217124.6
3	Newaygo	Evergreen Dr and Curve St	Original	Secondary	106	101	483510.8
3	Saginaw	State Hwy 52 and E 2nd St	Original	Secondary	115	100	180010.7
3	Saginaw	Oakley Rd and W Brady Rd	Original	Secondary	138	125	173136.9
3	Saginaw	N Main St and E Holland Rd	Original	Secondary	87	81	261750.2
3	Saginaw	Vassar Rd and E Washington Rd	Original	Secondary	74	67	288136.3
3	Saginaw	State Hwy 81 and N Portsmouth Rd	Original	Secondary	88	84	295196.1
3	Sanilac	State Hwy 53 and W Marlette Rd	Original	Secondary	139	130	68778.2
3	Sanilac	State Hwy 46 and N Van Dyke Rd	Original	Secondary	91	87	101791.8
3	Sanilac	State Hwy 19 and Maple Valley St.	Original	Secondary	215	210	378630.0
3	Sanilac	S Elk St and E Sanilac Rd	Original	Secondary	132	126	189391.4
3	Sanilac	State Hwy 46 and S Lakeshore Rd	Original	Secondary	51	50	156157.8
3	Shiawassee	S M 52 and W Lansing Rd	Original	Secondary	79	73	1351054.2
3	St. Clair	State Hwy 29 and Bethuy Rd	Original	Secondary	146	136	519837.3
3	St. Clair	Gratiot Blvd and Huron Blvd	Original	Secondary	367	344	678294.6
3	St. Clair	Beard Rd and North Rd	Original	Secondary	119	109	80448.3
3	St. Joseph	US Hwy 12 and M-62	Original	Secondary	153	143	418477.2
3	St. Joseph	US Hwy 131 N and N Washington St	Original	Secondary	68	66	93139.5
3	St. Joseph	State Hwy 66 and S Centerville Rd	Original	Secondary	231	229	315727.0
3	Ionia	Button Rd and N Whites Bridge Rd	Original	Local	30	21	8644895.7
3	Lenawee	Rodesiler Hwy and Yankee Rd	Original	Local	11	10	4322447.8
3	Muskegon	Shoreline Dr and Terrace St	Original	Local	213	197	18888847.2
3	Saginaw	N Michigan Rd and Tittabawassee Rd	Original	Local	151	142	12999361.7
3	Shiawassee	Lemon Rd and E Newburg Rd	Original	Local	2	0	8644895.7

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
4	Macomb	Ford Fwy and N River Rd	Original	Primary	172	171	55958.7
4	Macomb	I- 696 and Hoover Rd	Original	Primary	323	296	76825.7
4	Macomb	Walter P Reuther Fwy and Gratiot Ave	Original	Primary	146	129	129440.5
4	Macomb	Ford Fwy and Little Mack Ave	Original	Primary	167	160	58274.1
4	Wayne	Detroit Toledo Fwy and West Rd	Original	Primary	108	98	61552.0
4	Wayne	Edsel Ford Fwy and Vernier Rd/ M-102	Original	Primary	236	224	62870.0
4	Wayne	Walter P Chrysler Fwy and Caniff St.	Original	Primary	178	150	58316.0
4	Wayne	I- 275 and S Huron Rd.	Original	Primary	153	148	33590.1
4	Wayne	I- 275 and Ford Rd	Original	Primary	172	157	143937.1
4	Wayne	I- 94 and Wayne Road	Original	Primary	152	133	39496.9
4	Wayne	Detroit Industrial Expy and Belleville Rd	Original	Primary	238	220	65484.3
4	Wayne	I- 94 and Middlebelt Rd	Original	Primary	164	157	111150.7
4	Wayne	I- 75 and Northline Rd	Original	Primary	220	210	44689.6
4	Wayne	I- 75 and Charter St	Original	Primary	135	122	39716.9
4	Wayne	Walter P Chrysler Fwy and Mack Ave	Original	Primary	177	164	62371.3
4	Macomb	State Hwy 53 and 23 Mile Rd	Original	Secondary	204	197	31728.1
4	Macomb	State Hwy 53 Byp and Van Dyke Rd	Original	Secondary	188	185	136325.1
4	Macomb	State Hwy 53 Byp and 32 Mile Rd	Original	Secondary	205	194	119834.6
4	Macomb	State Hwy 53 and S Van Dyke Rd	Original	Secondary	141	130	144665.5
4	Macomb	State Hwy 59 and N Groesbeck Hwy/North Ave	Original	Secondary	182	178	272673.5
4	Macomb	20 Mile Rd and Romeo Plank Rd	Original	Secondary	239	230	440063.4
4	Macomb	Hall Rd and Schoenherr Rd	Original	Secondary	183	179	738906.6
4	Macomb	State Hwy 19 and 32 Mile Rd/Division Rd	Original	Secondary	264	258	71685.4
4	Macomb	Van Dyke Ave and 12 Mile Rd	Original	Secondary	259	248	161821.0
4	Macomb	Earl Memorial Hwy and E 14 Mile Rd	Original	Secondary	262	227	171854.6
4	Macomb	Van Dyke Ave and 15 Mile Rd	Original	Secondary	242	223	218919.7
4	Macomb	Metro Pkwy Crossover and Curwood Dr	Original	Secondary	83	79	16490.7
4	Macomb	Gratiot Ave and 14 Mile Rd	Original	Secondary	210	199	325113.1
4	Macomb	S Gratiot Ave and 15 Mile Rd	Original	Secondary	183	178	305752.0
4	Macomb	State Hwy 3 and 10 Mile Rd	Original	Secondary	220	200	272525.0
4	Wayne	US Hwy 24 and Van Horn Rd	Original	Secondary	171	159	92796.9
4	Wayne	Fort St and Van Horn Rd	Original	Secondary	206	197	109506.7
4	Wayne	State Hwy 85 and Sibley Rd	Original	Secondary	197	185	165154.0
4	Wayne	Woodward Ave and 7 Mile Rd	Original	Secondary	176	158	301624.8
4	Wayne	State Hwy 10 and 7 Mile Rd	Original	Secondary	181	160	60805.3
4	Wayne	Grand River Ave and Fenkell St	Original	Secondary	150	129	53044.4
4	Wayne	Grand River Ave and Beech-Daly Rd	Original	Secondary	222	204	213570.5
4	Wayne	Michigan Ave and Oakwood Blvd	Original	Secondary	113	107	143988.3
4	Wayne	US Hwy 12 and Venoy Rd	Original	Secondary	118	108	139126.6
4	Wayne	State Hwy 153 and N Wayne Rd	Original	Secondary	172	157	225092.9
4	Wayne	Telegraph Rd and Wick Rd	Original	Secondary	335	307	246697.3
4	Wayne	S Telegraph Rd and Van Born Rd	Original	Secondary	257	230	317323.2
4	Wayne	Michigan Ave and Evergreen Rd	Original	Secondary	228	205	167704.5
4	Wayne	State Hwy 39 and Oakwood Blvd	Original	Secondary	189	180	69494.8
4	Wayne	State Hwy 3 and Grand Blvd W	Original	Secondary	128	116	143052.4
4	Macomb	Hiawatha Dr and Jewell Rd	Original	Local	60	59	1318696.0
4	Macomb	Beacon Square Dr and 21 Mile Rd	Original	Local	96	89	1408679.8
4	Macomb	Pinehurst and Martin Rd	Original	Local	30	24	1205015.3
4	Wayne	Pinewood Ave and Hoover St	Original	Local	7	6	1205015.3
4	Wayne	Prevost St and Grand River Ave	Original	Local	3	2	2410030.6