2016 POST-CLICK IT OR TICKET DIRECT OBSERVATION SURVEY OF SAFETY BELT AND HAND-HELD DEVICE USE

Prepared for:
Michigan Office of Highway Safety Planning
Lansing, MI

Prepared by:
Michigan State University
East Lansing, MI

MICHIGAN OHSP Office of Highway Safety Planning

Date: August 2016

MICHIGAN STATE UNIVERSITY

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16. Abstract:
This report documents the results of the 2016 Post-Click It or Ticket Direct Observation Survey of Safety Belt and Hand-Held Device 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 June 2016. 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, and hand-held device use for each observed driver. The results of this survey show the safety belt usage rate in the state of Michigan is 94.5 percent. This represents an overall increase from the 92.8 percent use rate in 2015. Males and younger occupants, specifically those in pick-up trucks, continue to exhibit lower belt use rates. The observed rate of hand-held device use by all vehicle drivers is 7.5 percent which represents a marginal 0.1 percentage point decrease from the 7.6 percent device use rate observed in 2015.

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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 the first half of 2015, a statistical projection estimated 16,225 passenger vehicle occupants were killed in traffic crashes in the United States; an increase of 8.1 percent compared with 2014 [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 2014 alone, safety belts saved approximately 12,802 passenger vehicle occupants over the age of 5 [2]. A recent study conducted by the National Highway Traffic Safety Administration (NHTSA) on the economic and societal impacts of motor vehicle crashes states "The comprehensive societal benefits from safety belt use are enormous" [3]. In fact, this study found that from 1975 to 2010, safety belts have prevented $7.6 trillion in societal harm as measured by comprehensive costs, and are currently preventing $330 billion in societal harm annually [3]. Additionally, 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 2015 nationwide safety belt survey, 88.5 percent of drivers and right-front passengers use safety belts, which is a 1.8 percent increase from the 86.7 percent observed in 2014 [5]. The Midwest region as a whole showed an 81.7 percent safety belt use rate in 2015, slightly down from the 82.6 percent safety belt use rate observed in 2014 [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 2015 use rate was 92.8 percent, making Michigan one of 20 states with safety belt use rates higher than 90 percent [6]. It is important to recognize Michigan is currently one of the thirty-four "primary law" states, 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]. The most recent available national statistics (2015) indicate that states with primary safety belt laws exhibited an average use rate of 91.2 percent, which is 12.6 percent higher than the 78.6 percent exhibited by states without primary safety belt laws [5].

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 Post Click-It or Ticket (CIOT) 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 2016 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 2016 safety belt survey.

2.1 Design of Study

Michigan is comprised of 83 counties; 40 of which account for about 85 percent of the passenger vehicle crash-related fatalities according to FARS data averages for the years 2005 to 2009. Therefore, observation locations from within these 40 counties were eligible to be 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 safety 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 hand-held devices was also collected. This included information on 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.
Not belted	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, short-term road work or maintenance, 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 or closed for long-term construction, 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: performing observational surveys at the assigned location, in the assigned direction, during the assigned time period, completing the cover sheet and observation forms correctly, making accurate observations of safety belt use within an appropriate number of lanes.

3.0 SELECTION OF OBSERVATION SURVEY 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 Michigan State University (see Appendix II for the resume of the Principal Investigators, Dr. Timothy Gates and 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. FARS data were used to determine the average number of crash-related fatalities per county. It was determined 40 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.

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.

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

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 Safety 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.

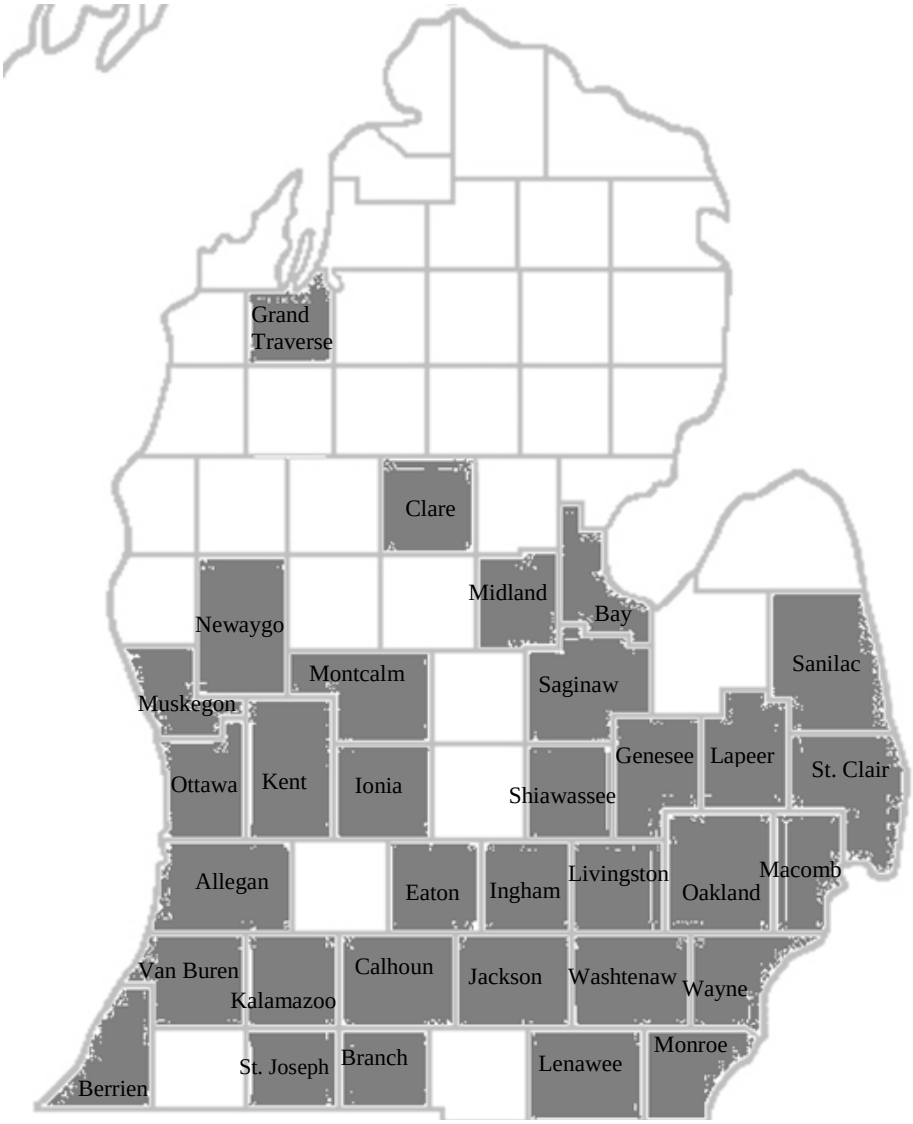

Figure 1: 33-County Statewide Sample for the Direct Observation Safety Belt Surveys

3.1 Sample Size and Precision

A standard error of less than 2.5 percent for the safety belt use estimates is required by the Final Rule. Since 1999, Michigan has conducted the Michigan Annual Safety Belt Use Study, and has historically obtained standard errors below this threshold (e.g. most recently 0.4 percent in 2015) via observed sample sizes of approximately 25,000 vehicles. Since the proposed design for the 2016 Post-CIOT survey was identical to the 2015 survey, it was expected that the sample size for the 2016 Post-CIOT Survey would be similar to the 2015 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 PPS using segment length as the measure of selection (MOS).

As such, the inclusion probability for a specific road segment is:

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

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

$$\sum_{\forall h} l_h$$

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 $\sum_{\forall h} l_h / n_{gc}$), 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 $\sum_{\forall h} l_h / n_{go}$. 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.

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 safety 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.

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

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 GPS coordinates were determined for the approximate location at which the observer was to stand. The GPS coordinates also allowed for efficient navigation to each observation site to assist the data collectors and QC monitors 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 safety 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 hand-held device use. The categories included 'handheld (talking)', 'handheld (typing)', 'hands-free (ear piece)', and hands-free (no ear piece)'. For cases where a driver was observed to be using a 'hands-free' 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 Investigators from MSU and 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 MSU and 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 MSU and was attended by both MSU and WSU staff. The training program began approximately four weeks prior to the first data collection period and included both lecture and classroom and field exercises, with repeated field training in the weeks leading up to the survey. 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 MSU campus. QC monitors were 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 weeks leading up to full-scale survey implementation.

The reliability and repeatability studies were performed at various intersections near the MSU and WSU campuses, as well as additional locations in mid and southeast 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.

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 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 Post-CIOT 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.

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), GPS coordinates, 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 hand-held device 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 hand-held device 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:

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

6.3 Non-Responding Site Adjustment

There were no sites which required 'non-responding' adjustment in the 2016 Post-CIOT Direct Observation Survey of Safety Belt Use.

6.4 Estimators

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

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

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:

$$p_{L_{gh}} = \frac{\sum_{all\ tfkimn\ in\ gh} w_{tfkim|gh} Length_{ght} y_{ghtfkimn}}{\sum_{all\ tfkimn\ in\ gh} w_{tfkim|gh} Length_{ght}}$$

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	7,576,298	11,371,893	2,217,122	**21,165,313**
2	7,517,022	11,617,548	1,809,337	**20,943,907**
3	5,985,436	13,303,119	2,198,301	**21,486,856**
4	7,604,025	11,167,232	2,343,003	**21,114,260**
Statewide	**28,682,781**	**47,459,792**	**8,567,763**	**84,710,336**

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. VMT data were obtained from the Michigan Highway Performance Monitoring System (HPMS) for the most recent year available (2013).

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 416 non-response observations which represents approximately 1.2 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 Post-CIOT Direct Observation Survey was performed between Monday, June 6 and Sunday, June 19, 2016. During this observation period, a total of 28,166 vehicles were observed resulting in 35,412 driver and right-front passenger observations at the 200 observation sites randomly selected to represent statewide safety belt use.

7.1 Safety Belt Survey Results and Conclusions

The overall weighted statewide safety belt use rate for Michigan was found to be 94.5 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
Post-Click It or Ticket Observational Survey	94.5% ± 0.4%	0.2%

* 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 daytime hours (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 No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Drivers	28,141	26,632	94.6%
Passengers	7,271	6,869	94.5%
Total	**35,412**	**33,501**	**94.6%**

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

Day of the Week	Post-CIOT 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	22	11.0%	4,897	13.8%
Monday	25	12.5%	4,571	12.9%
Tuesday	25	12.5%	3,670	10.4%
Wednesday	29	14.5%	4,265	12.0%
Thursday	36	18.0%	5,885	16.6%
Friday	29	14.5%	5,327	15.0%
Saturday	34	17.0%	6,797	19.2%
Total	**200**	**100.0%**	**35,412**	**100.0%**
Time of the Day	**Post-CIOT Safety Belt Observations**			
	No. of Sites Observed	**Percent of Sites in Time of Day**	**Actual Total No. of Observations (Occupants)**	**Percent of Observations in Day of Week (Occupants)**
7 am – 8 am	8	4.0%	1362	3.8%
8 am – 9 am	14	7.0%	2329	6.6%
9 am – 10 am	15	7.5%	2189	6.2%
10 am – 11 am	23	11.5%	4227	11.9%
11 am – 12 pm	20	10.0%	3353	9.5%
12 pm – 1 pm	21	10.5%	3577	10.1%
1 pm – 2 pm	22	11.0%	3788	10.7%
2 pm – 3 pm	19	9.5%	3094	8.7%
3 pm – 4 pm	17	8.5%	3548	10.0%
4 pm – 5 pm	16	8.0%	2993	8.5%
5 pm – 6 pm	16	8.0%	3381	9.5%
6 pm – 7 pm	9	4.5%	1571	4.4%
Total	**200**	**100.0%**	**35,412**	**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. These rates 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 No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Ingham County	1,962	1,845	94.0%
Kalamazoo County	1,905	1,753	92.0%
Oakland County	4,356	4,138	95.0%
Washtenaw County	1,741	1,642	94.3%
Total	**9,964**	**9,378**	**94.1%**
STRATUM 2	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Allegan County	819	780	95.2%
Bay County	416	402	96.6%
Calhoun County	697	657	94.3%
Eaton County	977	943	96.5%
Grand Traverse County	599	582	97.2%
Jackson County	1,112	1,069	96.1%
Kent County	1,637	1,557	95.1%
Livingston County	433	419	96.8%
Midland County	296	277	93.6%
Monroe County	799	777	97.2%
Ottawa County	471	457	97.0%
Total	**8,256**	**7,920**	**95.9%**
STRATUM 3	Actual Total No. of Observations.	Actual Belted No. of Observations	% Safety Belt Use
Berrien County	448	426	95.1%
Branch County	181	178	98.3%
Clare County	364	349	95.9%
Genesee County	376	336	89.4%
Ionia County	52	47	90.4%
Lapeer County	52	50	96.2%
Lenawee County	328	307	93.6%
Montcalm County	930	839	90.2%
Muskegon County	414	393	94.9%
Newaygo County	625	580	92.8%
Saginaw County	1,233	1,148	93.1%
Sanilac County	828	761	91.9%
Shiawassee County	342	322	94.2%
St. Clair County	1,164	1,097	94.2%
St. Joseph County	468	442	94.4%
Van Buren County	26	25	96.2%
Total	**7,831**	**7,300**	**93.2%**
STRATUM 4	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Macomb County	3,637	3,464	95.2%
Wayne County	5,724	5,439	95.0%
Total	**9,361**	**8,903**	**95.1%**
Grand Total (Unweighted)	**35,412**	**33,501**	**94.6%**

Stratum 2 displayed the highest safety belt use rate, followed closely by Strata 1 and 4. Consistent with recent surveys, Stratum 3 displayed the lowest safety belt use rate at 93.2 percent. 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 Post-CIOT Observation Survey.

Table 10. All Vehicles Statewide Summary

Day of the Week	All Vehicle Safety Belt Use		
	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Sunday	4,897	4,660	95.2%
Monday	4,571	4,342	95.0%
Tuesday	3,670	3,477	94.7%
Wednesday	4,265	4,011	94.0%
Thursday	5,885	5,588	95.0%
Friday	5,327	4,973	93.4%
Saturday	6,797	6,450	94.9%
Total	**35,412**	**33,501**	**94.6%**
Time of the Day	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
7 am – 8 am	1,362	1,292	94.9%
8 am – 9 am	2,329	2,210	94.9%
9 am – 10 am	2,189	2,065	94.3%
10 am – 11 am	4,227	4,001	94.7%
11 am – 12 pm	3,353	3,199	95.4%
12 pm – 1 pm	3,577	3,390	94.8%
1 pm – 2 pm	3,788	3,577	94.4%
2 pm – 3 pm	3,094	2,895	93.6%
3 pm – 4 pm	3,548	3,343	94.2%
4 pm – 5 pm	2,993	2,825	94.4%
5 pm – 6 pm	3,381	3,201	94.7%
6 pm – 7 pm	1,571	1,503	95.7%
Total	**35,412**	**33,501**	**94.6%**
Vehicle Type	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Passenger Cars	14,413	13,616	94.5%
Sport Utility Vehicles	11,425	10,958	95.9%
Vans/Minivans	3,825	3,650	95.4%
Pick-Up Trucks	5,749	5,277	91.8%
Total	**35,412**	**33,501**	**94.6%**
Gender	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Male	19,060	17,824	93.5%
Female	16,312	15,641	95.9%
Unknown	40	36	90.0%
Total	**35,412**	**33,501**	**94.6%**
Age	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
0 - 15	547	522	95.4%
16 - 29	7,904	7,416	93.8%
30 - 59	21,801	20,631	94.6%
60+	5,133	4,905	95.6%
Unknown	27	27	100.0%
Total	**35,412**	**33,501**	**94.6%**
Race	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Caucasian	30,010	28,424	94.7%
African-American	4,004	3,725	93.0%
Other	1,357	1,313	96.8%
Unknown	41	39	95.1%
Total	**35,412**	**33,501**	**94.6%**

Table 11. Passenger Cars Statewide Summary

Passenger Cars Safety Belt Use			
Day of the Week	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Sunday	2,197	2,075	94.4%
Monday	1,963	1,871	95.3%
Tuesday	1,610	1,524	94.7%
Wednesday	1,705	1,592	93.4%
Thursday	2,145	2,039	95.1%
Friday	1,859	1,732	93.2%
Saturday	2,934	2,783	94.9%
Total	**14,413**	**13,616**	**94.5%**
Time of the Day	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
7 am – 8 am	606	570	94.1%
8 am – 9 am	909	861	94.7%
9 am – 10 am	846	806	95.3%
10 am – 11 am	1,636	1,544	94.4%
11 am – 12 pm	1,230	1,181	96.0%
12 pm – 1 pm	1,492	1,403	94.0%
1 pm – 2 pm	1,618	1,528	94.4%
2 pm – 3 pm	1,242	1,168	94.0%
3 pm – 4 pm	1,499	1,393	92.9%
4 pm – 5 pm	1,280	1,204	94.1%
5 pm – 6 pm	1,407	1,336	95.0%
6 pm – 7 pm	648	622	96.0%
Total	**14,413**	**13,616**	**94.5%**
Gender	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Male	7,337	6,874	93.7%
Female	7,060	6,726	95.3%
Unknown	16	16	100.0%
Total	**14,413**	**13,616**	**94.5%**
Age	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
0 - 15	173	161	93.1%
16 - 29	4,297	4,036	93.9%
30 – 59	7,949	7,517	94.6%
60+	1,981	1,889	95.4%
Unknown	13	13	100.0%
Total	**14,413**	**13,616**	**94.5%**
Race	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Caucasian	11,504	10,884	94.6%
African-American	2,283	2,123	93.0%
Other	597	581	97.3%
Unknown	29	28	96.6%
Total	**14,413**	**13,616**	**94.5%**

Table 12. Sport Utility Vehicles Statewide Summary

Sport Utility Vehicles Safety Belt Use			
Day of the Week	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Sunday	1,784	1,719	96.4%
Monday	1,474	1,411	95.7%
Tuesday	1,045	996	95.3%
Wednesday	1,265	1,217	96.2%
Thursday	1,958	1,893	96.7%
Friday	1,751	1,667	95.2%
Saturday	2,148	2,055	95.7%
Total	**11,425**	**10,958**	**95.9%**
Time of the Day	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
7 am – 8 am	441	428	97.1%
8 am – 9 am	719	694	96.5%
9 am – 10 am	687	649	94.5%
10 am – 11 am	1,400	1,338	95.6%
11 am – 12 pm	1,108	1,076	97.1%
12 pm – 1 pm	1,138	1,096	96.3%
1 pm – 2 pm	1,200	1,139	94.9%
2 pm – 3 pm	967	927	95.9%
3 pm – 4 pm	1,169	1,119	95.7%
4 pm – 5 pm	945	908	96.1%
5 pm – 6 pm	1,130	1,080	95.6%
6 pm – 7 pm	521	504	96.7%
Total	**11,425**	**10,958**	**95.9%**
Gender	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Male	5,036	4,782	95.0%
Female	6,373	6,163	96.7%
Unknown	16	13	81.3%
Total	**11,425**	**10,958**	**95.9%**
Age	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
0 - 15	202	197	97.5%
16 - 29	2,246	2,139	95.2%
30 – 59	7,147	6,851	95.9%
60+	1,824	1,765	96.8%
Unknown	6	6	100.0%
Total	**11,425**	**10,958**	**95.9%**
Race	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Caucasian	9,848	9,471	96.2%
African-American	1,119	1,042	93.1%
Other	454	441	97.1%
Unknown	4	4	100.0%
Total	**11,425**	**10,958**	**95.9%**

Table 13. Van/Minivan Statewide Summary

Van/Minivans Safety Belt Use			
Day of the Week	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Sunday	396	384	97.0%
Monday	482	461	95.6%
Tuesday	449	432	96.2%
Wednesday	514	494	96.1%
Thursday	605	576	95.2%
Friday	581	546	94.0%
Saturday	798	757	94.9%
Total	**3,825**	**3,650**	**95.4%**
Time of the Day	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
7 am – 8 am	119	112	94.1%
8 am – 9 am	342	328	95.9%
9 am – 10 am	269	257	95.5%
10 am – 11 am	465	448	96.3%
11 am – 12 pm	408	390	95.6%
12 pm – 1 pm	411	393	95.6%
1 pm – 2 pm	388	369	95.1%
2 pm – 3 pm	323	299	92.6%
3 pm – 4 pm	342	331	96.8%
4 pm – 5 pm	277	265	95.7%
5 pm – 6 pm	337	319	94.7%
6 pm – 7 pm	144	139	96.5%
Total	**3,825**	**3,650**	**95.4%**
Gender	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Male	2,094	1,978	94.5%
Female	1,726	1,668	96.6%
Unknown	5	4	80.0%
Total	**3,825**	**3,650**	**95.4%**
Age	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
0 - 15	91	89	97.8%
16 - 29	490	466	95.1%
30 – 59	2,685	2,566	95.6%
60+	554	524	94.6%
Unknown	5	5	100.0%
Total	**3,825**	**3,650**	**95.4%**
Race	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Caucasian	3,247	3,104	95.6%
African-American	397	374	94.2%
Other	175	167	95.4%
Unknown	6	5	83.3%
Total	**3,825**	**3,650**	**95.4%**

Table 14. Pick-Up Trucks Statewide Summary

Pick-up Truck Safety Belt Use			
Day of the Week	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Sunday	520	482	92.7%
Monday	652	599	91.9%
Tuesday	566	525	92.8%
Wednesday	781	708	90.7%
Thursday	1,177	1,080	91.8%
Friday	1,136	1,028	90.5%
Saturday	917	855	93.2%
Total	**5,749**	**5,277**	**91.8%**
Time of the Day	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
7 am – 8 am	196	182	92.9%
8 am – 9 am	359	327	91.1%
9 am – 10 am	387	353	91.2%
10 am – 11 am	726	671	92.4%
11 am – 12 pm	607	552	90.9%
12 pm – 1 pm	536	498	92.9%
1 pm – 2 pm	582	541	93.0%
2 pm – 3 pm	562	501	89.1%
3 pm – 4 pm	538	500	92.9%
4 pm – 5 pm	491	448	91.2%
5 pm – 6 pm	507	466	91.9%
6 pm – 7 pm	258	238	92.2%
Total	**5,749**	**5,277**	**91.8%**
Gender	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Male	4,593	4,190	91.2%
Female	1,153	1,084	94.0%
Unknown	3	3	100.0%
Total	**5,749**	**5,277**	**91.8%**
Age	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
0 - 15	81	75	92.6%
16 - 29	871	775	89.0%
30 – 59	4,020	3,697	92.0%
60+	774	727	93.9%
Unknown	3	3	100.0%
Total	**5,749**	**5,277**	**91.8%**
Race	Actual Total No. of Observations	Actual Belted No. of Observations	% Safety Belt Use
Caucasian	5,411	4,965	91.8%
African-American	205	186	90.7%
Other	131	124	94.7%
Unknown	2	2	100.0%
Total	**5,749**	**5,277**	**91.8%**

Occupants of sport utility vehicles exhibited the highest safety belt use rate among vehicle types at 95.9 percent, followed closely by occupants of vans or minivans at 95.4 percent. Occupants of passenger cars exhibited a use rate of 94.5 percent, while occupants of pick-up trucks exhibited the lowest use rate at 91.8 percent; consistent with historical trends. Considering days of the week, Fridays demonstrated the lowest safety belt usage rate with 93.4 percent. Safety belt use rates were highest on Sundays with a rate of 95.2 percent. The time period of 2:00 PM to 3:00 PM exhibited a lower usage rate than all other times of the day (93.6 percent), while occupants were mostly likely to wear their safety belts between the hours of 6:00 PM to 7:00 PM (95.7 percent).

Female occupants had higher use rates than male occupants by 2.4 percent (95.9 percent use rate for females vs. 93.5 percent use rate for males). The safety belt usage rate was highest among occupants aged 60 and older at 95.6 percent and lowest for occupants between the ages of 16 to 29 (93.8 percent). The safety belt use rate for occupants aged 0 to 15 was found to be 95.4 percent while the use rate was 94.6 percent among occupants between 30 and 59. Considering occupant races, the safety belt use rate was found to be lowest among African American occupants (93.0 percent) and highest for individuals of 'other' races (96.8 percent) which includes individuals of Asian descent and Pacific Islanders. Caucasian occupants were found to have a safety belt use rate of 94.7 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 (40 total observations). Young African American males aged 16 to 29, as well as young African American females aged 0 to 15 exhibited the lowest belt use rates of all demographic groups with use rates of 90.2 percent and 76.2 percent, respectively. However it should be noted that the sample sizes for these groups were relatively small. Caucasian females of all ages generally exhibited the highest safety belt use rates compared with other demographics. 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 No. of Observations**	**Actual Belted No. of Observations**	**% Safety Belt Use**
Male	0 - 15	Caucasian	235	227	96.6%
		African- American	33	31	93.9%
		Other	12	11	91.7%
		Unknown	1	1	100.0%
		Total	**281**	**270**	**96.1%**
	16 - 29	Caucasian	2,921	2,694	92.2%
		African- American	592	534	90.2%
		Other	270	259	95.9%
		Unknown	9	8	88.9%
		Total	**3,792**	**3,495**	**92.2%**
	30 - 59	Caucasian	10,425	9,767	93.7%
		African-American	1,336	1,223	91.5%
		Other	529	510	96.4%
		Unknown	8	8	100.0%
		Total	**12,298**	**11,508**	**93.6%**
	60+	Caucasian	2,605	2,469	94.8%
		African- American	39	37	94.9%
		Other	32	32	100.0%
		Unknown	1	1	100.0%
		Total	**2,677**	**2,539**	**94.8%**
	Unknown	Caucasian	11	11	100.0%
		African- American	0	0	N/A
		Other	0	0	N/A
		Unknown	1	1	100.0%
		Total	12	12	100.0%
	TOTAL		**19,060**	**17,824**	**93.5%**

Table 15. All Vehicles Statewide Demographic Summary (Continued)

Demographic Data			All Vehicles Safety Belt Use		
Gender	**Age**	**Race**	**Actual Total No. of Observations**	**Actual Belted No. of Observations**	**% Safety Belt Use**
Female	0 - 15	Caucasian	228	221	96.9%
		African- American	21	16	76.2%
		Other	16	14	87.5%
		Unknown	0	0	N/A
		Total	**265**	**251**	**94.7%**
	16 - 29	Caucasian	3,312	3,161	95.4%
		African- American	604	570	94.4%
		Other	180	175	97.2%
		Unknown	7	6	85.7%
		Total	**4,103**	**3,912**	**95.3%**
	30 - 59	Caucasian	7,883	7,568	96.0%
		African- American	1,305	1,248	95.6%
		Other	289	283	97.9%
		Unknown	6	6	100.0%
		Total	**9,483**	**9,105**	**96.0%**
	60+	Caucasian	2,359	2,276	96.5%
		African- American	68	63	92.6%
		Other	25	25	100.0%
		Unknown	1	1	100.0%
		Total	**2,453**	**2,365**	**96.4%**
	Unknown	Caucasian	7	7	100.0%
		African- American	0	0	N/A
		Other	1	1	N/A
		Unknown	0	0	N/A
		Total	**8**	**8**	**100.0%**
	TOTAL		**16,312**	**15,641**	**95.9%**

In comparison to 2015, the 2016 Post-CIOT survey revealed a slight increase in safety belt usage from 92.8 percent to 94.5 percent. In any case, continued public awareness and enforcement efforts are warranted to 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, young males and pick-up truck drivers continue to exhibit lower safety belt use rates. Generally, belt use was also lower for those counties in Stratum 3. These areas should be emphasized in subsequent program efforts.

7.2 Hand-Held Device Use Results and Conclusions

As a part of the 2016 Post-CIOT observational survey of safety belt use, hand-held device use was also recorded for drivers only (passengers were not observed for hand-held device use). A total of 1,977 drivers were observed using hand-held device in some way and the overall weighted hand-held device use rate was found to be 7.5 percent. The weighted hand-held device use rate (shown in Table 16) was calculated using the same procedure as the weighted safety belt rate described in the "Overall Statewide Safety Belt Calculations" section of the report. This rate represents a 0.1 percent decrease from the 7.6 percent hand-held device use rate observed in Michigan in 2015. Nationally, the overall hand-held device use rate by drivers was found to be 7.8 percent in 2014 [8], which is the last year for which national data is available. This indicates Michigan's hand-held device use rate is close to the national average. In addition to overall hand-held device use, Table 17 presents driver hand-held device use by device type and use type.

Table 16. Statewide Weighted Hand-Held Device Use Rate for Drivers

Use by Category	Use Rate*	Standard Error
Overall Hand-Held Device Use	**7.5% ± 0.8%**	**0.4%**

* Weighted Safety Belt Usage ± 95% Confidence Band

Table 17. Statewide Unweighted Hand-Held Device Use Rates by Use Type

Use by Category	Total # of Driver Observations	Total # of Drivers Observed Using Hand-Held Device	Percent of Hand-Held Device Use by Type (Drivers)
Talking – Hand-held Device	28,141	1,226	4.4%
Talking – Hands-free Device (Earpiece Observed)	28,141	99	0.4%
Talking – Hands-free Device (Earpiece Not Observed)	28,141	46	0.2%
Typing – Hand-held	28,141	606	2.2%
Overall Hand-Held Device Use	**28,141**	**1,977**	**7.0%**

Table 18 summarizes hand-held device use for drivers in terms of day of the week, time of the day, vehicle type, gender, age and race. Females were found to be more likely to use a hand-held device while driving than males (8.8 percent and 5.7 percent, respectively). The electronic device use rate was found to be highest between 4 pm and 5 pm at 8.0 percent, while the hand-held device use rate was lowest between 10 am and 11 am (6.0 percent). Hand-held device use among drivers less than 30 years of age was greatest at 11.8 percent, in comparison to 6.6 percent among those between ages 30 and 59

and 1.7 percent for drivers age 60 and above. Additionally, African American drivers tended to exhibit higher hand-held device use rates while driving as compared to other demographics.

Table 18. Hand-Held Device Use Statewide Summary

Day of the Week	All Vehicles Hand-Held Device Use		
	Total No. of Driver Observations	Total No. of Drivers Observed Using Hand-Held Device	Percent of Hand-Held Device Use (Drivers)
Sunday	3,621	185	5.1%
Monday	3,890	335	8.6%
Tuesday	3,110	279	9.0%
Wednesday	3,529	290	8.2%
Thursday	4,946	355	7.2%
Friday	4,045	258	6.4%
Saturday	5,000	275	5.5%
Total	**28,141**	**1,977**	**7.0%**
Time of the Day	**All Vehicles Hand-Held Device Use**		
	Total No. of Driver Observations	**Total No. of Drivers Observed Using Hand-Held Device**	**Percent of Hand-Held Device Use (Drivers)**
7 am - 8 am	1,246	94	7.5%
8 am - 9 am	1,984	134	6.8%
9 am - 10 am	1,796	125	7.0%
10 am - 11 am	3,325	199	6.0%
11 am - 12 pm	2,671	191	7.2%
12 pm - 1 pm	2,769	203	7.3%
1 pm - 2 pm	2,975	214	7.2%
2 pm - 3 pm	2,497	156	6.2%
3 pm - 4 pm	2,817	223	7.9%
4 pm - 5 pm	2,345	187	8.0%
5 pm - 6 pm	2,519	159	6.3%
6 pm - 7 pm	1,197	92	7.7%
Total	**28,141**	**1,977**	**7.0%**

Table 18. Hand-Held Device Use Statewide Summary (Continued)

Vehicle Type	All Vehicles Hand-Held Device Use		
	Total No. of Driver Observations	Total No. of Drivers Observed Using Hand-Held Device	Percent of Hand-Held Device Use (Drivers)
Passenger Cars	11,778	846	7.2%
Sport Utility Vehicles	8,920	640	7.2%
Vans/ Minivans	2,883	202	7.0%
Pick-Up Trucks	4,560	289	6.3%
Total	**28,141**	**1,977**	**7.0%**
Gender	**All Vehicles Hand-Held Device Use**		
	Total No. of Driver Observations	**Total No. of Drivers Observed Using Hand-Held Device**	**Percent of Hand-Held Device Use (Drivers)**
Male	16,408	943	5.7%
Female	11,702	1,032	8.8%
Unknown	31	2	6.5%
Total	**28,141**	**1,977**	**7.0%**
Age	**All Vehicles Hand-Held Device Use**		
	Total No. of Driver Observations	**Total No. of Drivers Observed Using Hand-Held Device**	**Percent of Hand-Held Device Use (Drivers)**
16-29	5,975	707	11.8%
30-59	18,360	1,205	6.6%
60+	3,788	64	1.7%
Unknown	18	1	5.6%
Total	**28,141**	**1,977**	**7.0%**
Race	**All Vehicles Hand-Held Device Use**		
	Total No. of Driver Observations	**Total No. of Drivers Observed Using Hand-Held Device**	**Percent of Hand-Held Device Use (Drivers)**
Caucasian	23,782	1,569	6.6%
African American	3,245	308	9.5%
Other	1,081	92	8.5%
Unknown	33	8	24.2%
Total	**28,141**	**1,977**	**7.0%**

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

DIRECT OBSERVATION SURVEY COVER SHEET

Date: _____ - _____ - 2016 **Observer's 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:

Observation direction: Northbound Southbound Eastbound Westbound

Number of lanes observed: _____

Total number of lanes in this direction: _____

Weather Conditions: Clear Light Fog Light Rain

Site Start and End Time:

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

Sample Size

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		

Note: E.P. = Ear Piece

APPENDIX II
Resumes of Timothy J. Gates and Peter T. Savolainen

Dr. Timothy J. Gates

Summary

Dr. Timothy J. Gates is the current Principal Investigator of the Direct Observation Survey of Safety Belt Use. Dr. Gates is an Associate Professor in the Michigan State University (MSU) Department of Civil and Environmental Engineering. He has more than eight years of experience with direct observation surveys of safety restraint use. This includes a diverse range of experiences in sample design and selection, field data collection methods, observer training, statistical systems development, and optimization techniques. He also has expertise in the areas of survey research methodology, data processing, and statistical quality control.

Education

Ph.D., Civil Engineering, University of Wisconsin, 2007
M.A., Civil Engineering, Michigan State University, 2000
B.S., Civil Engineering, Michigan State University, 2000

Professional Associations

American Society of Civil Engineers
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 (2007 to Present)

Direct Observation Surveys of Seat Belt Use –PI or co-PI on OHSP-sponsored Michigan safety belt use survey from FY 2012 to present. Participated in proposal development, 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 and 2015.

Direct Observation Surveys of Child Restraint Device Use and Misuse (including Booster Seat Use) – PI or co-PI on OHSP-sponsored child restraint device use/misuse survey, including booster seats in FY 2009, 2011, 2013, and 2015.

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

Publications

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Dr. Peter T. Savolainen

Summary

Dr. Peter T. Savolainen is an Associate Professor in the Iowa State University Department of Civil, Construction, and Environmental Engineering. Dr. Savolainen serves as the lead statistical advisor for this project. Prior to joining Iowa State University in 2014, he was an Associate Professor of Civil Engineering at Wayne State University. He has more than nine 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 OHSP-sponsored Michigan safety belt use survey from FY 2008 to 2010 and FY 2012 to present. Participated in proposal development, 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 Child Restraint Device Use and Misuse (including Booster Seat Use) – PI or co-PI on OHSP-sponsored child restraint device use/misuse survey, including booster seats in FY 2009, 2011, 2013, and 2015.

Direct Observation Surveys of Motorcycle Helmet Use – co-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	194	177	82518.6
1	Ingham	E Saginaw St and Hagadorn Rd	Original	Primary	136	134	146803.1
1	Ingham	US Hwy 127 and N Cedar St	Original	Primary	219	207	44481.7
1	Kalamazoo	W Kalamazoo Ave and N Rose St	Original	Primary	230	208	63521.8
1	Kalamazoo	E Michigan Ave and N Edwards St	Original	Primary	279	254	162535.4
1	Kalamazoo	I-94 and Portage Rd	Original	Primary	349	330	75509.7
1	Kalamazoo	I-94 and S Kalamazoo St	Original	Primary	256	240	39428.1
1	Oakland	I-96 and 8 Mile Rd	Original	Primary	288	275	121527.4
1	Oakland	I-96 and Milford Rd	Original	Primary	182	178	31072.4
1	Oakland	I-696 and Orchard Lake Rd	Original	Primary	358	335	127337.5
1	Oakland	I-75 and Joslyn Rd	Original	Primary	331	321	77293.0
1	Washtenaw	I-94 and Kalmbach Rd	Original	Primary	34	32	31429.5
1	Washtenaw	US Hwy 12 and S Huron St	Original	Primary	165	158	107230.1
1	Washtenaw	US Hwy 12 and S Huron St	Original	Primary	209	199	207958.6
1	Washtenaw	I-94 Bus and N Maple Rd	Original	Primary	225	206	152236.0
1	Ingham	State Hwy 99 and W Holmes Rd	Original	Secondary	197	184	95535.0
1	Ingham	Lansing Rd and W Mt Hope Hwy	Original	Secondary	96	89	86752.2
1	Ingham	E Saginaw St and N Larch St	Original	Secondary	214	210	197870.8
1	Ingham	State Hwy 43 and Marsh Rd	Original	Secondary	223	209	121916.7
1	Ingham	S Martin Luther King Jr Blvd and W Jolly Rd	Original	Secondary	187	176	89651.9
1	Ingham	Eaton Rapids Rd and Bishop Rd	Original	Secondary	244	231	96247.3
1	Ingham	State Hwy 52 and N Clinton St	Original	Secondary	211	192	42047.3
1	Kalamazoo	State Hwy 43 and Solon St	Original	Secondary	316	284	172775.3
1	Kalamazoo	US Hwy 131 and W Centre Ave	Original	Secondary	65	59	44561.0
1	Kalamazoo	State Hwy 43 and M 40	Original	Secondary	153	148	99004.3
1	Kalamazoo	E Michigan Ave and 35th St N	Original	Secondary	199	183	46120.7
1	Kalamazoo	E C Ave and 32nd St N	Original	Secondary	58	47	34163.5
1	Oakland	Woodward Ave and W Big Beaver Rd	Original	Secondary	229	220	378426.1
1	Oakland	State Hwy 10 and W 13 Mile Rd	Original	Secondary	120	116	115426.1
1	Oakland	Telegraph Rd and W Long Lake Rd	Original	Secondary	267	246	70101.7
1	Oakland	State Hwy 15 and E Seymour Lake Rd	Original	Secondary	298	278	91060.7
1	Oakland	State Hwy 5 and W 8 Mile Rd	Original	Secondary	177	167	326830.5
1	Oakland	Telegraph Rd and W Maple Rd	Original	Secondary	174	168	267190.6
1	Oakland	Dixie Hwy and Williams Lake Rd	Original	Secondary	170	159	282401.6
1	Oakland	S Main St and E University Dr	Original	Secondary	185	174	241902.8
1	Oakland	State Hwy 150 and E Avon Rd	Original	Secondary	152	149	249248.9
1	Oakland	Lapeer Rd and Dutton Rd	Original	Secondary	164	159	198831.4
1	Oakland	State Hwy 59 and Hickory Ridge Rd	Original	Secondary	287	271	118685.8
1	Oakland	State Hwy 5 and W 13 Mile Rd	Original	Secondary	343	328	273377.7
1	Oakland	Woodward Ave and W 12 Mile Rd	Original	Secondary	342	325	204358.4
1	Washtenaw	US Hwy 23 and Washtenaw Ave	Original	Secondary	195	186	58134.5
1	Washtenaw	W Michigan Ave and N Ann Arbor St	Original	Secondary	167	160	79938.0
1	Washtenaw	Ann Arbor Hill and E Main St	Original	Secondary	194	181	35485.9
1	Washtenaw	W Michigan Ave and Platt Rd	Original	Secondary	217	204	98521.9
1	Washtenaw	State Hwy 52 and E Old US-12	Original	Secondary	222	208	144966.4
1	Ingham	N Waverly Rd and Columbia Hwy	Original	Local	41	36	1431232.1
1	Oakland	Heslip Dr and W 9 Mile Rd	Original	Local	72	66	1741933.7
1	Oakland	N Glenwood Ave and N Perry Street	Original	Local	165	154	6255973.6
1	Oakland	White Pines Dr and Beck Rd	Original	Local	52	49	1452279.6
1	Washtenaw	E Arkona Rd and Dexter St	Original	Local	113	108	1470850.9

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	64	67323.4
2	Bay	I-75 and E Pinconning Rd	Original	Primary	54	53	65893.8
2	Bay	US Hwy 10 and W Midland Rd	Original	Primary	56	53	65293.1
2	Calhoun	I-69 and M 60 E	Original	Primary	64	60	75017.6
2	Calhoun	I-194 and E Columbia Ave	Original	Primary	211	205	94135.4
2	Eaton	I-96 and W Saginaw Hwy	Original	Primary	135	132	107570.2
2	Eaton	I-69 and E Clinton Trail	Original	Primary	80	77	69145.0
2	Jackson	I-94 and 28 Mile Rd	Original	Primary	112	109	66326.5
2	Kent	I-96 and E Beltline Ave NE	Original	Primary	321	303	108873.8
2	Kent	I-96 and 28th St SE	Original	Primary	310	301	106123.6
2	Kent	I-96 and Walker Ave NW	Original	Primary	120	108	200672.0
2	Livingston	I-96 and Fowlerville Rd	Original	Primary	151	149	77762.1
2	Monroe	Detroit-Toledo Expy and Luna Pier Rd	Original	Primary	49	46	68926.4
2	Monroe	I-75 and S Otter Creek Rd	Original	Primary	29	29	62514.6
2	Ottawa	I-196 and Adams St	Original	Primary	132	130	64317.9
2	Allegan	Viaduct Rd and Central Ave	Original	Secondary	232	227	165806.3
2	Allegan	M-89/M-40 and N. Cedar St.	Original	Secondary	293	279	130630.7
2	Allegan	US Hwy 131 and W Superior St	Original	Secondary	224	210	127743.2
2	Bay	Bay Glad Rd and W Neuman Rd	Original	Secondary	5	4	37955.7
2	Bay	State Hwy 13 and W Thomas St	Original	Secondary	283	276	303645.3
2	Bay	State Hwy 138 and S Tuscola Rd	Original	Secondary	18	16	75911.3
2	Calhoun	W Dickman Rd and Hill Brady Rd N	Original	Secondary	191	180	188599.6
2	Calhoun	M 66 and E Burr Oak Rd	Original	Secondary	210	192	102733.3
2	Eaton	N Michigan Rd and Holt Hwy	Original	Secondary	123	120	142646.6
2	Eaton	State Hwy 50 and E Lawrence Ave	Original	Secondary	175	169	104983.7
2	Eaton	W Capital Ave and S Main St	Original	Secondary	238	229	113867.0
2	Eaton	M-43 and M-66	Original	Secondary	226	216	92664.2
2	Grand Traverse	State Hwy 72 and N Division St	Original	Secondary	314	305	350729.5
2	Grand Traverse	US Hwy 31 and M 72	Original	Secondary	285	277	246270.5
2	Jackson	US Hwy 127 Bus and Washington St	Original	Secondary	241	231	212069.7
2	Jackson	State Hwy 50 and US-127	Original	Secondary	264	254	242484.5
2	Jackson	S Meridian Rd and Jefferson Rd	Original	Secondary	304	301	193838.7
2	Jackson	N Main St and Chicago St	Original	Secondary	189	172	171154.1
2	Kent	17 Mile Rd NE and Algoma Ave NE	Original	Secondary	139	129	101215.1
2	Kent	Wilson Ave SW and Burton St SW	Original	Secondary	176	170	205544.5
2	Kent	State Hwy 11 and 3 Mile Rd NW	Original	Secondary	227	219	117188.1
2	Kent	State Hwy 6 and Broadmore Ave SE	Original	Secondary	200	194	107816.1
2	Livingston	Old US Hwy 23 and White Lake Rd	Original	Secondary	106	101	91264.2
2	Livingston	E State Hwy 36 and Chilson Rd	Original	Secondary	176	169	337135.6
2	Midland	Isabella Rd and S Meridian Rd	Original	Secondary	253	239	400553.4
2	Monroe	W Monroe St and Riley St / Main St	Original	Secondary	332	318	275079.4
2	Monroe	US Hwy 23 and Tecumseh St	Original	Secondary	172	171	246711.8
2	Monroe	State Hwy 50 and Ridge Hwy	Original	Secondary	217	213	186498.2
2	Ottawa	State Hwy 45 and W Olive Rd	Original	Secondary	70	68	87897.3
2	Ottawa	Chicago Dr and Balsam Dr	Original	Secondary	269	259	171895.4
2	Calhoun	E Dr N and 9 Mile Rd	Original	Local	21	20	2441051.4
2	Jackson	Springport Rd and Parma Rd	Original	Local	2	2	4882102.8
2	Kent	Whistlevale Dr and 76th St SW	Original	Local	12	12	2441051.4
2	Kent	5 Mile Rd NE and Lincoln Lake Rd.	Original	Local	132	121	6730666.0
2	Midland	Foster Rd and E Wheeler St	Original	Local	43	38	2441051.4

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	155	153	78177.7
3	Berrien	US Hwy 31 and E Napier Ave	Original	Primary	206	192	424135.6
3	Berrien	I-196 and Hagar Shore Rd	Original	Primary	87	81	77380.0
3	Branch	I-69 and Chicago St	Original	Primary	181	178	132360.6
3	Clare	US Hwy 127 and Clare Rd	Original	Primary	81	79	83332.3
3	Clare	US Hwy 127 and E Colonville Rd	Original	Primary	283	270	113278.0
3	Genesee	I-69 and Grand River Rd	Original	Primary	38	34	80048.3
3	Genesee	I-75 and W Pierson Rd	Original	Primary	338	302	300367.6
3	Saginaw	US Hwy 23 and Dixie Hwy	Original	Primary	76	68	96725.0
3	Saginaw	US Hwy 23 and Dixie Hwy	Original	Primary	275	255	136994.2
3	Shiawassee	I-69 and State Hwy 71	Original	Primary	91	88	89439.2
3	St. Clair	I-94 and Fred W Moore Hwy	Original	Primary	123	119	82743.0
3	St. Clair	I-94 and Gratiot Rd	Original	Primary	165	157	121673.4
3	St. Clair	I-94 and Gratiot Rd	Original	Primary	213	210	85770.6
3	Van Buren	I-196 and 32nd Ave	Original	Primary	26	25	77380.0
3	Lapeer	N Branch Rd & N Van Dyke	Original	Secondary	52	50	82841.2
3	Lenawee	US Hwy 12 and M-52	Original	Secondary	125	122	273310.9
3	Lenawee	State Hwy 52 and W Monroe Rd	Original	Secondary	111	104	250969.3
3	Lenawee	State Hwy 156 and W Carleton Rd	Original	Secondary	76	68	174159.3
3	Montcalm	N Greenville Rd and W Howard City Edmore	Original	Secondary	124	113	241898.4
3	Montcalm	State Hwy 46 and Holland Rd	Original	Secondary	209	193	187491.4
3	Montcalm	State Hwy 66 and W Stanton Rd	Original	Secondary	250	222	91532.6
3	Montcalm	Greenville Rd and E Vandeinse Rd	Original	Secondary	347	311	410275.2
3	Muskegon	E Apple Ave and S Maple Island Rd	Original	Secondary	196	181	298202.0
3	Newaygo	M-37 (Evergreen Dr) and Wilcox Ave.	Original	Secondary	206	190	377804.0
3	Newaygo	State Hwy 20 and N Evergreen Dr	Original	Secondary	100	95	181454.9
3	Newaygo	State Hwy 82 and Mason Dr	Original	Secondary	171	152	179036.4
3	Newaygo	Evergreen Dr and Curve St	Original	Secondary	148	143	351908.6
3	Saginaw	State Hwy 52 and E 2nd St	Original	Secondary	117	100	212733.3
3	Saginaw	Oakley Rd and W Brady Rd	Original	Secondary	146	131	214323.0
3	Saginaw	N Main St and E Holland Rd	Original	Secondary	166	160	209571.3
3	Saginaw	Vassar Rd and E Washington Rd	Original	Secondary	134	130	191230.1
3	Saginaw	M-81 and W Vassar Rd/M-15	Original	Secondary	170	167	199756.8
3	Sanilac	State Hwy 53 and W Marlette Rd	Original	Secondary	229	203	479406.3
3	Sanilac	State Hwy 46 and N Van Dyke Rd	Original	Secondary	121	110	184497.6
3	Sanilac	State Hwy 19 and Maple Valley St	Original	Secondary	252	236	476801.8
3	Sanilac	S Elk St and E Sanilac Rd	Original	Secondary	173	164	112672.9
3	Sanilac	State Hwy 46 and S Lakeshore Rd	Original	Secondary	53	48	170442.0
3	Shiawassee	S M 52 and W Lansing Rd	Original	Secondary	247	230	383964.5
3	St. Clair	State Hwy 29 and Bethuy Rd	Original	Secondary	231	219	445724.5
3	St. Clair	Gratiot Blvd and Huron Blvd	Original	Secondary	286	255	751880.1
3	St. Clair	Beard Rd and North Rd	Original	Secondary	146	137	84748.6
3	St. Joseph	US Hwy 12 and M-62	Original	Secondary	187	179	247311.0
3	St. Joseph	US Hwy 131 N and N Washington St	Original	Secondary	67	61	79224.7
3	St. Joseph	State Hwy 66 and S Centerville Rd	Original	Secondary	214	202	492319.7
3	Ionia	Button Rd and N Whites Bridge Rd	Original	Local	52	47	9088223.7
3	Lenawee	Rodesiler Hwy and Yankee Rd	Original	Local	16	13	4631194.1
3	Muskegon	Shoreline Dr and Terrace St	Original	Local	218	212	19298458.3
3	Saginaw	N Michigan Rd and Tittabawassee Rd	Original	Local	149	137	9859467.8
3	Shiawassee	Lemon Rd and E Newburg Rd	Original	Local	4	4	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	159	152	54142.2
4	Macomb	I-696 and Hoover Rd	Original	Primary	113	106	382522.8
4	Macomb	Walter P Reuther Fwy and Gratiot Ave	Original	Primary	276	260	93937.9
4	Macomb	Ford Fwy and Little Mack Ave	Original	Primary	187	183	36931.2
4	Wayne	Detroit Toledo Fwy and West Rd	Original	Primary	205	191	29039.9
4	Wayne	Edsel Ford Fwy and Vernier Rd / M-102	Original	Primary	260	251	181010.7
4	Wayne	Woodward Ave and 7 Mile Rd	Original	Primary	158	154	66607.0
4	Wayne	I-275 and S Huron Rd	Original	Primary	179	163	27416.6
4	Wayne	I-275 and Ford Rd	Original	Primary	296	282	107580.9
4	Wayne	I-94 and Wayne Rd	Original	Primary	189	173	31039.1
4	Wayne	Detroit Industrial Expy and Belleville Rd	Original	Primary	188	179	154930.3
4	Wayne	I-94 and Middlebelt Rd	Original	Primary	181	173	83121.5
4	Wayne	I-75 and Northline Rd	Original	Primary	178	175	57823.7
4	Wayne	I-75 and Charter St	Original	Primary	239	232	31526.9
4	Wayne	Walter P Chrysler Fwy and Mack Ave	Original	Primary	154	150	107103.8
4	Macomb	State Hwy 53 and 23 Mile Rd	Original	Secondary	134	127	115579.2
4	Macomb	State Hwy 53 Byp and Van Dyke Rd	Original	Secondary	25	25	31567.9
4	Macomb	State Hwy 53 Byp and 32 Mile Rd	Original	Secondary	142	134	172916.7
4	Macomb	State Hwy 53 and S Van Dyke Rd	Original	Secondary	162	156	260899.4
4	Macomb	State Hwy 59 and N Groesbeck Hwy / N. Ave	Original	Secondary	171	168	168045.7
4	Macomb	20 Mile Rd and Romeo Plank Rd	Original	Secondary	205	195	192687.2
4	Macomb	Hall Rd and Schoenherr Rd	Original	Secondary	241	232	319900.3
4	Macomb	State Hwy 19 and 32 Mile Rd / Division Rd	Original	Secondary	197	186	130245.2
4	Macomb	Van Dyke Ave and 12 Mile Rd	Original	Secondary	163	158	226597.0
4	Macomb	Earl Memorial Hwy and E 14 Mile Rd	Original	Secondary	166	158	260269.6
4	Macomb	Van Dyke Ave and 15 Mile Rd	Original	Secondary	146	141	290209.4
4	Macomb	Metro Pkwy Crossover - EB and Curwood Dr	Original	Secondary	148	141	103860.8
4	Macomb	Gratiot Ave and 14 Mile Rd	Original	Secondary	269	253	246657.7
4	Macomb	S Gratiot Ave and 15 Mile Rd	Original	Secondary	290	273	128649.1
4	Macomb	State Hwy 3 and 10 Mile Rd	Original	Secondary	265	250	181408.3
4	Wayne	US Hwy 24 and Van Horn Rd	Original	Secondary	185	178	89573.9
4	Wayne	Fort St and Van Horn Rd	Original	Secondary	109	107	273131.0
4	Wayne	State Hwy 85 and Sibley Rd	Original	Secondary	315	301	161697.8
4	Wayne	Walter P Chrysler Fwy and Caniff St	Original	Secondary	222	214	212443.4
4	Wayne	State Hwy 10 and 7 Mile Rd	Original	Secondary	299	273	62336.6
4	Wayne	Grand River Ave and Fenkell St	Original	Secondary	112	94	51837.8
4	Wayne	Grand River Ave and Beech-Daly Rd	Original	Secondary	329	312	169921.0
4	Wayne	Michigan Ave and Oakwood Blvd	Original	Secondary	252	234	79551.1
4	Wayne	US Hwy 12 and Venoy Rd	Original	Secondary	196	186	105713.5
4	Wayne	State Hwy 153 and N Wayne Rd	Original	Secondary	333	313	114520.0
4	Wayne	Telegraph Rd and Wick Rd	Original	Secondary	219	207	288203.2
4	Wayne	S Telegraph Rd and Van Born Rd	Original	Secondary	253	248	130735.7
4	Wayne	Michigan Ave and Evergreen Rd	Original	Secondary	160	155	299602.8
4	Wayne	State Hwy 39 and Oakwood Blvd	Original	Secondary	186	184	81789.6
4	Wayne	State Hwy 3 and Grand Blvd W	Original	Secondary	302	287	99459.6
4	Macomb	Hiawatha Dr and Jewell Rd	Original	Local	52	48	2462422.5
4	Macomb	Beacon Square Dr and 21 Mile Rd	Original	Local	98	94	1223000.6
4	Macomb	Pinehurst and Martin Rd	Original	Local	28	24	1248051.5
4	Wayne	Pinewood Ave and Hoover St	Original	Local	20	18	1205015.3
4	Wayne	Prevost St and Grand River Ave	Original	Local	5	5	2410030.6