

2013 POST-CLICK IT OR TICKET DIRECT OBSERVATION SURVEY OF SAFETY BELT USE

**Prepared for:
Office of Highway Safety Planning
333 South Grand Avenue
Lansing, MI**

**Prepared by:
Wayne State University
Transportation Research Group
Detroit, MI**

Date: September 2013



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The opinions, findings, and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Michigan Office of Highway Safety and Planning, the U.S. Department of Transportation, or the National Highway Transportation Safety Administration. This report was prepared in cooperation with the Michigan Office of Highway Safety Planning and the U.S. Department of Transportation, and the National Highway Traffic Safety Administration.

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16. Abstract: This report documents the results of the 2013 Post-Click It or Ticket 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 May and June of 2013. In addition to belt use, data were collected for vehicle type and use, as well as the gender, age, and race of each observed occupant. The results of this survey show the safety belt usage rate in the state of Michigan is 93.0 percent. While this represents a marginal decrease of 0.6 percent from 2012, changes to the study design do not allow for a direct comparison with prior survey results. Consistent with prior results, males, younger occupants, and those in pick-up trucks continue to exhibit lower belt use rates.			
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TABLE OF CONTENTS	PAGE
1.0 INTRODUCTION.....	1
1.1 Study Purpose and Objectives.....	2
1.2 Study Area.....	2
2.0 METHODOLOGY.....	2
2.1 Design of Study.....	2
2.2 Data Collection Process.....	3
2.3 Alternative Sites and Rescheduling.....	4
2.4 Quality Control Procedures.....	4
3.0 SELECTION OF OBSERVATIONAL LOCATIONS.....	5
3.1 Sample Size and Precision.....	9
3.2 Outline for Data Collection.....	13
4.0 OBSERVER TRAINING.....	14
5.0 QUALITY CONTROL.....	16
6.0 DATA ANALYSIS.....	17
6.1 Imputation.....	17
6.2 Sampling Weights.....	17
6.3 Non-Responding Site Adjustment.....	18
6.4 Estimators.....	18
6.5 Variance Estimation.....	19
6.6 Non-Response Rate.....	20
7.0 RESULTS AND CONCLUSIONS.....	20
7.1 Results.....	20
7.2 Conclusions.....	29
REFERENCES.....	32
APPENDIX I – Michigan Safety Belt Survey Cover Sheet and Data Collection Form.....	33
APPENDIX II – Resume of Peter T. Savolainen.....	36
APPENDIX III – List of Observation Locations by County, Stratum, and Road Classification Including Belt Use Observation Data	38

LIST OF FIGURES	PAGE
Figure 1: 33-County Statewide Sample for the Direct Observation Safety Belt Surveys.....	8
Figure 2: Training Syllabus.....	15

LIST OF TABLES	PAGE
Table 1: Michigan MTFCC Codes Included by Default in the Road Segment File.....	3
Table 2: Safety Belt Use Codes and Definitions.....	4
Table 3: Michigan Average Motor Vehicle Crash-Related Fatalities by County (2005–2009).....	6
Table 4: Roadway Functional Strata by County, Road Segments Population (N), Length of selected segments (miles), and Number of Segments Selected (n).....	11
Table 5: Annual Vehicle Miles of Travel by Stratum (in 1,000's).....	19
Table 6: Statewide Weighted Safety Belt Use Rate for Drivers and Front-Seat Passengers.....	21
Table 7: Statewide Raw/Unweighted Safety Belt Use Summary.....	21
Table 8: Statewide Safety Belt Use Day and Time Sampling Summary	22
Table 9: Statewide Safety Belt Use Rates by Stratum and County.....	23
Table 10: All Vehicles Statewide Summary.....	24
Table 11: Passenger Cars Statewide Summary.....	25
Table 12: Sport Utility Vehicles Statewide Summary.....	26
Table 13: Vans/Minivan Statewide Summary.....	27
Table 14: Pick-Up Trucks Statewide Summary.....	28
Table 15: All Vehicles Statewide Demographic Summary.....	30

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 2012, 34,080 passenger vehicle occupants were killed in 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 [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 2012 nationwide safety belt survey, 86 percent of drivers and right-front passengers use safety belts, which is a significant increase from the 84 percent use rate reported in 2011 [5]. The Midwest region as a whole showed an 85 percent seat belt use rate 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 2012 use rate was 93.6 percent, making Michigan one of sixteen states with safety belt use rates higher than 90 percent [6]. It is important to recognize Michigan is one of the thirty-two "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]. Research has shown states with primary belt use laws see, 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 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 2013 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 2013 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 Fatality Analysis Reporting System (FARS) data averages for the

years 2005 to 2009. Therefore, observation locations from within these 40 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 40 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.

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 information. 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.
Unbelted	The shoulder belt is not in front of the person's shoulder.
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, or inclement weather, data collection was rescheduled for a similar time of day and type of day of 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 40 counties accounted for at least 85 percent of Michigan's total crash-related fatalities during this period as shown in Table 3. These 40 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 60 vehicles, resulting in 12,000 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.

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 0.3 percent in 2012) via observed sample sizes of approximately 12,000-14,000 vehicles. These observed sample sizes have been obtained from previous sample designs using 4 strata (drawn from 32 counties) and 45-50 road segments per stratum. Therefore, since the proposed design was expected to yield a sample size of at least 12,000 vehicle observations (200 sites x 60 vehicles per observation site), the precision objective was expected to be achieved. In the event 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 (30 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: $\pi_{h|g,c} = n_{gc} l_h / \sum_{h \in g,c} l_h$, 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 $\sum_{h \in g,c} l_h$ is the total length of all segments in stratum g and MTFCC c . If a segment was selected with certainty (i.e., its MOS was equal to or exceeded $\sum_{h \in g,c} l_h / n_{gc}$), it was set aside as a certainty selection and the probabilities of selection were recalculated for the remaining segments in the MTFCC class. This was repeated and the certainty selections were identified successively until no segment's

MOS was equal to or exceeded the re-calculated $\sum_{i=1}^n L_i / n_{gc}$. 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. The 'unknown belt use' category was marked if an observer was unable to determine an occupant's belt use. 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. Additionally, data collectors 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 by 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.

<p><u>Day 1 – In-Class Training Program and Field Practice</u></p> <p>Welcome, introductions, and distribution of materials</p> <p>Survey overview</p> <p>Scheduling and rescheduling</p> <ul style="list-style-type: none"> Site Assignment Sheet Observation periods Temporary impediments such as weather Permanent impediments at data collection sites <p>Site locations</p> <ul style="list-style-type: none"> Locating assigned sites Alternate site selection Interstate ramps and surface streets Direction of travel/number of observed lanes <p>Data collection techniques</p> <ul style="list-style-type: none"> Definitions of belt/booster seat use, passenger vehicles Observation protocol: belt use, vehicle type/use, demographic characteristics Unobservable vehicles/occupants <p>Data collection forms</p> <ul style="list-style-type: none"> Cover sheet Recording alternate site information Recording observations <p>Data entry procedures</p> <p>Travel reports, lodging, and auto reservations</p> <p>Field practice at ramps and surface streets</p> <p><u>Days 2-10 Continued Field Practice</u></p> <p>Field practice at ramps and surface streets</p>

Figure 2. Training Syllabus

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.

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 received 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-Click It or Ticket (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 7:00 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 use were determined for each survey stratum, county, location, etc., as well as the statewide average. A 95-percent confidence interval for the estimate of safety belt use was determined according to the NHTSA guidelines.

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), $\pi_{ht|g}$ for road

segment, $\pi_{j|ght}$ for time segment, $\pi_{k|ghtj}$ for direction, $\pi_{l|ghtjk}$ for lane, and $\pi_{m|ghtjkl}$ for vehicle. So the overall vehicle inclusion probability was:

$$\pi_{ghtjklm} = \pi_g \pi_{ht|g} \pi_{j|ght} \pi_{k|ghtj} \pi_{l|ghtjk} \pi_{m|ghtjkl}.$$

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

$$W_{ghtjklm} = \frac{1}{\pi_{ghtjklm}}$$

6.3 Non-responding Site Adjustment

There were no sites with zero observations during the data collection period; therefore no adjustment for 'non-responding' sites was required.

6.4 Estimators

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

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

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:

$$P_{L_{gh}} = \frac{\sum_{\text{all } t|jklmn \text{ in } gh} w_{t|jklm|gh} \text{Length}_{ght} y_{ghtjklmn}}{\sum_{\text{all } t|jklmn \text{ in } gh} w_{t|jklm|gh} \text{Length}_{ght}}$$

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}):

$$P_{VMT} = \frac{\sum_g w_g \sum_h \text{VMT}_{gh} p_{gh}}{\sum_g w_g \sum_h \text{VMT}_{gh}}$$

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:

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

where:

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

p = Estimated statewide belt use rate

p_{gih} = 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:

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

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 223 non-response observations which represents 0.7 percent of the total number of observations. This non-response rate was well below the allowable maximum of 10 percent and, as such, there was no need to collect additional data.

7.0 RESULTS AND CONCLUSIONS

The Post-Click It or Ticket (CIOT) Direct Observation Survey was performed between Tuesday, May 28th and Monday, June 10th of 2013. During this observation period, a total of 24,834 vehicles were observed resulting in 31,102 driver and right-front passenger observations at the 200 observation sites randomly selected to represent statewide safety belt use.

7.1 Results

The overall weighted statewide safety belt use rate for Michigan was found to be 93.0 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 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	93.0% ± 0.8%	0.4%

* 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	24,834	23,245	93.6%
Passengers	6,268	5,774	92.1%
Total	31,102	29,019	93.3%

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%	3,724	12.0%
Monday	25	12.5%	4,207	13.5%
Tuesday	24	12.0%	2,997	9.6%
Wednesday	30	15.0%	4,497	14.5%
Thursday	36	18.0%	5,289	17.0%
Friday	29	14.5%	4,825	15.5%
Saturday	34	17.0%	5,563	17.9%
Total	200	100.0%	31,102	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	9	4.5%	1,392	4.5%
8 am – 9 am	13	6.5%	1,639	5.3%
9 am – 10 am	16	8.0%	2,349	7.6%
10 am – 11 am	20	10.0%	3,125	10.0%
11 am – 12 pm	19	9.5%	2,449	7.9%
12 pm – 1 pm	23	11.5%	3,553	11.4%
1 pm – 2 pm	21	10.5%	3,137	10.1%
2 pm – 3 pm	19	9.5%	2,985	9.6%
3 pm – 4 pm	19	9.5%	3,468	11.2%
4 pm – 5 pm	14	7.0%	2,375	7.6%
5 pm – 6 pm	16	8.0%	2,946	9.5%
6 pm – 7 pm	11	5.5%	1,684	5.4%
Total	200	100.0%	31,102	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	1,758	1,655	94.1%
Kalamazoo County	1,304	1,237	94.9%
Oakland County	3,795	3,629	95.6%
Washtenaw County	1,392	1,278	91.8%
Total	8,249	7,799	94.5%
STRATUM 2	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Allegan County	646	571	88.4%
Bay County	386	358	92.7%
Calhoun County	476	440	92.4%
Eaton County	933	858	92.0%
Grand Traverse County	386	365	94.6%
Jackson County	889	840	94.5%
Kent County	1,501	1,439	95.9%
Livingston County	597	574	96.1%
Midland County	215	197	91.6%
Monroe County	645	606	94.0%
Ottawa County	439	419	95.4%
Total	7,113	6,667	93.7%
STRATUM 3	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Branch County	147	139	94.6%
Berrien County	453	434	95.8%
Clare County	249	238	95.6%
Genesee County	270	229	84.8%
Ionia County	36	30	83.3%
Lapeer County	67	64	95.5%
Lenawee County	372	346	93.0%
Montcalm County	773	681	88.1%
Muskegon County	213	199	93.4%
Newaygo County	806	769	95.4%
Saginaw County	1,268	1,112	87.7%
Shiawassee County	221	191	86.4%
St. Clair County	940	930	98.9%
St. Joseph County	441	407	92.3%
Van Buren County	21	16	76.2%
Sanilac County	851	821	96.5%
Total	7,128	6,606	92.7%
STRATUM 4	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Macomb County	4,183	3,901	93.3%
Wayne County	4,429	4,046	91.4%
Total	8,612	7,947	92.3%
Grand Total (Unweighted)	31,102	29,019	93.3%

Tables 10 through 14 summarize occupant safety belt use for drivers and front-seat passengers by vehicle type for the day of the week, time of the day, gender, age and race for the Post-Click It or Ticket Observation Survey.

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	3,724	3,506	94.1%
Monday	4,207	3,928	93.4%
Tuesday	2,997	2,770	92.4%
Wednesday	4,497	4,180	93.0%
Thursday	5,289	4,991	94.4%
Friday	4,825	4,453	92.3%
Saturday	5,563	5,191	93.3%
Total	31,102	29,019	93.3%
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	1,392	1,290	92.7%
8 am – 9 am	1,639	1,513	92.3%
9 am – 10 am	2,349	2,200	93.7%
10 am – 11 am	3,125	2,911	93.2%
11 am – 12 pm	2,449	2,319	94.7%
12 pm – 1 pm	3,553	3,305	93.0%
1 pm – 2 pm	3,137	2,915	92.9%
2 pm – 3 pm	2,985	2,763	92.6%
3 pm – 4 pm	3,468	3,278	94.5%
4 pm – 5 pm	2,375	2,165	91.2%
5 pm – 6 pm	2,946	2,777	94.3%
6 pm – 7 pm	1,684	1,583	94.0%
Total	31,102	29,019	93.3%
Vehicle Type	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Passenger Cars	14,109	13,221	93.7%
Sport Utility	8,506	8,019	94.3%
Vans/Minivans	3,716	3,483	93.7%
Pick-Up Trucks	4,771	4,296	90.0%
Total	31,102	29,019	93.3%
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	16,941	15,598	92.1%
Female	14,142	13,404	94.8%
Unknown	19	17	89.5%
Total	31,102	29,019	93.3%
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 -15	565	515	91.2%
16 -29	8,757	8,064	92.1%
30 – 59	17,576	16,423	93.4%
60+	4,176	3,996	95.7%
Unknown	28	21	75.0%
Total	31,102	29,019	93.3%
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	27,262	25,534	93.7%
African-American	2,943	2,664	90.5%
Other	891	816	91.6%
Unknown	6	5	83.3%
Total	31,102	29,019	93.3%

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	1,838	1,723	93.70%
Monday	1,929	1,813	94.00%
Tuesday	1,448	1,355	93.60%
Wednesday	2,054	1,924	93.70%
Thursday	2,407	2,279	94.70%
Friday	1,865	1,737	93.10%
Saturday	2,568	2,390	93.10%
Total	14,109	13,221	93.70%
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	601	559	93.00%
8 am – 9 am	727	675	92.80%
9 am – 10 am	1,008	946	93.80%
10 am – 11 am	1,371	1,283	93.60%
11 am – 12 pm	1,065	1,011	94.90%
12 pm – 1 pm	1,637	1,527	93.30%
1 pm – 2 pm	1,535	1,429	93.10%
2 pm – 3 pm	1,309	1,237	94.50%
3 pm – 4 pm	1,591	1,494	93.90%
4 pm – 5 pm	1,104	1,015	91.90%
5 pm – 6 pm	1,322	1,252	94.70%
6 pm – 7 pm	839	793	94.50%
Total	14,109	13,221	93.70%
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	7,178	6,678	93.00%
Female	6,917	6,530	94.40%
Unknown	14	13	92.90%
Total	14,109	13,221	93.70%
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 -15	192	178	92.70%
16 -29	4,992	4,612	92.40%
30 – 59	6,949	6,536	94.10%
60+	1,965	1,886	96.00%
Unknown	11	9	81.80%
Total	14,109	13,221	93.70%
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	11,953	11,248	94.10%
African-American	1,690	1,545	91.40%
Other	461	423	91.80%
Unknown	5	5	100.00%
Total	14,109	13,221	93.70%

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	1,157	1,097	94.80%
Monday	1,239	1,173	94.70%
Tuesday	744	701	94.20%
Wednesday	1,098	1,017	92.60%
Thursday	1,378	1,320	95.80%
Friday	1,349	1,260	93.40%
Saturday	1,541	1,451	94.20%
Total	8,506	8,019	94.30%
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	443	425	95.90%
8 am – 9 am	458	428	93.40%
9 am – 10 am	663	633	95.50%
10 am – 11 am	803	756	94.10%
11 am – 12 pm	696	663	95.30%
12 pm – 1 pm	918	858	93.50%
1 pm – 2 pm	787	742	94.30%
2 pm – 3 pm	824	766	93.00%
3 pm – 4 pm	972	934	96.10%
4 pm – 5 pm	630	576	91.40%
5 pm – 6 pm	866	820	94.70%
6 pm – 7 pm	446	418	93.70%
Total	8,506	8,019	94.30%
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	3,955	3,684	93.10%
Female	4,548	4,333	95.30%
Unknown	3	2	66.70%
Total	8,506	8,019	94.30%
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 -15	190	168	88.40%
16 -29	2,126	1,960	92.20%
30 – 59	5,136	4,877	95.00%
60+	1,051	1,011	96.20%
Unknown	3	3	100.00%
Total	8,506	8,019	94.30%
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	7,487	7,104	94.90%
African-American	786	703	89.40%
Other	232	212	91.40%
Unknown	1	0	0.00%
Total	8,506	8,019	94.30%

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	384	372	96.90%
Monday	510	473	92.70%
Tuesday	362	337	93.10%
Wednesday	548	511	93.20%
Thursday	649	613	94.50%
Friday	597	547	91.60%
Saturday	666	630	94.60%
Total	3,716	3,483	93.70%
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	139	129	92.80%
8 am – 9 am	239	223	93.30%
9 am – 10 am	327	299	91.40%
10 am – 11 am	373	351	94.10%
11 am – 12 pm	312	292	93.60%
12 pm – 1 pm	461	440	95.40%
1 pm – 2 pm	336	311	92.60%
2 pm – 3 pm	330	306	92.70%
3 pm – 4 pm	411	387	94.20%
4 pm – 5 pm	269	253	94.10%
5 pm – 6 pm	346	330	95.40%
6 pm – 7 pm	173	162	93.60%
Total	3,716	3,483	93.70%
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	1,952	1,798	92.10%
Female	1,764	1,685	95.50%
Unknown	0	0	N/A
Total	3,716	3,483	93.70%
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 -15	96	91	94.80%
16 -29	637	599	94.00%
30 – 59	2,410	2,241	93.00%
60+	567	547	96.50%
Unknown	6	5	83.30%
Total	3,716	3,483	93.70%
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	3,253	3,062	94.10%
African-American	312	282	90.40%
Other	151	139	92.10%
Unknown	0	0	N/A
Total	3,716	3,483	93.70%

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	345	314	91.00%
Monday	529	469	88.70%
Tuesday	443	377	85.10%
Wednesday	797	728	91.30%
Thursday	855	779	91.10%
Friday	1,014	909	89.60%
Saturday	788	720	91.40%
Total	4,771	4,296	90.00%
Time of the Day	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
7 am – 8 am	209	177	84.70%
8 am – 9 am	215	187	87.00%
9 am – 10 am	351	322	91.70%
10 am – 11 am	578	521	90.10%
11 am – 12 pm	376	353	93.90%
12 pm – 1 pm	537	480	89.40%
1 pm – 2 pm	479	433	90.40%
2 pm – 3 pm	522	454	87.00%
3 pm – 4 pm	494	463	93.70%
4 pm – 5 pm	372	321	86.30%
5 pm – 6 pm	412	375	91.00%
6 pm – 7 pm	226	210	92.90%
Total	4,771	4,296	90.00%
Gender	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Male	3,856	3,438	89.20%
Female	913	856	93.80%
Unknown	2	2	100.00%
Total	4,771	4,296	90.00%
Age	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
0 -15	87	78	89.70%
16 -29	1,002	893	89.10%
30 – 59	3,081	2,769	89.90%
60+	593	552	93.10%
Unknown	8	4	50.00%
Total	4,771	4,296	90.00%
Race	Actual Total # of Obs.	Actual Belted # of Obs.	% Safety Belt Use
Caucasian	4,569	4,120	90.20%
African-American	155	134	86.50%
Other	47	42	89.40%
Unknown	0	0	N/A
Total	4,771	4,296	90.00%

7.2 Conclusions

Occupants of SUVs exhibited the highest safety belt use rate among vehicle types at 94.3 percent. Occupants of both passenger cars and vans/minivans exhibited a use rate of 93.7 percent while occupants of pick-up trucks exhibited the lowest use rate at 90.0 percent. The day of the week with the lowest safety belt usage rate was Friday with 92.3 percent. Safety belt use rates were highest on Thursdays with a rate of 94.4 percent. The period from 4:00 PM to 5:00 PM exhibited a lower usage rate than all other times of the day (91.2 percent), while occupants were mostly likely to wear their safety belts between the hours of 11:00 AM and 12:00 PM.

Female occupants had higher use rates than their male counterparts by 2.7 percent (94.8 percent use rate for females vs. 92.1 percent use rate for males). The safety belt usage rate was highest among occupants aged 60 and older at 95.7 percent and use rates decreased with descending ages. Safety belt use rates were lowest for occupants aged 0-15 at 91.2 percent while the use rate was 92.1 percent usage among occupants aged 16-29. In general, belt use was also lower among African Americans and occupants of other races.

Table 15 summarizes occupant safety belt use rates by gender, age, and race. Young males aged 0-15 and males aged 16-29 exhibited the lowest belt use rates of all the demographic groups with use rates of 89.1 percent and 90.0 percent, respectively. Females aged 60 and older exhibited the highest safety belt use rate at 96.2 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	266	245	92.1%
		African-American	33	22	66.7%
		Other	12	10	83.3%
		Unknown	0	0	N/A
		Total	311	277	89.1%
	16 - 29	Caucasian	3,577	3,268	91.4%
		African-American	530	467	88.1%
		Other	230	206	89.6%
		Unknown	2	2	100.0%
		Total	4,339	3,943	90.9%
	30 - 59	Caucasian	8,839	8,140	92.1%
		African-American	810	732	90.4%
		Other	288	268	93.1%
		Unknown	2	1	50.0%
		Total	9,939	9,141	92.0%
	60+	Caucasian	2,228	2,123	95.3%
		African-American	85	83	97.6%
		Other	22	18	81.8%
		Unknown	1	1	100.0%
		Total	2,336	2,225	95.2%
	Unknown	Caucasian	12	8	66.7%
		African-American	3	3	100.0%
		Other	1	1	100.0%
		Unknown	0	0	N/A
Total		16	12	75.0%	
TOTAL			16,941	15,598	92.1%

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	208	196	94.2%
		African-American	32	28	87.5%
		Other	14	14	100.0%
		Unknown	0	0	N/A
		Total	254	238	93.7%
	16 - 29	Caucasian	3,700	3,475	93.9%
		African-American	556	501	90.1%
		Other	152	136	89.5%
		Unknown	0	0	N/A
		Total	4,408	4,112	93.3%
	30 - 59	Caucasian	6,683	6,395	95.7%
		African-American	791	733	92.7%
		Other	155	146	94.2%
		Unknown	1	1	100.0%
		Total	7,630	7,275	95.3%
	60+	Caucasian	1,723	1,662	96.5%
		African-American	100	92	92.0%
		Other	16	16	100.0%
		Unknown	0	0	N/A
		Total	1,839	1,770	96.2%
	Unknown	Caucasian	10	8	80.0%
		African-American	1	1	100.0%
		Other	0	0	N/A
Unknown		0	0	N/A	
Total		11	9	81.8%	
TOTAL			14,142	13,404	94.8%

In comparison to 2012, the 2013 Post-CIOT survey revealed a marginal decrease in safety belt use. This 0.6-percent drop was not statistically significant. It should also be noted changes in the survey design make it difficult to directly compare results of prior studies. 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, males and pick-up truck drivers continue to exhibit lower safety belt use rates. Belt use was also found to lag behind the state average in urban and lowly populated rural areas. These areas should be emphasized in subsequent program efforts.

REFERENCES

1. Early Estimate of Motor Vehicle Traffic Fatalities in 2012. Rep. no. DOT HS 811 741. Washington DC: National Highway Safety Traffic Administration, 2013. Print.
2. NHTSA's National Center for Statistics and Analysis, "Traffic Safety Facts - 2011 Data – Occupant Protection", U.S. Department of Transportation, NHTSA, DOT HS 811 729.
3. Houston, David J., and Lilliard E. Richardson. "Seat Belt Use and the Switch to Primary Enforcement, 1991 - 2003." *American Journal of Public Health* 96.11 (2006): 1949-954. [Ajph.aphapublications.org](http://ajph.aphapublications.org). Web. 10 May 2013.
4. "Policy Impact: Seat Belts." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, 20 Jan. 2012. Web. 10 May 2013.
5. Pickrell, T. M., & Ye, T.J. (2012, November). Seat Belt Use in 2012 – Overall results. (Traffic Safety Facts Research Note. Report No. DOT HS 811 691). Washington, DC: National Highway Traffic Safety Administration.
6. Seat Belt Use in 2012 - Use Rates in the States and Territories. Rep. no. DOT HS 811 809. Washington DC: National Highway Safety Traffic Administration, 2013. Print.
7. National Highway Traffic Safety Administration, *An Example of a Compliant State Seat Belt Use Survey Design*, DOT HS 811 494, June 2011.

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

DIRECT OBSERVATION SURVEY COVER SHEET

Date: _____ - _____ - 2013 Observers Name: _____

Survey Type:

Safety Belt	CRD/Booster Seat	Motorcycle Helmet
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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

<u>Safety Belt Survey:</u> 60 Minute Volume Count (for lanes being observed): _____ Vehicles Number of Observations Recorded in 60 min: _____ Vehicles
<u>CRD/Booster Seat Survey:</u> Total Number of Children Observed in 60 min: _____ Children
<u>Motorcycle Helmet Use Survey:</u> Number of Observations Recorded in 60 min: _____ Motorcycles

VEHICLE TYPE:			
<input type="checkbox"/> Passenger Car		<input type="checkbox"/> SUV	<input type="checkbox"/> Van/Minivan
<input type="checkbox"/> Vehicle NOT Observable		<input type="checkbox"/> Pickup Truck	
VEHICLE USE			
		<input type="checkbox"/> Non-Commercial	<input type="checkbox"/> Commercial
DRIVER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 30-59	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 60+	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown
PASSENGER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 0 to 15	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 30-59	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> 60+		<input type="checkbox"/> Unknown
	<input type="checkbox"/> Unknown		

VEHICLE TYPE:			
<input type="checkbox"/> Passenger Car		<input type="checkbox"/> SUV	<input type="checkbox"/> Van/Minivan
<input type="checkbox"/> Vehicle NOT Observable		<input type="checkbox"/> Pickup Truck	
VEHICLE USE			
		<input type="checkbox"/> Non-Commercial	<input type="checkbox"/> Commercial
DRIVER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 30-59	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 60+	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown
PASSENGER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 0 to 15	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 30-59	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> 60+		<input type="checkbox"/> Unknown
	<input type="checkbox"/> Unknown		

VEHICLE TYPE:			
<input type="checkbox"/> Passenger Car		<input type="checkbox"/> SUV	<input type="checkbox"/> Van/Minivan
<input type="checkbox"/> Vehicle NOT Observable		<input type="checkbox"/> Pickup Truck	
VEHICLE USE			
		<input type="checkbox"/> Non-Commercial	<input type="checkbox"/> Commercial
DRIVER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 30-59	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 60+	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> Unknown		<input type="checkbox"/> Unknown
PASSENGER			
RESTRAINT USE:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Belted	<input type="checkbox"/> 0 to 15	<input type="checkbox"/> Male	<input type="checkbox"/> White
<input type="checkbox"/> Not Belted	<input type="checkbox"/> 16-29	<input type="checkbox"/> Female	<input type="checkbox"/> Black
<input type="checkbox"/> Unknown	<input type="checkbox"/> 30-59	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other
	<input type="checkbox"/> 60+		<input type="checkbox"/> Unknown
	<input type="checkbox"/> Unknown		

Appendix II Resume of 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.

Publications

- Datta, T. and P. Savolainen (2008). Evaluation of the 2008 May Click It or Ticket Mobilization, Report to Michigan OHSP, Lansing, MI.
- Datta, T., Savolainen, P., Vuyyuru, S., and A. Jayadevan (2008). 2008 Annual Direct Observation Survey of Safety Belt Use, Report to Michigan OHSP, Lansing, MI.
- Datta, T. and P. Savolainen (2009). Evaluation of the 2009 May Click It or Ticket Mobilization, Report to Michigan OHSP, Lansing, MI.
- Savolainen, P., Gates, T., and T. Datta (2009). 2009 Direct Observation Surveys of Booster Seat Use, Report to Michigan OHSP, Lansing, MI.
- Gates, T., Savolainen, P., and T. Datta (2009). 2009 Survey of Child Restraint Device Use and Misuse in Michigan, Report to Michigan OHSP, Lansing, MI.
- Datta, T. and P. Savolainen (2009). 2009 Annual Direct Observation Survey of Safety Belt Use, Report to Michigan OHSP, Lansing, MI.
- Datta, T., Savolainen, P., Gates, T., and A. Das (2010). Evaluation of the 2010 Click It or Ticket Mobilization, Report to Michigan OHSP, Lansing, MI.
- Savolainen, P., Gates, T., and T. Datta (2010). 2010 Direct Observation Surveys of Booster Seat Use, Report to Michigan OHSP, Lansing, MI.
- Datta, T., Savolainen, P., Gates, T., and A. Das (2010). 2010 Annual Direct Observation Survey of Safety Belt Use, Report to Michigan OHSP, Lansing, MI.
- Savolainen, P., Gates, T., Datta, T., and S. Boileau (2011). Direct Observation Survey of Child Restraint/Booster Seat Use, Report to Michigan OHSP, Lansing, MI.
- Datta, T.K., Savolainen, P.T., Gates, T.J., and B.J. Russo (2012), Commercial Motor Vehicle Direct Observation Survey, Report to OHSP, Lansing, MI.

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	E Saginaw St and Hagadorn Rd	Original	Primary	209	205	39452.35
1	Ingham	I-96 Bus and N MLK Blvd	Original	Primary	129	124	19164.98
1	Ingham	US Hwy 127 and N Cedar St	Original	Primary	204	194	1543.66
1	Ingham	E Saginaw St and N Larch St	Original	Secondary	175	165	99299.47
1	Ingham	Eaton Rapids Rd and Bishop Rd	Original	Secondary	147	141	131589.23
1	Ingham	Lansing Rd and W Mt Hope Hwy	Original	Secondary	98	96	16619.60
1	Ingham	S Martin L King Jr Blvd and W Jolly Rd	Original	Secondary	171	159	27731.20
1	Ingham	State Hwy 43 and Marsh Rd	Original	Secondary	135	128	3892.92
1	Ingham	State Hwy 52 and N Clinton St	Original	Secondary	277	253	4587.63
1	Ingham	State Hwy 99 and W Holmes Rd	Original	Secondary	158	143	19984.63
1	Ingham	N Waverly Rd and Columbia Hwy	Original	Local	55	47	2223245.11
1	Kalamazoo	E Michigan Ave and N Edwards St	Original	Primary	34	33	179799.33
1	Kalamazoo	I-94 and E Cork St	Original	Primary	131	127	1212.63
1	Kalamazoo	I-94 and S Kalamazoo St	Original	Primary	191	183	2420.52
1	Kalamazoo	W Kalamazoo Ave and N Rose St	Original	Primary	154	141	180359.89
1	Kalamazoo	E C Ave and 32nd St N	Original	Secondary	43	39	26387.43
1	Kalamazoo	E Michigan Ave and 35th St N	Original	Secondary	180	164	25890.60
1	Kalamazoo	State Hwy 43 and M 40	Original	Secondary	200	197	2744.11
1	Kalamazoo	State Hwy 43 and Solon St	Original	Secondary	254	239	18693.48
1	Kalamazoo	US Hwy 131 and W Centre Ave	Original	Secondary	117	114	1397.53
1	Oakland	I-696 and Orchard Lake Rd	Original	Primary	215	204	7906.94
1	Oakland	I-75 and Joslyn Rd	Original	Primary	299	291	1326.06
1	Oakland	I-96 and 8 Mile Rd	Original	Primary	189	185	4579.77
1	Oakland	I-96 and Pinckney Rd	Original	Primary	70	65	4609.65
1	Oakland	Dixie Hwy and Williams Lake Rd	Original	Secondary	186	177	18092.45
1	Oakland	Lapeer and Dutton	Original	Secondary	245	239	69409.07
1	Oakland	Northwestern Hwy and Orchard Lake Rd	Original	Secondary	198	191	7380.16
1	Oakland	Rochester and Avon Rd	Original	Secondary	315	306	21006.75
1	Oakland	S Main St and E University Dr	Original	Secondary	210	199	225945.64
1	Oakland	State Hwy 10 and W 13 Mile Rd	Original	Secondary	175	171	21505.87
1	Oakland	State Hwy 15 and E Seymour Lake Rd	Original	Secondary	188	182	18342.22
1	Oakland	State Hwy 5 and W 13 Mile Rd	Original	Secondary	177	170	75542.46
1	Oakland	State Hwy 5 and W 8 Mile Rd	Original	Secondary	193	187	23918.54
1	Oakland	State Hwy 59 and Hartland Rd	Original	Secondary	199	188	35693.69
1	Oakland	Telegraph Rd and W Maple Rd	Original	Secondary	188	182	24616.61
1	Oakland	Woodward Ave and W Big Beaver Rd	Original	Secondary	265	248	24383.38
1	Oakland	Woodward Avenue and W 12 Mile Rd	Original	Secondary	194	182	20122.70
1	Oakland	Heslip Dr and W 9 Mile Rd	Original	Local	60	53	2715151.52
1	Oakland	N Glenwood Ave and N Perry St	Original	Local	207	189	5537818.47
1	Oakland	Whitepines and N Beck	Original	Local	22	20	843985.60
1	Washtenaw	I-94 and Kalmbach Rd	Original	Primary	37	29	850.56
1	Washtenaw	I-94 Bus and N Maple Rd	Original	Primary	168	156	66715.70
1	Washtenaw	US Hwy 12 (I-94) and S Huron St	Original	Primary	199	194	17220.10
1	Washtenaw	US Hwy 12 and S Huron St	Original	Primary	172	166	53271.24
1	Washtenaw	Ann Arbor Hill and E Main St	Original	Secondary	114	95	63680.49
1	Washtenaw	State Hwy 52 and E Old US-12	Original	Secondary	161	147	5157.04
1	Washtenaw	US Hwy 23 and Wahtenaw Ave	Original	Secondary	119	106	3782.40
1	Washtenaw	W Michigan Ave and N Ann Arbor St	Original	Secondary	147	129	5977.65
1	Washtenaw	W Michigan Ave and Platt Rd	Original	Secondary	153	146	71273.66
1	Washtenaw	E Arkona Rd and Dexter St	Original	Local	122	110	973913.04

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	71	61	1971.31
2	Allegan	Lincoln Rd and Monroe Rd	Original	Secondary	152	138	10329.29
2	Allegan	US Hwy 131 and W Superior St	Original	Secondary	210	186	5574.79
2	Allegan	Viaduct Rd and Central Ave	Original	Secondary	177	154	70463.85
2	Allegan	34th St and 128th Ave	Original	Local	36	32	342120.19
2	Bay	I-75 and E Pinconning Rd	Original	Primary	58	52	1594.43
2	Bay	US Hwy 10 and W Midland Rd	Original	Primary	60	55	1790.97
2	Bay	Bay Glad Rd and W Neuman Rd	Original	Secondary	5	4	27379.40
2	Bay	State Hwy 13 and W Thomas St	Original	Secondary	248	233	26675.75
2	Bay	State Hwy 138 and S Tuscola Rd	Original	Secondary	15	14	10181.97
2	Calhoun	I-194 and E Columbia Ave	Original	Primary	125	121	31398.20
2	Calhoun	I-69 and M 60 E	Original	Primary	54	50	2119.87
2	Calhoun	M 66 and E Burr Oak Rd	Original	Secondary	139	129	14319.27
2	Calhoun	W Dickman Rd and Hill Brady Rd N	Original	Secondary	140	126	83961.16
2	Calhoun	E Dr N and 9 Mile Rd	Original	Local	18	14	938547.49
2	Eaton	I-69 and E Clinton Trail	Original	Primary	92	84	1606.10
2	Eaton	I-96 and W Saginaw Hwy	Original	Primary	167	152	11878.05
2	Eaton	N Michigan Rd and Holt Hwy	Original	Secondary	158	145	16387.05
2	Eaton	State Hwy 50 and E Lawrence Ave	Original	Secondary	178	155	2033.15
2	Eaton	W Capital Ave and S Main St	Original	Secondary	224	210	161904.09
2	Eaton	W Grand Ledge Hwy and Charlotte St	Original	Secondary	114	112	15116.73
2	Grand Traverse	State Hwy 72 and N Division St	Original	Secondary	199	189	137850.48
2	Grand Traverse	US Hwy 31 and M-72	Original	Secondary	187	176	15321.58
2	Jackson	I-94 and 28 Mile Rd	Original	Primary	69	64	1474.46
2	Jackson	N Main St and Chicago St	Original	Secondary	225	207	851648.75
2	Jackson	S Meridian Rd and Jefferson Rd	Original	Secondary	273	255	17670.81
2	Jackson	State Hwy 50 and US-127	Original	Secondary	173	171	13228.89
2	Jackson	US Hwy 127 Bus and Washington St	Original	Secondary	144	138	60240.65
2	Jackson	Springport Rd & Parma Rd	Original	Local	5	5	448598.13
2	Kent	I-96 and 28th St	Original	Primary	315	308	2782.65
2	Kent	I-96 and Beltline Ave	Original	Primary	332	316	3625.94
2	Kent	I-96 and Walker Ave NW	Original	Primary	102	96	27909.93
2	Kent	17 Mile Rd and Algoma Ave	Original	Secondary	173	155	12210.48
2	Kent	State Hwy 11 and 3 Mile Rd NW	Original	Secondary	229	222	12166.14
2	Kent	State Hwy 6 and Broadmore Ave	Original	Secondary	160	157	5712.60
2	Kent	Wilson Ave SW and Burton St SW	Original	Secondary	182	179	161957.87
2	Kent	Whistlevale and 76th St	Original	Local	8	6	4506665.23
2	Livingston	I-96 and Fowlerville Rd	Original	Primary	196	186	2188.17
2	Livingston	M-36 and Chilson	Original	Secondary	240	234	24950.45
2	Livingston	US Hwy 23 and White Lake Rd	Original	Secondary	161	154	2878.72
2	Midland	Isabella Rd and S Meridian Rd	Original	Secondary	153	141	74442.75
2	Midland	Foster Rd and E Wheeler St	Original	Local	62	56	3971598.57
2	Monroe	Detroit- Toledo Expy and Luna Pier Rd.	Original	Primary	61	57	2428.77
2	Monroe	I-75 and S. Otter Creek Rd.	Original	Primary	47	45	2054.90
2	Monroe	Statte Hwy 50 and Ridge Hwy	Original	Secondary	183	175	7692.31
2	Monroe	US. Hwy 23 and Tecumseh	Original	Secondary	155	141	4132.98
2	Monroe	W. Monroe St. and Riley	Original	Secondary	199	188	325396.38
2	Ottawa	I-196 and Adams St	Original	Primary	128	125	3188.20
2	Ottawa	Chicago Dr and Balsam Dr	Original	Secondary	233	223	16211.99
2	Ottawa	State Hwy 45 and Olive Rd	Original	Secondary	78	71	4954.11

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
3	Berrien	Hwy 31 and Napier	Original	Primary	208	201	32853.85
3	Berrien	I-196 and Hagar Rd	Original	Primary	104	95	7528.49
3	Berrien	I-94 and Sawyer	Original	Primary	141	138	1524.20
3	Branch	I-69 and Chicago St	Original	Primary	147	139	3855.64
3	Clare	US Hwy 127 and Clare Rd	Original	Primary	42	36	2738.54
3	Clare	US Hwy 127 and E Colonville Rd	Original	Primary	207	202	19485.45
3	Genesee	I-69 and Grand River Rd	Original	Primary	19	18	2359.82
3	Genesee	I-75 and W Pierson Rd	Original	Primary	251	211	8853.84
3	Ionia	Button Rd and N Whites Bridge Rd	Original	Local	36	30	2352891.25
3	Lapeer	North Branch Rd and N Van Dyke	Original	Secondary	67	64	11389.18
3	Lenawee	State Hwy 156 and W Carleton Rd	Original	Secondary	84	75	11534.58
3	Lenawee	State Hwy 52 and W Monroe Rd	Original	Secondary	138	131	5772.79
3	Lenawee	US Hwy 12 and M-52	Original	Secondary	138	131	72660.68
3	Lenawee	Rodesiler Hwy and Yankee Rd	Original	Local	12	9	6059006.19
3	Montcalm	Greenville Rd and E Vandeinse Rd	Original	Secondary	250	216	398591.29
3	Montcalm	N Greenville Rd and W Howard City Edmore Rd	Original	Secondary	150	140	17512.09
3	Montcalm	State Hwy 46 and Holland Rd	Original	Secondary	148	133	6386.62
3	Montcalm	State Hwy 66 and W Stanton Rd	Original	Secondary	225	192	4384.84
3	Muskegon	E Apple Ave and S Maple Island Rd	Original	Secondary	123	114	32110.95
3	Muskegon	Shoreline Dr and Terrace St	Original	Local	90	85	31944347.83
3	Newaygo	Evergreen Rd and Curve Rd	Original	Secondary	196	186	29249.93
3	Newaygo	Hwy 82 and Mason	Original	Secondary	263	259	6130.98
3	Newaygo	S Charles St and Baseline	Original	Secondary	200	189	292919.76
3	Newaygo	State Hwy 20 and N Evergreen Dr	Original	Secondary	147	135	5403.97
3	Saginaw	Northbound US Hwy 23 and Dixie Highway	Original	Primary	71	55	2434.03
3	Saginaw	Southbound US Hwy 23 and Dixie Highway	Original	Primary	253	227	5228.46
3	Saginaw	Main St (M-84) and E Holland Rd (M-46)	Original	Secondary	152	134	26066.59
3	Saginaw	Oakley Rd and W Brady Rd	Original	Secondary	165	141	25440.97
3	Saginaw	State Hwy 52 and E 2nd St	Original	Secondary	157	141	7408.05
3	Saginaw	State Hwy 81 and N Portsmouth Rd	Original	Secondary	191	175	16298.55
3	Saginaw	Vassar Rd (M-15) and E Washington Rd (M-81)	Original	Secondary	126	109	52978.63
3	Saginaw	N Michigan Rd and Tittabawassee Rd	Original	Local	153	130	2416666.67
3	Sanilac	S Elk St and E Sanilac Rd	Original	Secondary	217	214	168210.73
3	Sanilac	State Hwy 19 and Maple Valley Rd	Original	Secondary	238	233	6640.65
3	Sanilac	State Hwy 46 and N Van Dyke Rd	Original	Secondary	119	113	15393.78
3	Sanilac	State Hwy 46 and S Lakeshore Rd	Original	Secondary	69	67	22338.94
3	Sanilac	State Hwy 53 and W Marlette Rd	Original	Secondary	208	194	7260.38
3	Shiawassee	I-69 and State Hwy 71	Original	Primary	70	63	3823.44
3	Shiawassee	S M 52 and W Lansing Rd	Original	Secondary	150	127	21875.64
3	Shiawassee	Lemon Rd and E Newburg Rd	Original	Local	1	1	3952387.80
3	St. Clair	I-94 and Fred Moore Hwy	Original	Primary	123	120	5105.55
3	St. Clair	I-94 and Gratiot Rd EB	Original	Primary	131	130	2976.01
3	St. Clair	I-94 and Gratiot Rd WB	Original	Primary	185	183	6028.82
3	St. Clair	Beard Rd and North Rd	Original	Secondary	86	85	13461.59
3	St. Clair	Gratoit Blvd and Huron Blvd	Original	Secondary	245	243	201327.76
3	St. Clair	State Hwy 29 and Bethuy Rd	Original	Secondary	170	169	6786.00
3	St. Joseph	Hwy 12 and M-62	Original	Secondary	127	113	7166.18
3	St. Joseph	State Hwy 66 and S Centerville Rd	Original	Secondary	162	150	208582.75
3	St. Joseph	US Hwy 131 N and N Washington St	Original	Secondary	152	144	13110.31
3	Van Buren	I-196 and 32nd ST	Original	Primary	21	16	4223.10

Belt Use Stratum	County	Site Location	Site Type	Road Type	Actual Observations		Sample Weight
					Total	Belted	
4	Macomb	Ford Fwy (I-94) and Little Mack Ave	Original	Primary	206	192	13466.26
4	Macomb	Ford Fwy (I-94) and N River Rd	Original	Primary	145	138	10438.58
4	Macomb	I-696 and Hoover	Original	Primary	226	204	16596.64
4	Macomb	Walter P Reuther Fwy (I-696) and Gratiot Ave	Original	Primary	155	139	16693.32
4	Macomb	20 Mile Rd and Romeo Plank Pd	Original	Secondary	232	221	12491.65
4	Macomb	Eral Memorial Hwy and E. 14 Mile	Original	Secondary	186	162	48338.37
4	Macomb	Gratiot Ave and 14 Mile Rd	Original	Secondary	222	210	17854.11
4	Macomb	Gratiot Ave and 15 Mile Rd	Original	Secondary	184	165	173163.06
4	Macomb	Hall Rd and Schoenherr Rd	Original	Secondary	257	252	16690.92
4	Macomb	Metropolitan Pkwy Crossover and Curwood	Original	Secondary	189	169	16622784.81
4	Macomb	State Hwy 19 and 32 Mile Rd/Division Rd	Original	Secondary	242	240	3424.43
4	Macomb	State Hwy 3 and 10 Mile	Original	Secondary	201	181	12953.92
4	Macomb	State Hwy 53 and 23 Mile Rd	Original	Secondary	286	265	2543.85
4	Macomb	State Hwy 53 and S. Van Dyke Rd	Original	Secondary	137	127	9365.08
4	Macomb	State Hwy 53 Byp and 32 Mile Rd	Original	Secondary	237	224	6057.26
4	Macomb	State Hwy 53 Byp and Van Dyke	Original	Secondary	243	238	150662.03
4	Macomb	State Hwy 59 and N Groesbeck Hwy/North Ave	Original	Secondary	197	190	39925.88
4	Macomb	Van Dyke and 12 Mile	Original	Secondary	229	210	26113.84
4	Macomb	Van Dyke Ave. and 15 Mile	Original	Secondary	228	216	51646.11
4	Macomb	Beacon Square Dr and 21 Mile Rd	Original	Local	128	115	89552.22
4	Macomb	Iroquois and Hiawatha	Original	Local	12	8	3132203.39
4	Macomb	Pinehurst and Martin Rd	Original	Local	41	35	9333333.33
4	Wayne	Detroit Industrial Expy and Belleville Rd	Original	Primary	213	179	5285.41
4	Wayne	Detroit Toledo Fwy (I-75) and West Rd	Original	Primary	83	80	4615.91
4	Wayne	Edsel For Fwy and Vernier Rd/M-102	Original	Primary	228	217	5616.92
4	Wayne	Edward J Jefferies Fwy and Merriman Rd	Original	Primary	172	159	5414.24
4	Wayne	Edward J Jeffries Fwy and Newburgh Rd	Original	Primary	253	238	6780.78
4	Wayne	I-275 and Ford Rd	Original	Primary	166	162	4163.95
4	Wayne	I-75 and Charter St	Original	Primary	143	137	1382.88
4	Wayne	I-75 and Northline Rd	Original	Primary	149	142	2174.16
4	Wayne	I-94 and Middlebelt Rd	Original	Primary	148	128	2877.38
4	Wayne	Walter P Chrysler Fwy (I-75) and Mack Ave	Original	Primary	119	114	6008.75
4	Wayne	Walter P Chrysler Fwy and Caniff St	Original	Primary	129	118	9792.83
4	Wayne	Fort St and Van Horn Rd	Original	Secondary	152	144	6905.40
4	Wayne	Grand River Ave and Beech-Daly Rd	Original	Secondary	191	165	45240.94
4	Wayne	Grand River Ave and Fenkell St	Original	Secondary	145	129	17777.43
4	Wayne	Michigan Ave and Evergreen Rd	Original	Secondary	139	121	62402.57
4	Wayne	Michigan Ave and Oakwood Blvd	Original	Secondary	26	23	23202.98
4	Wayne	S Telegraph Rd and Van Born Rd	Original	Secondary	227	202	91094.45
4	Wayne	State Hwy 10 and 7 Mile Rd	Original	Secondary	95	76	22326.95
4	Wayne	State Hwy 153 and N Wayne Rd	Original	Secondary	304	284	6667.50
4	Wayne	State Hwy 3 and Grand Blvd	Original	Secondary	122	111	315600.36
4	Wayne	State Hwy 39 and Oakwood Blvd	Original	Secondary	218	206	2271.56
4	Wayne	State Hwy 85 and Sibley Rd	Original	Secondary	236	224	4720.47
4	Wayne	Telegraph Rd and Wick Rd	Original	Secondary	274	240	11625.62
4	Wayne	US Hwy 12 and Venoy Rd	Original	Secondary	160	137	6975.82
4	Wayne	US Hwy 24 and Van Born Rd	Original	Secondary	157	148	34372.77
4	Wayne	Woodward Ave and 7 Mile Rd	Original	Secondary	138	127	75207.83
4	Wayne	Pinewood Ave and Hoover St	Original	Local	27	24	589473.68
4	Wayne	Prevost St and Grand River Ave	Original	Local	15	11	513761.47