



FINAL REPORT

2009 Direct Observation Surveys of Booster Seat Use

Prepared for:
Office of Highway Safety Planning
4000 Collins Road
Lansing, MI

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

Date: September 2009



**WAYNE STATE
UNIVERSITY**

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| 16. Abstract This study reports the results of the 2009 statewide direct observation surveys of booster seat use in the State of Michigan. Two waves of observational surveys were conducted as a part of this study, one approximately six months after the State's passage of mandatory booster seat legislation and a second survey conducted twelve months post-legislation. All drivers and child passengers between ages 4 and 7 were observed for safety restraint use. Additional data was also collected, including child passenger seating position, vehicle type, and gender, age and race of the driver. Six months after enactment of the legislation, the statewide booster seat use rate was 36.7 percent and the use rate increased to 51.2 percent 12 months after enactment. While booster seat use has increased dramatically since the last statewide survey in 2004, a large percentage of Michigan children continue to travel while inappropriately restrained. | | | |
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TABLE OF CONTENTS

| | PAGE |
|---|-------------|
| 1.0 INTRODUCTION | 1 |
| 2.0 STUDY OBJECTIVES..... | 2 |
| 3.0 METHODOLOGY | 4 |
| 3.1 Sampling Strategy..... | 5 |
| 3.2 Observer Training..... | 7 |
| 3.3 Data Collection Procedures..... | 7 |
| 3.4 Site Selection | 9 |
| 4.0 DATA COLLECTION | 12 |
| 5.0 DATA ANALYSIS..... | 15 |
| 5.1 Statewide Booster Seat Use Calculation..... | 15 |
| 5.2 Statewide Booster Seat Use Variance Calculation | 16 |
| 6.0 RESULTS AND CONCLUSIONS..... | 17 |
| 6.1 Statewide and Stratum-Level Booster Seat Use Rates | 17 |
| 6.2 Booster Seat Use Rates by Geographic, Vehicle, and Driver Characteristics | 19 |
| 6.3 Conclusions..... | 22 |
| 7.0 REFERENCES | 24 |
| APPENDIX I – LIST OF DAYCARE CENTERS OBSERVED..... | 26 |
| APPENDIX II – LIST OF ELEMENTARY SCHOOLS OBSERVED | 28 |
| APPENDIX III – LIST OF FAST FOOD RESTAURANTS OBSERVED..... | 30 |
| APPENDIX IV – LIST OF SHOPPING CENTERS OBSERVED..... | 32 |
| APPENDIX V – LIST OF ROADSIDE LOCATIONS OBSERVED | 35 |

LIST OF FIGURES

| | PAGE |
|---|-------------|
| Figure 1. Sample Data Collection Form | 8 |

LIST OF TABLES

| | |
|---|----|
| Table 1. 2007 Population Estimate of Children Ages 0 to 7 by County..... | 10 |
| Table 2. Michigan Counties by Stratum | 11 |
| Table 3. Summary of Observations by Stratum and Site Type..... | 13 |
| Table 4. Summary of Observations by Vehicle Characteristics | 14 |
| Table 5. Summary of Observations by Driver Characteristics | 15 |
| Table 6. Statewide Weighted Booster Seat Use Rate for 4-to-7 Year Old Child Passengers..... | 18 |
| Table 7. Statewide Weighted Restraint Use Rates for 4-to-7 Year Old Child Passengers..... | 18 |
| Table 8. Booster Seat Use Summary by Stratum..... | 19 |
| Table 9. Booster Seat Use Summary by Site Type..... | 19 |
| Table 10. Booster Seat Use Summary by Vehicle Characteristics | 20 |
| Table 11. Booster Seat Use Summary by Driver Characteristics | 21 |

1.0 INTRODUCTION

Traffic crashes are the leading cause of death among children between the ages of 5 and 14 and the second most frequent cause of death among children under age 5 in the State of Michigan [1]. Improper use of child restraint devices has been recognized as a significant factor contributing to this public health dilemma. From 2004 to 2008, a total of 5,372 children between the ages of 4 and 7 were injured in Michigan traffic crashes [2]. Of those crash-involved child passengers, only 1,329 were restrained in some type of child restraint device. Among those children who were restrained in a child restraint device, 5.3 percent suffered fatal or incapacitating injuries in comparison to 15.8 percent of children who were either improperly restrained in a child restraint device or completely unrestrained [2]. These figures illustrate the heightened risks of injury faced by children when traveling in automobiles with inappropriate restraint devices for their particular age, weight, or height. Past research has shown that children between the ages of 4 and 7 and less than 4 feet 9 inches in height are best protected when restrained in either a child safety seat or booster seat [3-5]. The risk of injury for children in this age group is reduced by 59 percent when a proper child restraint device is used and the risk of head or brain injuries is reduced by 75 percent [4].

In light of such evidence, Section 14 of the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act of 2000 called for the development of a five-year strategic plan to reduce deaths and injuries caused by a failure to use booster seats among 4 to 7 year old children by 25 percent [6]. In response, several states passed legislation requiring the use of booster seats by child passengers in this age group, including the State of Wisconsin on June 1, 2006. An evaluation study conducted at locations in Milwaukee, Wisconsin and using sites in Detroit, Michigan as a control group revealed that a significantly higher proportion of children were appropriately restrained in Milwaukee following the enactment of the law as compared to Detroit [7]. Nationwide, research has revealed that children ages 4 through 7 in states with booster seat laws are 39 percent more likely to be appropriately restrained in a booster seat or child safety seat in comparison to states without booster seat laws [8].

In the State of Michigan, restraint use among child passengers under 4 years of age has increased from 74.5 percent in 1997 to 91.8 percent in 2007 [9,10]. These gains may be due to various

factors, including increased public awareness efforts aimed at educating the public of the importance of appropriate restraint use. However, restraint use among 4 to 7 year-olds has been shown to be substantially lower. A 2004 direct observation survey revealed that only 13.7 percent of Michigan children in this age group were in a child restraint device, with 8.6 percent of children in a booster seat and 5.1 percent in a child safety seat [11,12]. There are several potential explanations for the low booster seat use rate, including a lack of knowledge regarding the benefits of booster seats in comparison to seatbelts alone and differences in risk perception among parents [13-19]. However, the primary reason appeared to be a lack of appropriate booster seat legislation. In a 2004 telephone survey of 350 Michigan households with children between the ages of 4 and 8, 60 percent of part-time and non-booster seat users said they would be more likely to use booster seats if mandated by law. Among the part-time users, 70 percent of the respondents stated they used booster seats because they believed it was the law [16]. Consequently, the State of Michigan passed Senate Bill 82 on March 27, 2008, requiring the use of approved child restraint devices for all child passengers less than 8 years of age and less than 4 feet 9 inches in height.

2.0 STUDY OBJECTIVES

The purpose of this study is to determine the rate of booster seat use 6 months and 12 months after the enactment of the booster seat legislation of Michigan Senate Bill 82 through direct observation surveys. These survey results have the potential to provide valuable information regarding changes in booster seat use throughout the State of Michigan and identify areas for opportunity for increasing the use of appropriate child restraint devices by Michigan drivers. Understanding the degree of nonuse will also assist agencies in developing educational efforts, public awareness campaigns, and enforcement initiatives that may be used to improve booster seat use. Prior to conducting these booster seat use surveys, a methodology was developed based upon previous studies of child restraint device use that have been conducted both in Michigan and nationwide. These studies have utilized a variety of implementation methods and sampling designs.

Since 1998, the Children's Hospital of Philadelphia has partnered with State Farm Insurance to conduct a national study of restraint use. This study has utilized a 30-minute telephone survey to

collect data on 4 to 8 year old children involved in crashes where the crash-involved vehicle was insured by the State Farm Insurance Company. Michigan is one of 16 states included in the survey, which has reported nationwide booster seat use to have increased from 4 percent in 1999 to 46 percent in 2007 [20-23]. The 2007 study showed a booster seat use rate of 39 percent in Michigan [23], though it should be noted that this data sample may not be representative of the population of target age child passengers since these occupants were both crash involved and in a vehicle insured by a specific insurance company.

The Motor Vehicle Occupant Safety Survey (MVOSS) is another telephone survey, conducted biennially for the National Highway Traffic Safety Administration (NHTSA) to obtain data related to occupant protection issues, including the use of child restraint devices. The 2003 survey provided data on 669 children between ages 4 and 7 and found that 21 percent had reportedly used booster seats on at least one occasion during the year of the study [24].

One of the drawbacks of telephone surveys is the potential for self-selection bias as certain persons may be more or less likely to respond or provide accurate information regarding their use of restraint devices. Ideally, a survey design will allow for the direct, covert observation of child passengers in a manner similar to the annual safety belt use surveys that are conducted in the State of Michigan [25-28]. However, the random sampling procedure utilized for the safety belt surveys is problematic when analyzing booster seat use due to the relatively low frequency of target age child passengers generally observed at controlled intersections. Consequently, most direct observation surveys of booster seat use are instead conducted using some form of convenience sampling which occurs at locations subject to high volumes of 4-to-7 year old child passengers.

The Safe Kids organization sponsored observational surveys and driver interviews as part of a 2002 study conducted at 174 sites nationwide, resulting in a sample of 9,332 children under age 15 [29]. Among children ages 4 through 7 and weighing over 40 pounds, 37 percent were observed in booster seats. These observations were obtained from a sample of gas stations, fast food restaurants, and shopping malls that were selected at the discretion of the trained observers.

Recently, the National Survey of the Use of Booster Seats (NSUBS) provided the first nationwide probability-based estimate of booster seat use [30-32]. The survey resulted in observations at 430 sites in 16 geographic areas across the country. Data was collected at four types of sites, including gas stations, recreation centers, daycare centers, and fast-food restaurants due to the expected high frequency of child trips at such locations. In the target 4 to 7 year-old age group, 37 percent of children were restrained in booster seats.

To date, one statewide direct observation survey of booster seat use was conducted in the State of Michigan as part of a 2004 Michigan Department of Community Health study [11,12]. A total of 3,420 children were observed at day care centers, grocery stores, shopping centers, and McDonald's restaurants. These types of sites were selected based upon National Household Travel Survey (NHTS) data, which revealed trips to such establishments to be among the most common for children in the target age group. Day care centers were observed during the morning drop off period while the other types of establishments were observed during peak traffic periods. Observations were conducted for 90-minute time periods at the day care centers and 60-minute time periods at all other locations. Field staff observed the restraint use and gender of 4-to-8 year old child passengers. The restraint use, gender, and age of the driver was also observed and recorded as vehicles entered the parking areas of each establishment. Overall, the statewide booster seat use rate was 8.6 percent and use was highest in sport-utility vehicles and lowest in pickup trucks. Booster seat use rates were also higher for drivers between 30 and 59 years of age and when the driver was properly restrained.

This study builds off of the methodologies from these and other previous surveys of booster seat use to estimate the booster seat use rate in the State of Michigan. The remainder of this report documents the methods, procedures, and results of these direct observation surveys.

3.0 METHODOLOGY

The methodologies used in previous booster seat use surveys, both in Michigan and nationwide, were examined to determine their appropriateness in addressing the needs of the Office of Highway Safety Planning (OHSP) and the State of Michigan. In addition to booster seat

surveys, similar study designs were reviewed from direct observation surveys of safety belt and child restraint device use in Michigan [9,10,25-28].

3.1 Sampling Strategy

Two specific sampling strategies were compared for consideration of implementation for the statewide surveys. The two strategies can be broadly described as a “Roadside” sampling strategy based upon the methodology developed for the 2005 to 2008 Direct Observation Surveys of Safety Belt Use [25-27] and a “Destination” sampling strategy based upon the methodology utilized in the recent National Survey of the Use of Booster Seats [30-32]. The methodology from the NSUBS involves sampling of target age children from gas stations, day care centers, fast food restaurants, and shopping centers and is closely related to that of recent studies conducted in the State of Michigan [11,12,33,34].

Pilot data collection efforts were conducted during November and December at locations that were randomly selected within Wayne County to compare these two sampling schemes. The locations for the “Roadside” sample were randomly selected from the 41 sites within Wayne County that are utilized for the annual safety belt surveys [25-27]. The “Destination” locations were randomly selected from a list of 582 Wayne County elementary schools obtained from SchoolTree.org [35] and from a list of businesses, including fast food restaurants and shopping centers obtained from Microsoft Live Search Maps [36].

Data were collected at the “Roadside” locations throughout the day from approximately 7 AM to 4 PM. For the “Destination” locations, data were collected at elementary schools during the periods immediately before school started in the morning and immediately after school finished in the afternoon. Data were collected at the restaurants and shopping centers between the AM and PM school data collection periods.

The pilot data revealed that during the periods before and after school, the “Destination” sample yielded an average of 16.81 target age (4 to 7-year old) children per observer per hour in comparison to 4.65 target age children per observer per hour for the “Roadside” sample. During the off-peak period, the two samples yielded only 1.28 and 2.61 target age children per person

per hour, respectively. While the “Roadside” sample provided a marginally better sample size during the off-peak periods, it should be noted that this data collection occurred in Wayne County where the per-site traffic volumes are substantially larger than those of other sample counties. It is assumed that the off-peak volumes in less populous counties would reduce these samples further.

Based upon the findings of these pilot studies, the following destination-based sampling strategy was proposed and accepted by the Office of Highway Safety Planning:

Weekdays

1. During the time period from approximately 7:30 to 9:00 AM (prior to the start of the elementary school day), observations were conducted for one-hour periods at elementary schools (one-half hour before the school start time until one-half hour after).
2. During the time period from approximately 9:00 AM to 2:30 PM, observations were conducted for 90-minute time periods at other destination locations, which included shopping centers and fast food restaurants.
3. During the time period from approximately 2:30 PM to 3:30 PM (when elementary schools are dismissed), additional one-hour observational studies were conducted at elementary schools.
4. During the time period from 3:30 to 5:30 PM (or until darkness precluded the ability of observers to accurately determine restraint usage), additional 90-minute studies were conducted at other destination locations (shopping centers and fast food restaurants).

Weekends

5. During the time period from approximately 7:30 AM to 5:30 PM (or until darkness precluded the ability of observers to accurately determine restraint usage), observations were conducted for 90-minute time periods at destination locations consisting of shopping centers and fast food restaurants.

3.2 Observer Training

Staff members of the Wayne State University Transportation Research Group (WSU-TRG) participated in the field data collection activities for this project. All participating staff members were trained in general traffic data collection methods and procedures, and the majority of these field observers also participated in 2008 direct observation surveys of safety belt use.

At the onset of the observer training program, each data collector received targeted instruction comprised of classroom training and field data collection for the booster seat survey. Observers were paired up for the field training, and field data collection involved two person teams at each study location. In addition to the classroom training, each data collector also received a training manual, supplementing the information received during the training session, as well as all necessary field supplies.

The Principal Investigators conducted the classroom training sessions on October 30th and December 4th of 2008 and on April 3rd and June 15th of 2009, in addition to monitoring the performance of the field observers. Comparisons were made between the observations of each paired observer, as well as between each group of observers. The performance of each observer was assessed through a series of classroom tests and field training exercises conducted until desired levels of performance were achieved. Classroom tests required observers to accurately determine the age and restraint use of target age child passengers in photographs. Reliability and repeatability were assessed by comparing the results of observations made within and between pairs of observers in the field data collection exercises.

Observers who did not satisfy validity, repeatability, and reliability requirements were provided additional training until such requirements were satisfied. Those observers who did not satisfy these requirements were not sent into the field for the full-scale implementation of the surveys.

3.3 Data Collection Procedures

For the direct observation field surveys, the driver of each vehicle and all child passengers under age 8 in each vehicle were observed for restraint use and non-use. A sample field observation form is shown in Figure 1. In each survey, all drivers were identified based upon their gender,

age group, and ethnicity. In addition, the seating position and age of each child passenger was recorded. It was assumed that neither gender nor ethnicity of the child passenger would impact the use of booster seats and this data was not collected.

The vehicles were categorized into four groups: passenger vehicles, sport utility vehicles, vans or minivans, and pickup trucks. Driver restraint use was categorized as one of the following: not belted; belted; belt behind back; and belt under arm.

Due to similarities between the data collection efforts of the booster seat survey and a similar survey on child restraint device use, a common form was utilized for both projects. Consequently, an age assessment was required for each child passenger under age 8, in addition to their restraint use and seating position in the vehicle. The same restraint use categories were used as for the drivers, with the addition of categories for each of the four types of child restraint devices (front-facing child safety seat, rear-facing child safety seat, high-back booster, and backless booster).

BOOSTER SEAT/CHILD RESTRAINT DEVICE DIRECT OBSERVATION SURVEY FORM

Vehicle/Observation Number: _____ Location: _____
 Traffic Flow/Direction: _____ Site Number: _____ Date: _____
 Time Started Observations: _____ AM PM Time Ended Observations: _____ AM PM
 Volume Count: _____ / _____ Observer's Name/s _____

| | | | | | | | | | | | | | | |
|--|--------------------------|--------------------------------|--|--|--|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> SAME VEHICLE/DRIVER AS PREVIOUS CHILD | | | | | | | | | | | | | | |
| VEHICLE TYPE: | | | | | | | | | | | | | | |
| <input type="checkbox"/> Passenger Car | | <input type="checkbox"/> SUV | | <input type="checkbox"/> Van/Minivan | | | | | | | | | | |
| | | | | <input type="checkbox"/> Pickup Truck | | | | | | | | | | |
| DRIVER | | | | | | | | | | | | | | |
| RESTRAINT USE: | | AGE: | | GENDER: | | | | | | | | | | |
| <input type="checkbox"/> Not Belted | | <input type="checkbox"/> 16-29 | | <input type="checkbox"/> Male | | | | | | | | | | |
| <input type="checkbox"/> Belted | | <input type="checkbox"/> 30-59 | | <input type="checkbox"/> Female | | | | | | | | | | |
| <input type="checkbox"/> Belt Behind Back | | <input type="checkbox"/> 60+ | | | | | | | | | | | | |
| <input type="checkbox"/> Belt Under Arm | | | | <input type="checkbox"/> Caucasian <input type="checkbox"/> African American <input type="checkbox"/> Asian or Pacific Islander <input type="checkbox"/> Hispanic <input type="checkbox"/> Native American/Other | | | | | | | | | | |
| CHILD PASSENGER | | | | | | | | | | | | | | |
| RESTRAINT USE: | | | AGE: | | SEATING POSITION: | | | | | | | | | |
| <input type="checkbox"/> Not Belted | | | <input type="checkbox"/> Front-Facing CSS | | <table border="1" style="width: 100%; text-align: center;"> <tr> <td>D</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> | D | <input type="checkbox"/> |
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| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | |
| <input type="checkbox"/> Belted | | | <input type="checkbox"/> Rear-Facing CSS | | | | | | | | | | | |
| <input type="checkbox"/> Belt Behind Back | | | <input type="checkbox"/> High-Back Booster | | | | | | | | | | | |
| <input type="checkbox"/> Belt Under Arm | | | <input type="checkbox"/> Backless Booster | | | | | | | | | | | |

FIGURE 1: SAMPLE DATA COLLECTION FORM

3.4 Sample Size Determination and Site Selection

Once the sampling strategy was finalized, it was necessary to identify the individual sites to be observed through the direct observation surveys. However, before making that determination, it was first necessary to determine a target number of sites to ensure the reliability of the booster seat use estimates. In order to calculate the number of children to observe within the target 4 to 7 year old age group, an acceptable error rate was specified, as well as a preliminary estimate of the booster seat use rate among that age group. The following formula was then used, which provides an approximate sample size for a two-sided test on a binomial proportion, such as the proportion of booster seat users:

$$n = \left(\frac{Z_{\alpha/2}}{E} \right)^2 p(1 - p),$$

where:

n = minimum required sample size,

$Z_{\alpha/2}$ = standard normal value corresponding to 95-percent confidence

E = acceptable error rate, and

p = proportion of children restrained in booster seats.

Assuming the 8.6 percent booster seat use rate from the 2004 survey [10,11] as a baseline and a 1 percent error rate in order to provide as precise an estimate as is practically possible, a target sample size of 3,020 children between ages 4 and 7 was established.

These observations should be representative of vehicles and target age passengers within the State of Michigan. In order to ensure the representativeness of the sample, these observations should be diverse in terms of geographic coverage, vehicle mix, and socioeconomic characteristics of the drivers. To ensure such representativeness, a methodology similar to the NHTSA safety belt use survey requirements was utilized, similar to that of the recent direct observation surveys of seat belt use conducted by the WSU-TRG. However, instead of sampling from those counties which represent at least 85 percent of the state population, efficiencies are created by instead selecting those counties which represent 85 percent of the target population between ages 4 and 7. The census estimates of children in this age range are provided in Table 1 for the 26 counties that represent at least 85 percent of the target age population in the State of

Michigan. These 26 counties are all included among the 32 counties from the direct observation surveys of seatbelt use, though differences in the population base allowed for the removal of Clinton, Ionia, Isabella, Marquette, Montcalm, and St. Joseph counties.

TABLE 1 2007 Michigan Population Estimate of Children Ages 0 to 7 by County

| County | Total Population Age 4 to 7 | Percent of Statewide 4 to 7 Population | Cumulative Percent of 4 to 7 Population |
|----------------|------------------------------------|---|--|
| Wayne | 109,512 | 21.1% | 21.1% |
| Oakland | 62,349 | 12.0% | 33.1% |
| Macomb | 42,237 | 8.1% | 41.2% |
| Kent | 36,923 | 7.1% | 48.3% |
| Genesee | 23,669 | 4.6% | 52.9% |
| Washtenaw | 17,006 | 3.3% | 56.2% |
| Ottawa | 14,676 | 2.8% | 59.0% |
| Ingham | 13,615 | 2.6% | 61.6% |
| Kalamazoo | 12,497 | 2.4% | 64.0% |
| Saginaw | 10,226 | 2.0% | 66.0% |
| Muskegon | 9,333 | 1.8% | 67.8% |
| Livingston | 9,269 | 1.8% | 69.6% |
| St. Clair | 8,455 | 1.6% | 71.2% |
| Berrien | 8,352 | 1.6% | 72.8% |
| Jackson | 8,161 | 1.6% | 74.4% |
| Monroe | 7,406 | 1.4% | 75.8% |
| Calhoun | 7,197 | 1.4% | 77.2% |
| Allegan | 6,096 | 1.2% | 78.4% |
| Bay | 5,040 | 1.0% | 79.4% |
| Eaton | 5,245 | 1.0% | 80.4% |
| Lenawee | 4,994 | 1.0% | 81.3% |
| Lapeer | 4,326 | 0.8% | 82.2% |
| Van Buren | 4,246 | 0.8% | 83.0% |
| Midland | 4,035 | 0.8% | 83.8% |
| Grand Traverse | 4,034 | 0.8% | 84.5% |
| Shiawassee | 3,552 | 0.7% | 85.2% |

The candidate counties were subsequently partitioned into four strata based upon historical seatbelt use and vehicle miles traveled as per the direct observation surveys of safety belt use. These counties were partitioned as shown in Table 2.

Table 2. Michigan Counties by Stratum

| Stratum 1 | Stratum 2 | Stratum 3 | Stratum 4 |
|------------------|------------------|------------------|------------------|
| Ingham | Allegan | Berrien | Wayne |
| Kalamazoo | Bay | Calhoun | |
| Oakland | Eaton | Genesee | |
| Washtenaw | Grand Traverse | Lapeer | |
| | Jackson | Lenawee | |
| | Kent | Monroe | |
| | Livingston | Muskegon | |
| | Macomb | Saginaw | |
| | Midland | Shiawassee | |
| | Ottawa | St. Clair | |
| | | Van Buren | |

The specific sites to be observed were selected from a sample of locations that are expected to yield high volumes of target age child passengers, including day care centers, fast food restaurants, and shopping centers throughout the state. To allow for a direct comparison between the results of these surveys and those conducted for the 2004 Michigan Department of Community Health study, the same sites utilized as a part of that study were selected for use as a part of this study. For the 6-month survey, elementary school sites were added to the sample as this is the primary type of trip made during the school year according to National Household Travel Survey data. A list of all elementary schools in the 26-county sample was obtained from SchoolTree.org [35] and schools were randomly selected within each stratum in this list. Another difference between the sites of the 2004 and 2009 studies was due to the fact that sites were removed from those counties that were no longer among the 26 most populous counties in terms of target age children due to changes in the 4-to-7 year old child population. In addition, several of the destination locations observed in 2004 were no longer in business. The fast food restaurant and shopping center sites were replaced from a list of businesses obtained through Microsoft Live Search Maps [36]. Daycare centers were selected from a list provided through the Michigan Department of Human Services [37]. These locations were also randomly selected within each stratum. In cases where sites were removed due to a county no longer being included in the sample, these locations were replaced by a sample of locations from the “new” counties that were added to the sample for the 2009 surveys. Complete lists of locations used for the booster seat use surveys are included by site type in Appendix I (Daycare Centers), Appendix

II (Elementary Schools), Appendix III (Fast Food Restaurants), Appendix IV (Shopping Centers), and Appendix V (Roadside Locations) of this report.

During weekday surveys, the data collection schedule was arranged such that observations could be conducted at an elementary school at the start of the day, followed by destination locations that were en route to the second elementary school that would be visited later that day. Each school was contacted to determine exact start and end times and each restaurant and shopping center was contacted to ensure it was still in operation. In order to minimize the travel time and distance required to conduct this study, the observation sites were clustered into geographic regions upon final selection.

During the collection of the first wave of data, it was noted that the sample sizes for the non-elementary school sites were substantially lower than was initially anticipated based upon the 2004 survey and the pilot data collection activities. Consequently, additional sites were added to the sample until the minimum sample size requirement was met. For the 12-month post-legislation survey, additional observational data was collected in coordination with the post-Click-It-or-Ticket surveys of safety belt use to supplement the destination-based data.

4.0 DATA COLLECTION

The observational survey for the 6-month post-legislation statewide sample was performed between Saturday, January 3rd and Wednesday, January 21st of 2009. During this observation period, a total of 3,756 observations were made throughout the 26-county sample.

The observational survey for the 12-month post-legislation statewide sample was performed between Sunday, May 31st and Tuesday, July 14th of 2009. During this observation period, 3,059 observations were made at the same sites used during the January survey, with the exception of the school sites that were replaced by day care centers, in addition to data collected at roadside locations in coordination with a post-Click-It-Or-Ticket survey of safety belt use. Additional sites were added to the sample as the initial sample of locations did not meet the sample size requirement of the study.

Summary statistics detailing the two booster seat use surveys are provided in Table 3, Table 4, and Table 5. Table 3 shows the number of target age children observed by stratum and type of site. During the 6-month post-legislation survey, between 823 and 1075 observations were obtained in each stratum while during the 12-month post-legislation survey, sample sizes ranged from 744 to 791 target age children. The relative proportion of observations obtained at fast food restaurants and shopping centers remained relatively consistent between the two survey periods. However, the number of day care observations was increased as a part of the 12-month post-legislation survey as elementary schools were not in session at the time the surveys were conducted. Elementary schools provided over half of the sample during the 6-month post-implementation survey.

Table 3. Summary of Observations by Stratum and Site Type

| Stratum | Number of Target Age Children Observed by Stratum and Survey Period | |
|-----------------|---|----------|
| | 6-Month | 12-Month |
| 1 | 823 | 747 |
| 2 | 1018 | 777 |
| 3 | 1075 | 791 |
| 4 | 840 | 744 |
| Total | 3756 | 3059 |
| Site Type | Number of Target Age Children Observed by Site Type and Survey Period | |
| | 6-Month | 12-Month |
| Food | 432 | 498 |
| Shop | 1181 | 1305 |
| Day Care | 160 | 436 |
| School/Roadside | 1983 | 0 |
| Roadside | 0 | 820 |
| Total | 3756 | 3059 |

Table 4 provides details of the number of children observed by type of vehicle and seating position. The distribution of vehicle types was similar between the two periods, as was seating position, with the exception of first row seating. During the 6-month survey, 21.9 percent of children were observed in the first row of seating, compared to only 11.1 percent during the 12-month survey. This is an encouraging finding as Michigan legislation requires that children are not restrained in the front seat if other alternatives are available.

Table 4. Summary of Observations by Vehicle Characteristics

| Vehicle Type | Number of Target Age Children Observed by Vehicle Type and Survey Period | |
|----------------------------------|--|----------|
| | 6-Month | 12-Month |
| Passenger Car | 1677 | 1403 |
| Sport Utility Vehicle | 961 | 773 |
| Van/Minivan | 911 | 693 |
| Pickup Truck | 207 | 190 |
| Total | 3756 | 3059 |
| Child Passenger Seating Position | Number of Target Age Children Observed by Seating Position and Survey Period | |
| | 6-Month | 12-Month |
| First Row – Center | 19 | 10 |
| First Row – Right | 804 | 330 |
| Second Row – Left | 1526 | 1211 |
| Second Row – Center | 326 | 195 |
| Second Row – Right | 1001 | 1231 |
| Third Row – Left | 43 | 39 |
| Third Row – Center | 2 | 7 |
| Third Row – Right | 35 | 36 |
| Total | 3756 | 3059 |

Table 5 presents data on the number of children observed by various driver characteristics, including gender, age, race, and belt use. Approximately one-third of children (33.4%) were traveling with a male driver during the 6-month survey and this percentage decreased slightly (29.9%) during the 12-month survey. The vast majority of drivers were in the 30-to-59 year old age group, which comprised 86.3 percent of all observations during the 6-month survey and 84.5 percent during the 12-month survey. The percentage of drivers age 60 and above increased from 3.3 percent to 4.7 percent between the two survey periods while the percentage of drivers in the youngest age group did not change significantly. The relative frequency of observations by driver race also remained stable between the two survey periods. Safety belt use by the drivers increased from 97.8 percent during the first wave of surveys to 98.8 percent during the second wave. These rates were slightly above the statewide belt use average and the 12-month survey was conducted after the conclusion of the Michigan State Police Click-It-Or-Ticket campaign, which may have contributed to changes in both driver belt use and child restraint use.

Table 5. Summary of Observations by Driver Characteristics

| Driver Gender | Number of Target Age Children Observed By Driver Gender and Survey Period | |
|---------------------------|---|-----------------|
| | 6-Month | 12-Month |
| Male | 1253 | 915 |
| Female | 2503 | 2144 |
| Total | 3756 | 3059 |
| Driver Age | Number of Target Age Children Observed by Driver Age and Survey Period | |
| | 6-Month | 12-Month |
| 16 to 29 | 391 | 331 |
| 30 to 59 | 3242 | 2585 |
| 60 or above | 123 | 143 |
| | 3756 | 3059 |
| Driver Race | Number of Target Age Children Observed by Driver Age and Survey Period | |
| | 6-Month | 12-Month |
| Caucasian | 2998 | 2506 |
| African American | 624 | 418 |
| Asian or Pacific Islander | 60 | 60 |
| Hispanic | 69 | 75 |
| | 3751 | 3059 |
| Driver Belt Use | Number of Target Age Children Observed by Driver Restraint Use and Survey Period | |
| | 6-Month | 12-Month |
| Belted Appropriately | 3673 | 3023 |
| Not Belted Appropriately | 83 | 36 |
| Total | 3756 | 3059 |

5.0 DATA ANALYSIS

Rates for booster seat use were determined at the state-level, as well as for each survey stratum, and each of the characteristics previously described. The procedures used to calculate these rates and their associated variances are outlined in this section of the report.

5.1 Statewide Booster Seat Use Rate Calculation

In order to determine the statewide booster seat use rate, a procedure was utilized similar to that of previous studies, including the previous direct observation surveys of seatbelt use [25-27].

First, the booster seat use rate at each study location was calculated as shown here:

$$g_{ij} = \frac{b_{ij}}{o_{ij}}$$

where:

g_{ij} = booster seat rate at location i in stratum j

b_{ij} = number of target age children restrained in booster seats at location i in stratum j

o_{ij} = total number of target age children observed at location i in stratum j

Then, the booster seat use rate within each stratum (r_j) was determined as follows:

$$r_j = \frac{\sum_i b_{ij}}{\sum_i o_{ij}}$$

Once the booster seat use rates were determined within each stratum, the statewide booster seat use rate was calculated using the following equation:

$$r_{TOTAL} = \frac{\sum_j p_j r_j}{\sum_j p_j}$$

where:

r_{TOTAL} = statewide booster seat use rate

p_j = population of target age children in stratum j

The p-values in the preceding equation are weighting factors that are necessary because strata with higher populations of 4 to 7 year-old children will have a greater impact on the statewide usage rate than strata with lower populations.

5.2 Statewide Booster Seat Use Variance Calculation

Upon obtaining estimates of the booster seat use rates for each of the four strata, the variance for each stratum was determined using Cochran's equation [38]:

$$Var_j \approx \frac{n_j}{n_j - 1} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 (g_{ij} - r_j)^2 + \frac{n_j}{N_j} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 \frac{(g_{ij} - r_j^2)^2}{g_i}$$

where:

Var_j = variance for stratum j

n_j = number of sampled observation locations in stratum j

N_j = number of available observation locations in stratum j

The second term in the above equation can be dropped from the equation with no significant impact on the resulting estimate, providing the following formula where all variables are as previously defined:

$$Var_j \approx \frac{n_j}{n_j - 1} \sum_i \left(\frac{o_{ij}}{\sum_i o_{ij}} \right)^2 (g_{ij} - r_j)^2$$

Given the variance of booster seat use within each stratum, the statewide variance in booster seat use can then be calculated using the following formula:

$$Var_{TOTAL} = \sum_j p_j^2 Var_j$$

where:

Var_{TOTAL} = statewide variance in booster seat use

The calculated variances were used to construct 95-percent confidence intervals for the strata and statewide booster seat use rates using the following equation:

$$\text{Strata-level } 95\%CI = r_j \pm 1.96\sqrt{Var_j}$$

$$\text{Statewide } 95\%CI = r_{TOTAL} \pm 1.96\sqrt{Var_{TOTAL}}$$

6.0 RESULTS AND CONCLUSIONS

6.1 Statewide and Stratum-Level Booster Seat Use Rates

The overall weighted statewide booster seat use rates are shown in Table 6, along with a 95-percent confidence interval for each estimate, as well as the associated standard error and relative error. The overall weighted statewide booster seat use rates were calculated based upon the procedure described in the previous section. These results are promising as the rate of booster seat use has increased from 8.6 during the 2004 survey to 36.7 percent six months after enactment of the booster seat legislation and 51.2 percent one year after enactment.

Table 6. Statewide Weighted Booster Seat Use Rate for 4-to-7 Year Old Child Passengers

| Survey Period | Safety Belt Use Rate | Standard Error | Relative Error |
|----------------------|-----------------------------|-----------------------|-----------------------|
| 6-Month | 36.7% ± 3.5% | 1.8% | 4.9% |
| 12-Month | 51.2% ± 2.7% | 1.4% | 2.7% |

When examining each of the specific categories of child restraint use, it is found that 26.0 percent of children were observed in high-back boosters during the 6-month survey and 36.9 percent were in high-back boosters during the 12-month survey as shown in Table 7. The percentage of target age child passengers in each type of booster seat increased significantly between the two survey periods while the percentage of children restrained in only a safety belt declined from 54.5 percent to 38.8 percent. The percentage of children in child safety seats and the percentage completely unrestrained were not significantly different between the two survey periods. However, it is encouraging to note that the percentage of children completely unrestrained has decreased dramatically from the 2004 survey, which showed 37.5 percent of children to travel completely unrestrained. These findings are consistent with other Michigan restraint use surveys that have demonstrated persistent increases in recent years.

Table 7. Statewide Weighted Restraint Use Rates for 4-to-7 Year Old Child Passengers

| Survey Period | Child Safety Seats | High Back Booster Seat | Backless Booster Seat | Safety Belt Only | Completely Unrestrained |
|----------------------|---------------------------|-------------------------------|------------------------------|-------------------------|--------------------------------|
| 6-Month | 3.1% ± 1.2% | 26.0% ± 2.8% | 10.6% ± 1.8% | 54.4% ± 3.2% | 5.8% ± 1.2% |
| 12-Month | 2.2% ± 0.6% | 36.9% ± 2.2% | 14.3% ± 1.6% | 38.8% ± 2.6% | 7.7% ± 1.4% |

When examining use by stratum, those strata that have historically exhibited higher belt use rates by drivers and front seat passengers also exhibited higher rates of booster seat use as shown in Table 8. Booster seat use was highest in strata 1 and 2, followed by stratum 3, and finally stratum 4. While strata 3 and 4 exhibited lower use, all strata exhibited substantial improvements in comparison to 2004, as well as between the periods six months and twelve months after enactment of the booster seat legislation.

Table 8. Booster Seat Use Summary by Stratum

| Stratum | 6-Month Post-Legislation | | 12-Month Post-Legislation | |
|-----------|--------------------------|----------------|---------------------------|----------------|
| | Booster Seat Use Rate | Standard Error | Booster Seat Use Rate | Standard Error |
| Stratum 1 | 44.3% ± 8.8% | 4.5% | 52.9% ± 5.9% | 3.0% |
| Stratum 2 | 38.4% ± 5.7% | 2.9% | 54.1% ± 5.1% | 2.6% |
| Stratum 3 | 34.0% ± 5.3% | 2.7% | 49.1% ± 5.1% | 2.6% |
| Stratum 4 | 29.4% ± 7.1% | 3.6% | 47.8% ± 6.3% | 3.2% |

6.2 Booster Seat Use Rates by Geographic, Vehicle, and Driver Characteristics

Table 9 presents booster seat use rates by type of site. Booster seat use was highest at day care centers during both survey periods. Interestingly, use was higher in fast food restaurants than shopping centers during the 6-month survey and the opposite was true during the 12-month survey. The use rates were found to increase at each site type and these increases were most pronounced at the day care centers, followed by the shopping centers and fast food restaurants. The use rates at the roadside locations were approximately equal to that of the fast food restaurants, though less than the other types of sites.

Table 9. Booster Seat Use Summary by Site Type

| Site Type | Booster Seat Use Rates by Site Type and Survey Period | | | | | |
|-----------------------|---|-------------------|--------------|----------------------------|-------------------|--------------|
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| Fast Food Restaurants | 183 | 432 | 42.4% | 222 | 498 | 44.6% |
| Shopping Centers | 428 | 1181 | 36.2% | 686 | 1305 | 52.6% |
| Day Care Centers | 77 | 160 | 48.1% | 298 | 436 | 68.3% |
| Elementary Schools | 680 | 1983 | 34.3% | - | - | - |
| Roadside Locations | - | - | - | 353 | 820 | 43.0% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |

Booster seat use was highest among sport utility vehicles and vans as shown by Table 10. These types of vehicles, particularly vans and minivans, are generally owned by larger families with more children and this finding may be an indication of unobservable demographic or socioeconomic characteristics that may influence restraint use, such as income or education. Use was lowest among pickup trucks and passenger cars, consistent with results of the 2004 booster seat study.

When examining seating position, booster seat use was highest in the second row of seating, particularly in the outside seats. Use rates were substantially lower in the front seat, which is particularly troubling due to the fact that children should not be seated in the front seat if other seating options are available. Subsequent public awareness and educational campaigns targeted toward this issue may be warranted.

Table 10. Booster Seat Use Summary by Vehicle Characteristics

| Vehicle Type | Booster Seat Use Rates by Vehicle Type and Survey Period | | | | | |
|-------------------------------------|--|----------------------|-------------|----------------------------|----------------------|-------------|
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| Passenger Car | 494 | 1677 | 29.5% | 558 | 1403 | 39.8% |
| Sport Utility Vehicle | 421 | 961 | 43.8% | 504 | 773 | 65.2% |
| Van/Minivan | 405 | 911 | 44.5% | 433 | 693 | 62.5% |
| Pickup Truck | 48 | 207 | 23.2% | 64 | 190 | 33.7% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |
| Child Passenger Seating Position | Booster Seat Use Rates by Seating Position and Survey Period | | | | | |
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| First Row – Center | 6 | 19 | 31.6% | 2 | 10 | 20.0% |
| First Row – Right | 31 | 804 | 3.9% | 16 | 330 | 4.8% |
| Second Row – Left | 693 | 1526 | 45.4% | 638 | 1211 | 52.7% |
| Second Row – Center | 151 | 326 | 46.3% | 91 | 195 | 46.7% |
| Second Row – Right | 444 | 1001 | 44.4% | 764 | 1231 | 62.1% |
| Third Row – Left | 25 | 43 | 58.1% | 25 | 39 | 64.1% |
| Third Row – Center | 0 | 2 | 0.0% | 3 | 7 | 42.9% |
| Third Row – Right | 18 | 35 | 51.4% | 20 | 36 | 55.6% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |

Tables 11 illustrates the rate of booster seat use by various driver characteristics. Use among female drivers was 7.6 percent higher than among male drivers six months after enactment of the booster seat legislation and 10.2 percent higher during the 12-month survey. This is in contrast to the 2004 study, which did not find a substantial difference in booster use between male and female drivers [10,11].

Table 11. Booster Seat Use Summary by Driver Characteristics

| Driver Gender | Booster Seat Use Rates by Driver Gender and Survey Period | | | | | |
|---------------------------|--|-------------------|--------------|----------------------------|-------------------|--------------|
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| Male | 393 | 1253 | 31.4% | 401 | 915 | 43.8% |
| Female | 975 | 2503 | 39.0% | 1158 | 2144 | 54.0% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |
| Driver Age | Booster Seat Use Rates by Driver Age and Survey Period | | | | | |
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| 16 to 29 | 141 | 391 | 36.1% | 149 | 331 | 45.0% |
| 30 to 59 | 1188 | 3242 | 36.6% | 1350 | 2585 | 52.2% |
| 60 or above | 39 | 123 | 31.7% | 60 | 143 | 42.0% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |
| Driver Race | Booster Seat Use Rates by Driver Age and Survey Period | | | | | |
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| Caucasian | 1207 | 2998 | 40.3% | 1372 | 2506 | 54.7% |
| African American | 108 | 624 | 17.3% | 136 | 418 | 32.5% |
| Asian or Pacific Islander | 26 | 60 | 43.3% | 38 | 60 | 63.3% |
| Hispanic | 25 | 69 | 36.2% | 13 | 75 | 17.3% |
| Total | 1368 | 3751 | 36.5% | 1559 | 3059 | 51.0% |
| Driver Belt Use | Booster Seat Use Rates by Driver Restraint Use and Survey Period | | | | | |
| | 6 Months Post-Legislation | | | 12 Months Post-Legislation | | |
| | Children in Boosters | Children Observed | Use Rate | Children in Boosters | Children Observed | Use Rate |
| Belted Appropriately | 1354 | 3673 | 36.9% | 1552 | 3023 | 51.3% |
| Not Belted Appropriately | 14 | 83 | 16.9% | 7 | 36 | 19.4% |
| Total | 1368 | 3756 | 36.4% | 1559 | 3059 | 51.0% |

Use rates by age group were similar to previous studies as the 30-to-59 year old drivers were most likely to use booster seats while older drivers were least likely [10,11]. Each of the age groups experienced substantial increases in use between the two survey waves, ranging from an 8.9-percent improvement for young drivers, 10.3 percent for older drivers, and 15.6 percent for the middle age group. The use rates by race were also consistent with previous studies. Drivers of Asian or Pacific Island descent were most likely to use booster seats, followed by Caucasians,

African American, and Hispanic drivers. These trends are similar to those of the statewide safety belt use surveys.

Finally, booster seat use was dramatically lower among drivers who were not belted appropriately. The use rate among belted drivers was 36.9 percent during the 6-month survey and increased to 51.3 percent during the 12-month survey. Conversely, drivers who were not belted appropriately exhibited only 16.9 percent and 19.4 percent booster seat use rates during the two survey periods.

6.3 Conclusions

The first statewide survey of booster seat use, conducted in 2004 for the Michigan Department of Community Health, estimated a booster seat use rate of 8.6 percent. On July 1, 2008, legislation was enacted requiring all children less than 8 years of age and less than 4 feet 9 inches in height to be restrained in an appropriate child restraint device. The purpose of this study was to determine the statewide booster seat use through two direct observation surveys conducted approximately six months and one year after enactment of the legislation.

The first survey, conducted during January of 2009 at a sample of elementary schools, daycare centers, fast food restaurants, and shopping centers, showed the booster seat use rate had increased to 36.7 percent. The second survey was conducted between June and July of 2009 at daycare centers, fast food restaurants, and shopping centers, as well as roadside locations in coordination with a statewide safety belt survey. This survey estimated a statewide booster seat use rate of 51.2 percent. These increases were found to be consistent across geographic regions of the state and by various population characteristics.

While the results are encouraging, there are several areas where booster seat use lagged behind the statewide average. Booster seat use was lowest among non-daycare center sites, which may be due to parents who bring their children to daycare having greater knowledge or concern regarding appropriate child restraint devices. Booster seat use was lowest among pickup trucks and passenger cars, particularly when children were seated in the front seat. Males and drivers age 60 and above were less likely to use booster seats, as were African American and Hispanic

drivers. Finally, drivers who were not appropriately restrained themselves were significantly less likely to appropriately restrain their children, as well. These findings are consistent with those reported by Doyle and Levitt [39], who find that unrestrained children generally appear to be in vehicles with riskier drivers, including those who are less likely to be properly restrained and more likely to be crash-involved. These groups of drivers present the greatest area of opportunity and should be the focus of future education and outreach programs aimed at informing the public of the importance of appropriate child restraint device use. Similar programs have proven particularly effective at increasing safety belt use among Michigan drivers.

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APPENDIX I – LIST OF DAYCARE CENTERS OBSERVED

| Stratum | County | Name of Day Care Center | Address |
|---------|------------|--|--|
| 1 | Ingham | Educational Child Care Center | 1715 W. Main St., Lansing, MI 48915 |
| 1 | Ingham | Helping Hands Day Care | 2727 W. Holmes Rd., Lansing, MI 48911 |
| 1 | Ingham | Little Rainbows | 2443 Olds Rd., Leslie MI, 49251 |
| 1 | Ingham | Small Folks Development Center | 3140 S. Pennsylvania , Lansing, MI 48910 |
| 1 | Ingham | Spartan Child Development Center | 1730 Crescent Rd., East Lansing, MI 48823 |
| 1 | Kalamazoo | Child Development Center - Borgess | 1521 Gull Rd., Kalamazoo, MI 49048 |
| 1 | Oakland | Art Start Montessori Academy of Farmington Hills | 31195 W. 13 Mile Rd., Farmington Hills, MI 48334 |
| 1 | Oakland | Brookfield Academy - Troy Campus | 3950 Livernois, Troy, MI 48098 |
| 1 | Oakland | Carpenter School - Latch Key | 2290 Flintridge, Orion, MI 48359 |
| 1 | Oakland | Farmington Hills Nurserv School | 25225 Middlebelt Rd, Farmington Hills, MI 48336 |
| 1 | Oakland | Goodison Child Care Center, Inc. | 4461 Collins Rd., Rochester, MI 48306 |
| 1 | Oakland | Red Apple Pre-School | 28117 Milford Rd., New Hudson, MI 48165 |
| 1 | Oakland | Rochester Hills Public Library | 500 Olde Towne Rd., Rochester, MI 48307 |
| 1 | Oakland | Whitney Bloomfield Inc. | 4500 Arline Dr., Orchard Lake, MI 48323 |
| 1 | Washtenaw | Chelsea Com. Hosp. Children's Center | 14600 Old US 12, Chelsea, MI 48118 |
| 2 | Allegan | Appletree Learning Center | 909 Dix St., Otsego, MI 49078 |
| 2 | Jackson | Spring Arbor Cherubs Preschool | 120 E Main, Spring Arbor, MI 49283 |
| 2 | Kent | Appletree Christian Learning Center | 732 52nd St., Kentwood, MI 49508 |
| 2 | Livingston | Garden Gate School | 2100 Progressive Dr., Hartland, MI 48353 |
| 2 | Livingston | Lakeland Montessori School | 5520 M-36, Lakeland, MI 48143 |
| 2 | Macomb | Kinder Care Learning Center#821 | 33300 Rvan Rd., Sterling Heights, MI 48310 |
| 2 | Macomb | Richmond Early Learning Center | 68560 Stoecker Lane, Richmond, MI, 48062 |
| 2 | Macomb | Warren Woods Childcare | 14000 Thirteen Mile, Warren, MI 48088 |
| 2 | Midland | Heaven's Elect Day Care | Suite B 3305 Ridgecrest, Midland, MI 48642 |
| 2 | Midland | Michigan Child Care Centers, Inc. | 1184 James Savage Rd., Midland, MI 48640 |
| 2 | Ottawa | Appletree Christian Learning Center | 11272 Edgewater Dr. Allendale, MI 49401 |
| 2 | Ottawa | Daily Shepherd Child Care | 1481 Baldwin St., Jenison, MI 494288910 |
| 3 | Berrien | The Children's Center, Inc. | 324 E. Dewey St., Ste. 107, Buchanan, MI 49107 |
| 3 | Calhoun | Child Development Center - Lakeview | 55 Arbor St., Battle Creek, MI 49015 |
| 3 | Calhoun | Little Friends Day Care | 1305 Olive St., Battle Creek, MI 49017 |
| 3 | Genesee | Bethel Child Care Center | 6029 Lapeer Rd., Burton, MI 48509 |
| 3 | Genesee | Honey Bear Child Care | 5171 S Linden Road, Swartz Creek, MI 48473 |
| 3 | Genesee | Mulberry Bush Child Care | 5182 N Elms Rd., Flushing, MI 48433 |
| 3 | Lapeer | Family Circle Children's Learning Center | 2266 N Lapeer Road, Lapeer, MI 48446 |
| 3 | Monroe | Carleton Country Day School | 12707 Maxwell Rd., Carleton, MI 48117 |
| 3 | Saginaw | Adventure Land Day Care | 3111 Barnard Road, Saginaw, MI 48603 |
| 3 | Saginaw | Kinder Kare Child Center | 928 West Ardussi, Frankenmuth, MI 48734 |
| 3 | St. Clair | Kids Connection | 301 N 6th Street, St. Clair, MI 48079 |
| 3 | St. Clair | Marysville Childrens Center | 901 Michigan Ave, Marysville, MI 48040 |
| 3 | St. Clair | Nu-Nu'S Nursery and Daycare | 1714 Holland Ave, Port Huron, MI 48060 |
| 4 | Wayne | Beard Early Childhood Center | 840 Waterman, Detroit, MI 48209 |
| 4 | Wayne | Blossoming Child Development Center | 4919 Elmhurst, Detroit, MI 48204 |
| 4 | Wayne | Childrens Corner Center Learning II | 16901 Schoolcraft, Detroit, MI 48227 |
| 4 | Wayne | Childtime Children's Center | 34203 Ford Rd, Westland, MI 48185 |
| 4 | Wayne | Christ the King's Early Childhood Center | 16700 Pennsylvania, Southgate, MI 48195 |
| 4 | Wayne | Henry Ford Kids Child Care Center | 1110 Seward, Detroit, MI 48202 |
| 4 | Wayne | Meadow Bank Day Care | 2122 Dix Hwy, Lincoln Park, MI 48146 |
| 4 | Wayne | Nanny's Nursery School | 9529 Pardee Road, Taylor, MI 48180 |
| 4 | Wayne | Northville First Care | 777 W. Eight Mile Rd., Northville, MI 48167 |
| 4 | Wayne | Order of the Fisherman Ministry Headstart | 10025 Grand River, Detroit, MI 48204 |
| 4 | Wayne | Peter Rabbit Day Care Center, Inc. | 5901 Cadieux, Detroit, MI, 48224 |
| 4 | Wayne | Plymouth/Canton Montessori | 45245 Joy Rd., Canton, MI 48187 |
| 4 | Wayne | Sugar N Spice Nursery School | 16555 Wyoming, Detroit, MI 48236 |
| 4 | Wayne | Sunrise 2 Sunset Child Development | 18708 Telegraph Rd., Brownstown, MI 48174 |
| 4 | Wayne | The Learning Tree - South | 32955 Plymouth Rd., Livonia, MI 48150 |

APPENDIX II – LIST OF ELEMENTARY SCHOOLS OBSERVED

| Stratum | County | Name of Elementary School | Address |
|----------------|----------------|--|---|
| 1 | Ingham | Middle-Michigan Public School Academy | 730 W. Maple Street, Lansing, MI 48906 |
| 1 | Ingham | Moore's Park School | 316 Moore's River Dr, Lansing, MI 48910 |
| 1 | Ingham | St. Thomas Aquinas School | 915 Alton Rd, East Lansing, MI 48823 |
| 1 | Ingham | Woodworth Elementary School | 212 Pennsylvania St, Leslie, MI 49251 |
| 1 | Kalamazoo | Parchment Northwood Elementary School | 600 Edison Street, Kalamazoo MI 49004 |
| 1 | Oakland | Alfred E. Upton Elementary School | 4400 Mandalay Ave, Royal Oak, MI 48073 |
| 1 | Oakland | Carpenter Year Round Elementary School | 2290 Flintridge St, Lake Orion, MI 48359 |
| 1 | Oakland | Green Elementary School | 4500 Walnut Lake Rd, W. Bloomfield, MI 48323 |
| 1 | Oakland | Pleasant Lake Elementary School | 4900 Halsted Road, West Bloomfield, MI 48323 |
| 1 | Washtenaw | North Creek Elementary School | 699 McKinley St., Chelsea, MI 48118 |
| 1 | Washtenaw | South Meadows Elementary School | 335 Pierce St, Chelsea, MI 48118 |
| 2 | Grand Traverse | Kingsley Area Elementary School | 311 Clark Street, Kingsley, MI 49649 |
| 2 | Jackson | Bean Elementary School | 3201 Noble Road., Spring Arbor, MI 49283 |
| 2 | Kent | Creston Christian School | 1031 Page Street Ne, Grand Rapids, MI, 49505 |
| 2 | Kent | Dutton Elementary School | 3820 68th Street SE., Caledonia, MI 49316 |
| 2 | Kent | Grand View Elementary School | 3701 52nd Street SW, Grandville, MI 49418 |
| 2 | Macomb | Briarwood Elementary School | 14100 Leisure Drive., Warren, MI 48088 |
| 2 | Macomb | Harwood Elementary School | 4900 Southlawn Dr, Sterling Heights, MI 48310 |
| 2 | Midland | Adams Elementary School | 1005 Adams Drive., Midland, MI 48642 |
| 2 | Midland | Siebert School | 5700 Siebert Street, Midland, MI 48642 |
| 2 | Ottawa | Allendale Lower Elementary School | 10690 Learning Lane, Allendale, MI, 49401 |
| 2 | Ottawa | Alward Elementary School | 3811 Port Sheldon St., Hudsonville, MI 49426 |
| 2 | Ottawa | Rosewood School | 2370 Tyler Street, Jenison, MI 49428 |
| 3 | Genesee | Dieck Elementary School | 2239 Van Vleet Rd., Swartz Creek, MI 48473 |
| 3 | Genesee | Elms Elementary School | 6125 N Elms Rd., Flushing, MI 48433 |
| 3 | Genesee | Hill Elementary School | 404 Aloha St., Davison, MI 48423 |
| 3 | Monroe | St. Patrick Elementary School | 2970 West Labo Road, Carleton, MI 48117 |
| 3 | Saginaw | Heavenrich School | 2435 Perkins St., Saginaw, MI 48601 |
| 3 | Saginaw | Lorenz C. List School | 805 E Genesee St., Frankenmuth, MI 48734 |
| 3 | Saginaw | Sherwood Elementary School | 3870 Shattuck Rd., Saginaw, MI 48603 |
| 3 | Saginaw | Shields Elementary School | 6900 Stroebel Rd., Saginaw, MI 48609 |
| 3 | St. Clair | Michigamme Elementary School | 2855 Michigan Rd., Port Huron, MI 48060 |
| 3 | St. Clair | Theo V. Eddy Elementary School | 301 N 9th St., St Clair, MI 48079 |
| 3 | St. Clair | Washington Elementary School | 905 16th St., Marysville, MI 48040 |
| 4 | Wayne | Barton Elementary School | 8530 Joy Road, Detroit, MI 48204 |
| 4 | Wayne | Birney Elementary School | 4055 Richton Street, Detroit, Michigan 48204 |
| 4 | Wayne | Burns Elementary School | 14350 Terry St., Detroit, MI 48227 |
| 4 | Wayne | Christ The Good Shepherd School | 1590 Riverbank St., Lincoln Park, MI 48146 |
| 4 | Wayne | Garfield Elementary School | 10218 Arthur St., Livonia, MI 48150 |
| 4 | Wayne | Henry Ruff School | 30300 Maplewood St., Garden City, MI 48135 |
| 4 | Wayne | James Gallimore Elementary School | 8375 N. Sheldon Rd, Canton, MI 48187 |
| 4 | Wayne | MacDowell Elementary School | 4201 W. Outer Drive, Detroit, Michigan 48221 |
| 4 | Wayne | Myers Elementary School | 16201 Lauren Drive, Taylor, MI 48180 |
| 4 | Wayne | Raupp School | 1351 Ethel Ave, Lincoln Park, MI 48146 |

APPENDIX III – LIST OF FAST FOOD RESTAURANTS OBSERVED

| Strata | County | Name of Site | Address |
|---------------|----------------|---------------------|---|
| 1 | Kalamazoo | McDonalds | 3320 S Westnedge, Kalamazoo, MI, 49008 |
| 1 | Kalamazoo | McDonalds | 6355 S Westnedge Ave, Portage, MI 49002 |
| 1 | Kalamazoo | McDonalds | 224 W Kalamazoo Avenue, Kalamazoo, MI 49007 |
| 1 | Kalamazoo | McDonalds | 830 Riverview Dr., Kalamazoo, MI 49001 |
| 1 | Oakland | McDonalds | 808 Rochester Rd., Rochester, MI, 48307 |
| 1 | Oakland | McDonalds | 2985 Walton Blvd., Rochester Hills, MI, 48309 |
| 1 | Oakland | McDonalds | 141 N. Telegraph, Waterford, MI, 48328 |
| 1 | Oakland | McDonalds | 22100 Pontiac Trail, South Lyon, MI 48178 |
| 1 | Oakland | McDonalds | 22525 Woodward, Ferndale, MI 48220 |
| 1 | Oakland | McDonalds | 423 W. 11 Mile, Royal Oak, MI 48067 |
| 1 | Oakland | McDonalds | 1212 W. Maple Rd., Walled Lake, MI 48390 |
| 1 | Oakland | McDonalds | 2829 W. 14 Mile Rd., Royal Oak, MI 48073 |
| 1 | Washtenaw | McDonalds | 1535 S. Main St., Chelsea, MI 48118 |
| 1 | Washtenaw | McDonalds | 5550 W. Michigan Ave, Ypsilanti, MI 48197 |
| 2 | Eaton | McDonalds | 5225 N Grand River Ave, Lansing, MI 48917 |
| 2 | Grand Traverse | McDonalds | 2468 S Airport Rd W, Traverse City, MI 49684 |
| 2 | Kent | McDonalds | 3030 Walker Ave, Walker, MI, 49504 |
| 2 | Kent | McDonalds | 417 Michigan St, Grand Rapids, MI 49503 |
| 2 | Kalamazoo | McDonalds | 415 28th St., Kalamazoo, MI 49548 |
| 2 | Macomb | McDonalds | 25900 Crocker, Mt. Clemens, MI 48045 |
| 2 | Macomb | McDonalds | 15401 E. 12 Mile, Roseville, MI 48066 |
| 2 | Macomb | McDonalds | 41500 Garfield Rd., Clinton Twp, MI 48038 |
| 2 | Ottawa | McDonalds | 5371 Lake Michigan Dr., Allendale, MI 49401 |
| 2 | Ottawa | McDonalds | 213 N River Rd., Holland, MI 49424 |
| 3 | Berrien | McDonalds | 150 E. Ryno Rd., Coloma, MI 49038 |
| 3 | Calhoun | McDonalds | 812 W. Columbia, Battle Creek, MI 49015 |
| 3 | Genesee | McDonalds | 214 N State St., Otisville, MI 48463 |
| 3 | Genesee | McDonalds | 213 N River Rd., Holland, MI 49424 |
| 3 | Genesee | McDonalds | 3212 Clio Rd., Flint, MI 48504 |
| 3 | Genesee | McDonalds | 3391 S Saginaw St., Burton, MI 48529 |
| 3 | Lapeer | McDonalds | 486 S. Main St., Lapeer, MI 48446 |
| 3 | Lenawee | McDonalds | 503 S Meridian St., Hudson, MI 49247 |
| 3 | Monroe | McDonalds | 1001 S. Monroe St., Monroe, MI 48161 |
| 3 | Muskegon | McDonalds | 3586 E Apple Ave., Muskegon, MI 49442 |
| 3 | Muskegon | McDonalds | 1832 W. Sherman Blvd., Muskegon, MI 49444 |
| 3 | Saginaw | McDonalds | 6331 Dixie Hwy, Bridgeport, MI 48722 |
| 3 | Saginaw | McDonalds | 2745 Bay Rd., Saginaw, MI 48603 |
| 3 | St. Clair | McDonalds | 1201 24th St, Port Huron, MI 48060 |
| 3 | St. Clair | McDonalds | 4155 24th Ave, Fort Gratiot, MI 48095 |
| 4 | Wayne | McDonalds | 15405 Southfield, Allen Park, MI 48101 |
| 4 | Wayne | McDonalds | 1469 Fort St. Lincoln Park, MI 48146 |
| 4 | Wayne | McDonalds | 3975 Conner, Detroit, MI 48215 |
| 4 | Wayne | McDonalds | 17800 E. 8 Mile Rd., Harper Woods, MI 48225 |
| 4 | Wayne | McDonalds | 39700 Five Mile, Plymouth, MI 48170 |
| 4 | Wayne | McDonalds | 4145 S. Telegraph, Dearborn Heights, MI 48125 |
| 4 | Wayne | McDonalds | 27255 Telegraph Rd., Flat Rock, MI 48134 |
| 4 | Wayne | McDonalds | 1581 Van Horn, Trenton, MI 48183 |
| 4 | Wayne | McDonalds | 23000 Eureka Rd., Taylor, MI 48180 |
| 4 | Wayne | McDonalds | 38418 Ford Road, Westland, MI 48185 |
| 4 | Wayne | McDonalds | 13158 Ford Rd, Dearborn, MI 48126 |
| 4 | Wayne | McDonalds | 10236 S. Telegraph Rd., Taylor, MI 48180 |

APPENDIX IV – LIST OF SHOPPING CENTERS OBSERVED

| Strata | County | Name of Shopping Center | Address |
|---------------|----------------|--------------------------------|--|
| 1 | Ingham | Eastwood Town Center | 1500 W. Lake Lansing Rd., Lansing, MI 48840 |
| 1 | Ingham | Meijer | 5125 W Saginaw Hwy, Lansing, MI 48917 |
| 1 | Ingham | Target | 4890 Marsh Rd, Okemos, MI 48864 |
| 1 | Kalamazoo | Felpausch Food Center | 120 W Prairie St, Vicksburg, MI 49097 |
| 1 | Kalamazoo | Harding's Market | 6330 S Westnedge, Portage, MI 49002 |
| 1 | Kalamazoo | Harding's Market | 5161 W Main St, Kalamazoo, MI 49009 |
| 1 | Kalamazoo | K-Mart | 6355 S Westnedge Ave, Portage, MI 49002 |
| 1 | Kalamazoo | K-Mart | 4620 Stadium Dr, Kalamazoo, MI 49008 |
| 1 | Kalamazoo | Meijer | 5800 Gull Rd, Kalamazoo, MI 49048 |
| 1 | Oakland | Ferndale Foods | 600 W 9 Mile Rd, Ferndale, MI 48220 |
| 1 | Oakland | Great Lakes Crossing | 4000 Baldwin Road, Auburn Hills, MI 48326 |
| 1 | Oakland | Holiday Food Center | 1203 S Main, Royal Oak, MI 48067 |
| 1 | Oakland | Kmart | 29101 John R Rd, Madison Heights, MI 48071 |
| 1 | Oakland | Kroger | 6625 Dixie Highway, Clarkston, MI 48346 |
| 1 | Oakland | Kroger | 25780 Middlebelt Rd, Farmington, MI 48336 |
| 1 | Oakland | Meijer | 5150 Coolidge Hwy, Royal Oak, MI 48073 |
| 1 | Oakland | Walmart Supercenter | 3301 N. Pontiac Trail, Commerce, MI 48382 |
| 1 | Oakland | Walmart Supercenter | 30729 Lyon Center Dr. E, New Hudson, MI 48165 |
| 1 | Oakland | Walmart Supercenter | 2500 S. Adams Rd., Rochester, MI 48309 |
| 1 | Washtenaw | Briarwood Mall | 100 Briarwood Circle, Ann Arbor, MI 48108 |
| 1 | Washtenaw | Kroger | 400 S Maple Rd, Ann Arbor, MI 48103 |
| 1 | Washtenaw | Meijer | 5645 Jackson Rd, Ann Arbor, MI 48103 |
| 1 | Washtenaw | Meijer | 3825 Carpenter Rd, Ypsilanti, MI 48197 |
| 2 | Allegan | Walmart Supercenter | 412 Oaks Crossing, Plainwell, MI 49080 |
| 2 | Bay | Kroger | 2910 Center Ave, Essexville, MI 48732 |
| 2 | Bay | Pinny Food Center | 704 S Mable St, Pinconning, MI 48650 |
| 2 | Grand Traverse | Grand Traverse Mall | 3200 S. Airport Road W, Traverse City, MI 49684 |
| 2 | Grand Traverse | Tom's Food Center | 13940 S West Bay Shore Dr, Traverse City, MI 49684 |
| 2 | Ingham | Kroger | 6430 W Saginaw Hwy, Lansing, MI 48917 |
| 2 | Ingham | Meijer | 5225 N Grand River Ave, Lansing, MI, 48917 |
| 2 | Ingham | Village Market | 5125 W Saginaw Hwy, Lansing, MI 48917 |
| 2 | Jackson | Frank's Shoprite | 400 Michigan Ave, Grass Lake 49240 |
| 2 | Jackson | Meijer | 2777 Airport Rd, Jackson, MI 49202 |
| 2 | Kent | Century Park Treehouse | 5710 Kenowa Avenue, SW Grandville, MI 49418 |
| 2 | Kent | Meijer | 5500 Clyde Park Ave SW, Wyoming, MI 49509 |
| 2 | Kent | Rivertown Crossings Mall | 3700 RiverTown Parkway, Grandville, MI 49418 |
| 2 | Livingston | Rosati's Market | 130 S. Grand Rd., Fowlerville, MI 48836 |
| 2 | Macomb | Farmer Jack | 50 N. Groesbeck Highway, Mount Clemens, MI 48043 |
| 2 | Macomb | Kroger | 26130 Gratiot Ave, Roseville, MI 48066 |
| 2 | Macomb | Lakeside Mall | 14000 Hall Road, Sterling Heights, MI |
| 2 | Macomb | Shoppers Market | 22800 Van Dyke, Warren, MI 48089 |
| 2 | Macomb | Walmart | 44575 Mound Rd, Sterling Heights, MI 48314 |
| 2 | Ottawa | Meijer | 746 E 16th St, Holland, MI 49423 |
| 2 | Saginaw | Glen's | 2026 N Saginaw St, Midland, MI 49640 |
| 2 | Saginaw | Walmart | 910 Joe Mann Blvd, Midland, MI 48642 |

| Strata | County | Name of Shopping Center | Address |
|---------------|---------------|--------------------------------|--|
| 3 | Berrien | Target | 960 Fairplain Dr., Benton Harbor, MI 49022 |
| 3 | Berrien | Walmart Super Center | 1400 Mall Drive, Benton Harbor, MI 49022 |
| 3 | Calhoun | Lakeview Square Mall | 5775 Beckley Rd, Battle Creek, MI 49015 |
| 3 | Calhoun | Meijer | 2177 W Columbia Ave, Battle Creek, MI 49015 |
| 3 | Calhoun | Walmart Supercenter | 6020 B Drive North, Battle Creek, MI 49014 |
| 3 | Genesee | First Friends Discovery Center | Bldg 1 8031 E. Court Street, Davison, MI 48423 |
| 3 | Genesee | K-Mart | 3083 Miller Rd, Flint, MI 48507 |
| 3 | Genesee | K-Mart | 1145 N Belsay Rd, Burton, MI 48509 |
| 3 | Genesee | Kroger | 7188 N Saginaw Rd, Mt. Morris, MI 48458 |
| 3 | Genesee | Kroger | 2629 W Pierson Rd, Flint, MI 48504 |
| 3 | Genesee | Meijer | 4333 W Pierson Rd, Flint, MI 48504 |
| 3 | Genesee | Meijer | 2333 S Center Rd, Burton, MI 48519 |
| 3 | Genesee | Toys "R" Us | 3250 S Linden Rd, Flint, MI |
| 3 | Lapeer | Walmart | 555 East Genesee, Lapeer, MI 48446 |
| 3 | Lenawee | Borchardt Brothers | 628 W Adrian St, Blissfield, MI 49228 |
| 3 | Lenawee | Busch's Valu Land | 1450 W Chicago Blvd, Tecumseh, MI 49286 |
| 3 | Lenawee | Meijer | 217 E US Highway 223, Adrian, MI 49221 |
| 3 | Monroe | Walmart | 2155 N Telegraph Rd, Monroe, MI 48162 |
| 3 | Muskegon | Lakeshore Market Place | 5241 Harvey, Muskegon, MI 49444 |
| 3 | Muskegon | Meijer | 700 W Norton Ave, Muskegon, MI 49440 |
| 3 | Muskegon | Target | 1740 E Sherman Blvd, Muskegon, MI 49444 |
| 3 | Saginaw | Kroger | 3430 State St, Saginaw, MI 48602 |
| 3 | Saginaw | Meijer | 8400 Gratiot Rd, Saginaw, MI 48609 |
| 3 | Saginaw | Toys "R" Us | 2772 Tittabawassee Rd, Saginaw, MI 48604 |
| 3 | St. Clair | Walmart | 1621 E M 21, Owosso, MI 48867 |
| 3 | Van Buren | Village Market | 407 N. State St., Gobles, MI 49055 |
| 3 | Van Buren | Wagoner's | 24064 McGillen, Mattawan, MI 49071 |
| 3 | Van Buren | Walmart Supercenter | 201 73rd Street, South Haven, MI 49090 |
| 4 | Wayne | Farmer's Food Center | 2411 Central Ave, Detroit MI 48209 |
| 4 | Wayne | Food Pride | 500 E. Warren Ave., Detroit, MI 48201 |
| 4 | Wayne | Harbortown Foods | 3472 East Jefferson, Detroit MI 48207 |
| 4 | Wayne | Holiday Market | 520 S. Lilley Rd., Canton, MI 48188 |
| 4 | Wayne | K-Mart | 2095 Rawsonville Rd, Belleville, MI 48111 |
| 4 | Wayne | Kroger | 23303 Michigan Ave, Dearborn, MI 48124 |
| 4 | Wayne | Kroger | 1647 Merriman Rd., Westland, MI 48185 |
| 4 | Wayne | Kroger | 2060 Dix Ave., Lincoln Park, MI, 48146 |
| 4 | Wayne | Kroger | 37700 Six Mile Rd., Livonia, MI 48152 |
| 4 | Wayne | Kroger | 45540 Michigan Ave, Canton, MI 48188 |
| 4 | Wayne | Kroger | 1905 N Canton Center Rd, Canton, MI 48187 |
| 4 | Wayne | Meijer | 45001 Ford Rd, Canton, MI 48187 |
| 4 | Wayne | Meijer | 14640 Pardee Rd, Taylor, MI 48180 |
| 4 | Wayne | Sak n Save - Merriman | 1647 S Merriman Rd, Westland, MI, 48186 |
| 4 | Wayne | Sears | 2100 Southfield Road, Lincoln Park, MI 48146 |
| 4 | Wayne | Target | 20100 Haggerty Rd, Livonia, MI 48152 |
| 4 | Wayne | Target | 29859 Plymouth Road, Livonia, MI 48150 |
| 4 | Wayne | Toys "R" Us | 29150 W. Seven Mile Rd, Livonia, MI 48152 |
| 4 | Wayne | Walmart | 30007 Plymouth Rd., Livonia, MI 48150 |
| 4 | Wayne | Walmart | 29555 Plymouth Rd, Livonia, MI 48150 |
| 4 | Wayne | Walmart | 5851 Mercury Drive, Dearborn, MI 48126 |
| 4 | Wayne | Walmart Supercenter | 7555 Telegraph Rd, Taylor, MI 48180 |

APPENDIX V – LIST OF ROADSIDE LOCATIONS OBSERVED

| Strata | County | Roadside Location |
|--------|-----------|-----------------------------|
| 1 | Ingham | Barnes and Eden |
| 1 | Ingham | Cavanaugh and Pennsylvania |
| 1 | Ingham | Haslett and Zimmer |
| 1 | Ingham | I-496 and Dunkel |
| 1 | Ingham | Lake Lansing and Hagadorn |
| 1 | Ingham | M-43 and Putnam |
| 1 | Ingham | M-52 and M-106 |
| 1 | Ingham | Michigan and Waverly |
| 1 | Ingham | Rossman and Onodaga |
| 1 | Ingham | Tihart and Cornell |
| 1 | Ingham | US-127 and Cedar |
| 1 | Ingham | US-127 and Saginaw |
| 1 | Kalamazoo | G Avenue and 33rd |
| 1 | Kalamazoo | G Avenue and Riverview |
| 1 | Kalamazoo | H-Avenue and Sprinkle |
| 1 | Kalamazoo | M-43 and 9th |
| 1 | Kalamazoo | M-43 and M-89 |
| 1 | Kalamazoo | M-89 and 34th St. |
| 1 | Kalamazoo | Q Avenue and 8th |
| 1 | Kalamazoo | Sprinkle and Center |
| 1 | Kalamazoo | Sprinkle and Zylman |
| 1 | Oakland | 14 Mile and Main |
| 1 | Oakland | Baldwin and Clarkston |
| 1 | Oakland | Dixie Hwy and Davisburg |
| 1 | Oakland | Grange Hall and Holly |
| 1 | Oakland | I-696 and Woodward |
| 1 | Oakland | I-75 and Sashabaw |
| 1 | Oakland | M-10 and 8 Mile |
| 1 | Oakland | Northwestern and Middlebelt |
| 1 | Oakland | Orchard Lake and I-696 |
| 1 | Oakland | Snell and Rochester |
| 1 | Oakland | Taft and 9 Mile |
| 1 | Oakland | Walton and Lapeer |
| 1 | Washtenaw | Ann Arbor/Saline and S Main |
| 1 | Washtenaw | Austin and Schneidr |
| 1 | Washtenaw | Geddes and Earhart |
| 1 | Washtenaw | I-94 and Huron |
| 1 | Washtenaw | I-94 and Jackson |
| 1 | Washtenaw | I-94 and State |
| 1 | Washtenaw | Miller Ave and Maple |
| 1 | Washtenaw | Mooreville and Stoney Creek |
| 1 | Washtenaw | Saline Milan and Mooreville |
| 1 | Washtenaw | Zeeb and North Territorial |

| Strata | County | Roadside Location |
|--------|------------|---------------------------------|
| 2 | Allegan | 30th and 128th |
| 2 | Allegan | M-89 and Main |
| 2 | Allegan | M-89 and US-131 |
| 2 | Allegan | US-131 and US-135 |
| 2 | Bay | I-75 and Pinconning |
| 2 | Bay | M-15 and Munger |
| 2 | Eaton | Battle Creek and Ainger Rd |
| 2 | Eaton | I-96 and Nash |
| 2 | Eaton | Kalamo and Battle Creek |
| 2 | Eaton | M-43 and Canal |
| 2 | Eaton | M-43 and M-50 |
| 2 | Eaton | Nixon and Willow |
| 2 | Eaton | Royston and Island Hwy |
| 2 | Eaton | Wahington and Lawrence |
| 2 | Grand | M-72 and US-31 |
| 2 | Jackson | Elm Road and Rosenhill |
| 2 | Jackson | Michigan and Lake |
| 2 | Jackson | US-127 and Michigan |
| 2 | Jackson | US-127 and Page |
| 2 | Jackson | Wolflake and Cady |
| 2 | Kent | 10 Mile and Wabasis |
| 2 | Kent | 4 Mile and Walker |
| 2 | Kent | Aberdeen and Diamond |
| 2 | Kent | Myers Lake and 17 Mile |
| 2 | Kent | Sparta and Ball Creek |
| 2 | Kent | US-131 and 10 Mile |
| 2 | Kent | US-131 and 68th |
| 2 | Kent | US-131 and 84th |
| 2 | Livingston | Grand River and Kensington |
| 2 | Livingston | Grand River and Pleasant Valley |
| 2 | Livingston | Old US-23 and M-59 |
| 2 | Livingston | US-23 and Clyde |
| 2 | Macomb | 22 Mile and Heydenreich |
| 2 | Macomb | I-696 and Groesbeck Hwy |
| 2 | Macomb | Jefferson and Martin |
| 2 | Macomb | Moranian and Harrington |
| 2 | Macomb | Romeo Plank and 27 Mile |
| 2 | Macomb | Van Dyke and 23 Mile |
| 2 | Macomb | Van Dyke and 34 Mile |
| 2 | Midland | Lake saford and Curtis |
| 2 | Midland | M-20 and Homer |
| 2 | Midland | Pine River and Badour |
| 2 | Midland | Redstone and 11 Mile |
| 2 | Midland | Redstone and Coleman |
| 2 | Ottawa | Polk @ 104th |
| 2 | Ottawa | US-131 and Lake Michigan |

| Strata | County | Roadside Location |
|---------------|---------------|--------------------------|
| 3 | Berrien | I-94 and M-139 |
| 3 | Berrien | Lakeside and Union Pier |
| 3 | Berrien | Piperstone and Nickerson |
| 3 | Calhoun | 15 Mile and Michigan |
| 3 | Calhoun | Beckley and 5 Mile |
| 3 | Calhoun | Evanston and Michigan |
| 3 | Calhoun | I-94 and 5 Mile |
| 3 | Clinton | Clark and Upton |
| 3 | Clinton | Clark and Upton |
| 3 | Clinton | M-21 and Lowell |
| 3 | Clinton | M-21 and Shepherdville |
| 3 | Clinton | Main and Westphalia |
| 3 | Genesee | Chavez and Court |
| 3 | Genesee | Grand Blanc and Duffield |
| 3 | Genesee | Mt.Morris and I-75 |
| 3 | Genesee | N Ballenger and Flushing |
| 3 | Genesee | N Elms Rd and Beacher |
| 3 | Lapeer | M-24 and Coulter |
| 3 | Lenawee | M-50 and Pentecost Hwy |
| 3 | Lenawee | US-12 and Brooklyn |
| 3 | Monroe | Eureka and Telegraph |
| 3 | Monroe | Hull and Dunbar |
| 3 | Monroe | Plank and Ostrander |
| 3 | Monroe | Tecumseh and Ann Arbor |
| 3 | Monroe | Telegraph and 7th |
| 3 | Monroe | Telegraph and Northline |
| 3 | Monroe | US-23 and US-223 |
| 3 | Muskegon | Maple Island and Ravenna |
| 3 | Muskegon | Moorland and Ravenna Hts |
| 3 | Muskegon | Ravanna Hts and Blackmer |
| 3 | Saginaw | M-52 and Fergus |
| 3 | St. Clair | I-69 and Riley Center |
| 3 | St. Clair | M-19 and Lambs |
| 3 | St. Clair | M-29 and Palms |
| 3 | St. Joseph | Banker and Klinger |
| 3 | St. Joseph | Millard and US-131 |
| 3 | Van Buren | CR-380 and CR-681 |
| 3 | Van Buren | CR-681 and CR-684 |
| 3 | Van Buren | I-196 and Phoenix |
| 3 | Van Buren | M-51 and CR-352 |

| Strata | County | Roadside Location |
|---------------|---------------|--------------------------|
| 4 | Wayne | 7 Mile and Van Dyke |
| 4 | Wayne | 8 Mile and Randolph |
| 4 | Wayne | Annapolis and Wayne |
| 4 | Wayne | Eureka and Telegraph |
| 4 | Wayne | Farmington and Plymouth |
| 4 | Wayne | Ford and Sheldon |
| 4 | Wayne | Fort and Goddard |
| 4 | Wayne | Geddes and Canton Center |
| 4 | Wayne | Grand River and 8 Mile |
| 4 | Wayne | Greenfield and 9 Mile |
| 4 | Wayne | Greenfield and M-10 |
| 4 | Wayne | Greenfield and Plymouth |
| 4 | Wayne | Haggerty and Ecorse |
| 4 | Wayne | Huron River and Haggerty |
| 4 | Wayne | I-75 and Southfield |
| 4 | Wayne | I-94 and Harper |
| 4 | Wayne | I-96 and Livernois |
| 4 | Wayne | I-96 and Middlebelt |
| 4 | Wayne | Inkster and Van Horn |
| 4 | Wayne | Jefferson and Randolph |
| 4 | Wayne | Michigan and Greenfield |
| 4 | Wayne | Middlebelt and Eureka |
| 4 | Wayne | Monroe and Ecorse |
| 4 | Wayne | Northline and I-75 |
| 4 | Wayne | Outer Drive and Rotunda |
| 4 | Wayne | Palmer and Lilley |
| 4 | Wayne | Rawsonville and Textile |
| 4 | Wayne | Rawsonville and Willis |
| 4 | Wayne | Schafer and Grand River |
| 4 | Wayne | Sumpter and Main |
| 4 | Wayne | Sumpton and Oakville |
| 4 | Wayne | Telegraph and Northline |
| 4 | Wayne | Van Dyke and McNichols |
| 4 | Wayne | Vernier and Lake Shore |
| 4 | Wayne | Vernier and Mack |
| 4 | Wayne | Waltz and Huron River |
| 4 | Wayne | Waltz and Willow |
| 4 | Wayne | Warren and Southfield |
| 4 | Wayne | Wick and Wayne |
| 4 | Wayne | Woodward and Warren |