



FINAL REPORT

2011 Direct Observation Survey of Child Restraint/Booster Seat Use

Prepared for:
Office of Highway Safety Planning
333 South Grand Avenue
P.O. Box 30634
Lansing, MI 48909

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

Date: September 2011



WAYNE STATE
UNIVERSITY

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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.

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle 2011 Direct Observation Survey of Child Restraint/Booster Seat Use		5. Report Date September 2011	
		6. Performing Organization Code	
7. Author(s) Peter T. Savolainen, Timothy J. Gates, Tapan K. Datta, Stephanie Boileau		8. Performing Organization Report No.	
9. Performing Organization Name and Address Wayne State University-Transportation Research Group Department of Civil and Environmental Engineering 5050 Anthony Wayne Drive, Room 0504 Detroit, MI 48202		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address Office of Highway Safety Planning 333 South Grand Avenue P.O. Box 30634 Lansing, MI 48909-0634		13. Type of Report and Period Covered Draft Final Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract This study reports the results of the 2011 statewide direct observation survey of child restraint device use and misuse in the state of Michigan. Child restraint use rates were determined through a direct observation survey conducted at daycare centers, elementary schools, fast food restaurants, shopping centers, and recreational areas throughout Michigan. Misuse rates were determined through on-site inspections conducted at a similar set of locations, in addition to large inspection events. The use rate survey, conducted between May and August of 2011, showed actual child restraint use rates of 95.0 percent among 0-to-3 year-old children and 43.9 percent among 4-to-7 year-olds. Restraint use was highest at daycare center and lowest at elementary schools in comparison to the other sites types. Booster seat use was found to be higher in vans/minivans and sport utility vehicles in comparison to other vehicle types. Children were also more likely to be appropriately restrained when the driver was female and/or restrained appropriately themselves while child restraint use was lowest in vehicles with drivers age 60 and above. Only 26.1 percent of the statewide inspections of the restraint characteristics of children under age 8 showed correct utilization of the child restraint device. The most common and high-risk child restraint device misuse was excessive slack in the internal harness straps.			
17. Key Words Booster Seat, Child Restraint, Michigan, Safety		18. Distribution Statement Unlimited	
19. Security Classification (report) Unclassified	20. Security Classification (Page) Unclassified	21. No of Pages 47	22. Price

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1.0 INTRODUCTION

Motor vehicles crashes continue to be among the leading causes of death and injury among children less than 8 years of age. From 2006 to 2010, a total of 17,223 child passengers within this age group were involved in Michigan traffic crashes [1]. Among those child passengers, only 10,711 (62.2 percent) were restrained in some type of child restraint, either a child restraint device (CRD) or a booster seat. Among those children who were restrained in such a device, 1.9 percent suffered fatal (K) or incapacitating (A) injuries. This is significantly less than the 3.1 percent of children who sustained such injuries while restrained by only a safety belt and the 11.2 percent of children who suffered K or A injuries while improperly or completely unrestrained [1]. Prior research confirms that the appropriate use of child restraint devices (CRDs) and booster seats can greatly reduce the risk of serious injury to children involved in traffic crashes. The risk of serious injury for children between 12 and 47 months of age is 78 percent lower for children seated in forward-facing CRDs than children restrained in safety belts alone [2]. Similarly, the risk of injury for children between ages 4 and 7 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 [3].

In recent years, the State of Michigan has exhibited increases in the use of CRDs among children under 4 years of age from 74.5 percent in 1997 to 94 percent in 2009 [4-6]. In spite of these gains, over half of the children under the age of 4 that were killed in traffic crashes were not restrained in a CRD from 2004 to 2009 [1]. It is also troubling that many of the children who were in CRDs may have been improperly restrained. Recent studies by the Wayne State University Transportation Research Group (WSU-TRG) have shown roughly 70 to 80 percent of CRDs in Michigan are improperly used to some degree [4-6].

CRDs are most effective when: (1) the devices are appropriate for the age, height, and weight of the child being restrained, (2) the devices are properly installed in the vehicle using seatbelts or a LATCH system, and (3) the child is properly restrained in the device. Improper CRD use may expose a child to a heightened risk of injury when involved in a crash. The most recent CRD study performed by the WSU-TRG in 2009 found that the two most common CRD misuses were 1) too much slack in the harness straps and 2) improper positioning of the harness retainer clip

[6]. Loose harnesses were particularly common for rear-facing CRDs with nearly three-quarters of the rear-facing CRDs utilizing a harness that was too loose. This is concerning as loose harnesses have been identified in previous research as one of the most severe forms of misuse [7,8].

While restraint use has increased dramatically among children under age 4, restraint use among 4-to-7-year-olds has been shown to be substantially lower [9]. 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 seat belts alone and differences in risk perception among parents [10-16]. Following enactment of statewide legislation, booster seat use was found to increase substantially through a series of direct observation surveys conducted by the Wayne State University Transportation Research Group (WSU-TRG) [17,18]. However, approximately half of 4-to-7-year-old child passengers continue to travel while inappropriately restrained.

2.0 STUDY OBJECTIVES

The purpose of this study is to determine the rates of child restraint device use and misuse among 0 to 7 year old child passengers in the State of Michigan. The survey results provide valuable information regarding changes in child restraint use patterns throughout the State of Michigan and identify areas of opportunity for increasing the use of appropriate child restraint devices by Michigan drivers. Understanding the degree of nonuse and misuse will also assist in developing educational efforts, public awareness campaigns, and enforcement initiatives that may be used to improve use.

The proposed study built off of the methodologies from previous surveys, such as the 2009 and 2010 studies conducted by the WSU-TRG [6,18], in order to accurately and efficiently estimate the rates of use and misuse of CRDs and booster seats by child passengers in the State of Michigan. Use rates were determined through a series of destination surveys conducted at locations subject to high volumes of target age children. Misuse rates were based on visual and hands-on inspection of children under the age of 8 that were seated in a child restraint device. This year's survey also included inspection of booster seats, which were not performed as part of the 2009 inspections. Each device was inspected for type, location in the vehicle, direction of placement, attachment to the vehicle, and placement of the child in the device. Such data may

assist the OHSP in the development of public awareness messages specifically targeted to common or critical CRD/booster misuses.

3.0 METHODOLOGY

The study methodology essentially consists of two separate, but related, components. The first component involves direct observational surveys of CRD and booster seat use. This allows for a longitudinal comparison of use rates over time and provides data that may be used by the State of Michigan to develop targeted educational and public awareness programs to positively impact child safety. This portion of the study will result in the determination of overall rates of CRD and booster seat use in Michigan.

The second component focuses on CRD and booster seat misuse and is based upon visual and hands-on inspection. The main objectives of this analysis were to determine both the rate and degree/severity of misuse, as well as to identify patterns of common and severe misuse of CRDs and booster seats.

The study methodology has similarities to past surveys, utilizing a destination-based sampling strategy for both the use surveys and inspections. This sampling scheme is based upon the methodology utilized during the 2009 and 2010 surveys and involves collecting data from a random sample of target age children at day care centers, elementary schools, fast food restaurants, and shopping centers.

3.1 Site Selection

In order to accurately determine rates of CRD and booster seat use and misuse, a representative sample of two target groups of children were required as a part of this study: (a) children under 4 years of age; and (b) children from ages 4 to 7. 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 while maintaining data collection efficiency, sites were sampled from those counties that represent approximately 85 percent of the target population (children ages 0 to 7). The sampling frame consists of the same 26 counties studied during the 2009 and 2010 surveys [6,18]. The most

recent census estimates of children in this age range are provided in Table 1 for these 26 counties [19].

To provide similar levels of precision in comparison to previous studies, a target sample size of approximately 3,000 children within each age group was established for the child restraint use survey while a sample size of 300 children was established for the inspections of misuse. The same 26 counties that were sampled for the 2009 and 2010 surveys were also used for the 2011 survey [6,18].

The candidate counties were previously partitioned into four strata based upon historical safety belt use rates and vehicle miles traveled (VMT) as per the direct observation surveys of safety belt use. This stratification was based upon the fact that CRD and booster seat use have been shown to be related to the driver's safety belt use by previous studies [6,18]. Combining counties with similar use and/or misuse rates into strata reduces the within-stratum variability and allows for a reasonable number of observations within each stratum while ensuring desired levels of precision. Stratum 1 includes those counties with the highest historical restraint use rates while Stratum 4 has exhibited the lowest use rate. These counties were partitioned as shown in Table 2.

The specific observation sites were selected from a statewide sample of locations expected to yield high volumes of target age child passengers, including day care centers, elementary schools, fast food restaurants, and shopping centers. To allow for a direct comparison between the results of these surveys and those conducted as a part of previous surveys, the same sites were utilized where feasible. Some of the observation sites from previous surveys had subsequently closed or were found to yield very low volumes of target age children. Such locations were replaced by alternate sites within the same county and these alternate sites were of the same type as the initial sites they replaced. Complete lists of locations used for the child restraint device use surveys are included by site type in Appendix I (Daycare Centers), Appendix II (Elementary Schools), and Appendix III (Fast Food Restaurants, Shopping Centers, and Recreational Sites).

Table 1. 2009 Michigan Population Estimate of Children Ages 0 to 3 and 4 to 7 by County

County	Children Ages 0-3	Percent of Statewide Population Age 0-3	Cumulative Percentage of Age 0-3 Population	Children Ages 4-7	Percent of Statewide Population Age 4-7	Cumulative Percentage of Age 4-7 Population
Allegan	6,095	1.2%	1.2%	6,061	1.2%	1.2%
Bay	5,051	1.0%	2.3%	4,981	1.0%	2.2%
Berrien	8,414	1.7%	4.0%	8,346	1.7%	3.9%
Calhoun	7,163	1.5%	5.4%	7,095	1.4%	5.3%
Eaton	4,614	0.9%	6.4%	4,892	1.0%	6.3%
Genesee	22,702	4.6%	11.0%	22,707	4.5%	10.8%
Grand Traverse	4,006	0.8%	11.8%	4,052	0.8%	11.6%
Ingham	13,792	2.8%	14.6%	13,043	2.6%	14.2%
Jackson	7,888	1.6%	16.2%	7,859	1.6%	15.8%
Kalamazoo	12,654	2.6%	18.7%	12,166	2.4%	18.2%
Kent	36,756	7.5%	26.2%	35,231	7.0%	25.2%
Lapeer	3,801	0.8%	27.0%	4,292	0.9%	26.1%
Livingston	7,849	1.6%	28.6%	9,012	1.8%	27.9%
Macomb	39,125	7.9%	36.5%	40,527	8.1%	36.0%
Midland	3,675	0.7%	37.2%	4,004	0.8%	36.8%
Monroe	6,942	1.4%	38.6%	7,140	1.4%	38.2%
Muskegon	9,307	1.9%	40.5%	9,111	1.8%	40.0%
Oakland	55,826	11.3%	51.9%	60,448	12.1%	52.1%
Ottawa	14,451	2.9%	54.8%	14,458	2.9%	54.9%
Saginaw	9,803	2.0%	56.8%	9,935	2.0%	56.9%
Shiawasee	3,250	0.7%	57.4%	3,364	0.7%	57.6%
St. Clair	7,863	1.6%	59.0%	8,120	1.6%	59.2%
Tuscola	2,545	0.5%	59.6%	2,598	0.5%	59.7%
Van Buren	4,361	0.9%	60.4%	4,357	0.9%	60.6%
Washtenaw	15,965	3.2%	63.7%	15,923	3.2%	63.8%
Wayne	102,197	20.7%	84.4%	104,506	20.8%	84.6%

Site selection for the misuse inspections was largely based upon the methodology of the 2009 study [6]. In the 2009 study, inspections were performed at fast-food restaurants, shopping centers, day care centers, and various car seat check events. Several of the high yield inspection sites from the 2009 study were again contacted to determine their willingness to participate in the CRD/booster inspections for this study. Several new locations were included in the 2011 study, including health care centers, government offices, community and church events, and permanent inspections stations (i.e., fire stations and police departments).

Table 2. Michigan Counties by Stratum

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

The county strata assignments for the inspections were identical to those used in the CRD direct observation surveys, although the minimum necessary sample size for the inspection of the restraint use characteristics of passengers under the age of four was much smaller (in comparison to the use rate survey) due to the time and human resources necessary to perform the inspections. A list of all CRD inspection locations is provided in Appendix IV.

3.2 Observer Training

Two targeted training programs specific to this project were conducted during the spring of 2011: (1) training for inspection of CRD/booster seat misuse; and (2) training for direct observation of CRD/booster seat use. All classroom training occurred during April of 2011.

Classroom training for the inspections was conducted on April 8, 2011 by a NHTSA certified Child Passenger Safety Technician Instructor. This training session included both classroom instruction and hands-on in-vehicle instruction on child safety restraint use and misuse. Each data collector received a training manual summarizing the information received during the training session. At the end of the training session, each data collector was required to successfully demonstrate inspections of actual CRD/booster seat installations prepared by the instructor. After the initial training, each new technician “shadowed” an experienced technician

during his/her initial inspection event. Regular field audits were also conducted to ensure that the inspectors were accurately assessing CRD/booster seat misuse.

Classroom training for the direct observation survey of child restraint use was conducted on April 21, 2011. The classroom training session was immediately followed by practice field data collection. During the classroom training, data collectors were provided with information to aid in assessing the age of child passengers, including height/weight information and sample photographs. At the conclusion of the training session, field personnel were tested on their ability to assess the age of child passengers based upon a series of photographs. Subsequent follow-up training was conducted for those data collectors who had difficulty in properly identifying the ages of the child passengers. After completing the classroom training, practice data collection was conducted at a local elementary school which included a daycare program to provide observers with an opportunity to gain field experience in assessing child passenger age and determining the type of restraint use. Additional field observation training sessions were conducted between May 14th and May 21st. Observers were paired up for the field training, and each pair of data collectors were sent to various types of locations (e.g., elementary schools, shopping centers, etc.) and their performance was monitored to ensure consistency among observers. This included comparing the number of target age children that were identified by each observer, as well as the restraint use by each observed child. In addition to these training exercises, each data collector received a training manual, as well as all necessary field supplies.

3.3 Data Collection Procedures for Use Survey

During weekday surveys, the data collection schedule was arranged such that observations could be conducted at an elementary school or daycare center at the start of the day, followed by destination locations that were en route to another elementary school or daycare center that was visited later that day. Each school and daycare center was contacted to determine exact start and end times, and other locations (e.g., shopping centers, fast food restaurants, recreation centers) were contacted to ensure they were 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. Weekend data collection occurred exclusively at shopping centers, fast food restaurants, and recreation centers.

During the use surveys, several factors were assessed as a part of data collection. For all vehicles that were identified to have a 0 to 7 year-old child passenger, the driver and all target age child passengers were observed for restraint use and non-use. A sample field observation form is shown in Figure 1. 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 child restraint devices, so these data were 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. 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 eight restraint categories for each child were: not belted, belted, belt behind back, belt under arm, 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 Number: _____ Location: _____ County: _____
 Traffic Flow/Direction: _____ Date: _____ Weather: _____
 Time Started Observations: _____ AM/PM Time Ended Observations: _____ AM/PM
 Observer's Name: _____

<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:	RACE:									
<input type="checkbox"/> Not Belted <input type="checkbox"/> Belted <input type="checkbox"/> Belt Behind Back <input type="checkbox"/> Belt Under Arm	<input type="checkbox"/> 16-29 <input type="checkbox"/> 30-59 <input type="checkbox"/> 60+	<input type="checkbox"/> Male <input type="checkbox"/> Female	<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"/> Belted <input type="checkbox"/> Belt Behind Back <input type="checkbox"/> Belt Under Arm	<input type="checkbox"/> Front-Facing CSS <input type="checkbox"/> Rear-Facing CSS <input type="checkbox"/> High-Back Booster <input type="checkbox"/> Backless Booster	<input type="checkbox"/> 0 to 3 <input type="checkbox"/> 4 to 7	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	D	<input type="checkbox"/>							
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Figure 1. Sample Data Collection Form

3.4 Data Collection Procedures for Inspections

This portion of the data collection involved visual and hands-on inspection of the child restraint devices for children under the age of 8. The same driver data were collected as for the use survey. Data collected with respect to the child passengers were similar, but also included age, height, and weight information reported by the adult driver or passenger. The vehicle year, make, and model were also noted. The child restraint devices were inspected for type, location in the vehicle, direction of placement, attachment to the vehicle, and placement of the child in the device. LATCH availability and utilization were also determined.

Each child in a child restraint device or booster seat was inspected for several common misuses, as well as the degree or extent of each misuse. Particular attention was paid to the prevalence of severe misuse categories, such as loose harnesses, which were found to occur in 73.7 percent and 56.8 percent of the rear-facing and forward-facing CRDs, respectively, during the 2009 inspections. A risk priority assessment based on the frequency and severity of all misuses observed during the 2009 inspections showed that loose harnesses accounted for approximately 45 percent of the total risk priority score for both rear and forward-facing CRDs [6]. Other severe CRD misuses that were monitored included: internal harness not buckled, not buckling the seatbelt or attaching the LATCH anchor, improper routing of the seatbelt when restraining the CRD to the vehicle seat, shoulder harness straps that are routed incorrectly, and excessive space between the CRD and the vehicle seat. All observed restraint misuses were carefully recorded onto the data collection form along with descriptive notes. A sample inspection form is found in Appendix V.

3.5 Data Analysis

Rates of “appropriate” child restraint use and child restraint misuse were determined at the statewide- and stratum-level, as well as with respect to each of the characteristics previously described. For the purposes of this study, “appropriate” child restraint use was defined as any instance where a 0-to-3 year-old child was seated in a forward-facing or rear-facing child safety seat. Premature graduation to a booster seat was classified as inappropriate. For 4-to-7 year-olds, “appropriate” use included high-back and backless boosters, as well as forward-facing child safety seats. A limited number of 4-to-7 year-olds were observed in rear-facing child safety

seats, which was classified as inappropriate use. The procedures used to calculate the appropriate use rates and their associated variances are outlined in this section of the report.

3.5.1 Statewide Child Restraint Device Use Rate Calculations

In order to determine the statewide child restraint use (or misuse) rate, a procedure was utilized similar to that of previous studies [4-6,17,18]. This procedure is illustrated here with respect to the appropriate use rate calculation. First, the child restraint device use rate at each study location was calculated as shown here:

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

where:

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

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

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

Then, the child restraint device use rate within each stratum (r_j) was determined as follows:

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

Once the child restraint use rates were determined within each stratum, the statewide 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 child restraint device 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 target age children will have a greater impact on the statewide use rate. Separate estimates were obtained for the 0-to-3 and 4-to-7 year-old age groups.

3.5.2 Statewide Child Restraint Device Use Variance Calculation

Upon obtaining estimates of the child restraint device use and misuse rates for each of the four strata, the variance for each stratum was determined using the following equation [20]:

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

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 child restraint device use within each stratum, the statewide variance in use (or misuse) can then be calculated using the following formula:

$$Var_{TOTAL} = \frac{\sum_j (p_j^2 Var_j)}{\left(\sum_j p_j \right)^2}$$

where:

Var_{TOTAL} = statewide variance in child restraint device use

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

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

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

3.5.3 Misuse Rate Determination

The CRD/booster misuse rates were determined for each stratum and statewide based on the data obtained from the inspections. Separate rates were also computed for rear-facing CRDs, forward-facing CRDs, and booster seats. A CRD/booster was considered to be “misused” if one or more of the itemized misuse characteristics was observed during the inspection or if no CRD was utilized to restrain the child. The misuse rate was computed based on the number of inspected CRDs with one or more misuses divided by the total number of inspected CRDs.

A severity score was determined for both the forward-facing CRDs and rear-facing CRDs. The severity scores were similar to those used in a study conducted in Canada in 2002 [21], which were developed by CRD safety experts [22]. A severity score of ‘10’ indicates a misuse of the highest severity and a severity score of ‘0’ indicates that the misuse has no safety impact. A severity score of ‘4’ or higher will compromise the effect of the CRD on the child’s safety during a crash [21].

For the inspections performed here, the severity scores for each type of misuse were multiplied by the percent of occurrence. This resulted in a risk priority number for each type of misuse. The risk priority numbers were summed for all misuse types to determine the total risk priority number for both the forward-facing CRD and rear-facing CRD. The weighted average severity score per rear-facing and forward-facing CRD was also determined. The average risk priority numbers were compared with those observed in previous studies performed by the WSU-TRG.

4.0 DATA SUMMARY

4.1 Child Restraint Device Use

The statewide child restraint device use survey was performed between Tuesday, May 31, 2011 and Tuesday, August 9, 2011. During this observation period, a total of 5,861 observations of 0 to 7 year-old child passengers were conducted at the daycare centers, elementary schools, fast food restaurants, shopping centers, and recreation centers throughout the 26-county sample.

Summary statistics detailing the results of the child restraint use survey 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 survey, between 18.5 percent and 31.7 percent of all observations were obtained in each stratum. Shopping centers provided the majority of each sample and the relative sample sizes by site type were relatively consistent, except for daycare centers and elementary schools. As expected, daycare centers exhibited higher numbers of 0-to-3 year-old children while elementary schools included more 4-to-7 year-olds.

Table 3. Summary of Observations by Stratum and Site Type

Stratum	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
1	927	31.7%	832	28.4%
2	686	23.4%	752	25.6%
3	541	18.5%	580	19.8%
4	774	26.4%	769	26.2%
Total	2928	100.0%	2933	100.0%
Site Type	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Day Care	225	7.7%	174	5.9%
Elementary School	110	3.8%	421	14.4%
Shopping Centers	2149	73.4%	1831	62.4%
Fast Food Restaurants	81	2.8%	95	3.2%
General Recreation	363	12.4%	412	14.0%
Total	2928	100.0%	2933	100.0%

Table 4 provides details of the number of children observed by type of vehicle and seating position. Nearly half of the target age children were in passenger cars, with lower percentages in sport utility vehicles, vans/minivans, and pickup trucks. During the survey, 13.4 percent of 4 to 7 year-old children were observed in the first row of seating. While this is a slight decrease from 2010, this issue is problematic since these seating positions put children at a higher risk of injury due to issues such as airbag deployment. More encouragingly, only 1.2 percent of 0-to-3 year-old children were restrained in the front seat, with the majority of these cases involving pickup trucks where other seating alternatives may not be available. Michigan legislation requires that children less than 4 years of age not be restrained in the front seat if other alternatives are available.

Table 4. Summary of Observations by Vehicle Characteristics

Vehicle Type	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Passenger Car	1423	48.6%	1389	47.4%
Sport Utility Vehicle	751	25.6%	740	25.2%
Van/Minivan	660	22.5%	659	22.5%
Pickup Truck	94	3.2%	145	4.9%
Child Passenger Seating Position	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
First Row - Center	10	0.3%	20	0.7%
First Row - Right	26	0.9%	372	12.7%
Second Row - Left	1129	38.6%	1025	34.9%
Second Row - Center	616	21.0%	267	9.1%
Second Row - Right	1126	38.5%	1170	39.9%
Third Row - Left	5	0.2%	37	1.3%
Third Row - Center	4	0.1%	9	0.3%
Third Row - Right	12	0.4%	33	1.1%

Table 5 presents data on the number of children observed by various driver characteristics, including gender, age, race, and belt use. Overall, approximately 69.9 percent of children were traveling with a female driver and this proportion was higher among 0-to-3 year-olds in comparison to 4-to-7 year-olds. The vast majority of children (74.0 percent) were traveling with a driver in the 30-to-59 year old age group and approximately 80 percent of the children observed were traveling with a Caucasian driver. Among 0 to 3 year-old children, 96.6 percent were traveling with a driver who was appropriately belted while 95.8 percent of 4 to 7 year-old children were traveling with an appropriately restrained driver.

Table 5. Summary of Observations by Driver Characteristics

Driver Gender	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Male	811	27.7%	955	32.6%
Female	2117	72.3%	1978	67.4%
Driver Age	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
16-29	898	30.7%	438	14.9%
30-59	1954	66.7%	2385	81.3%
60+	76	2.6%	110	3.8%
Driver Race	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Caucasian	2412	82.4%	2323	79.2%
African American	342	11.7%	411	14.0%
Asian or Pacific Islander	88	3.0%	92	3.1%
Hispanic	86	2.9%	107	3.6%
Native American	0	0.0%	0	0.0%
Driver Belt Use	Number of Children 0-3 Years Old Observed	Percent of Total Sample	Number of Children 4-7 Years Old Observed	Percent of Total Sample
Unbelted	71	2.4%	103	3.5%
Belted	2828	96.6%	2811	95.8%
Shoulder Belt Behind Back	26	0.9%	18	0.6%
Shoulder Belt Under Arm	3	0.1%	1	0.0%

4.2 Child Restraint Device Inspections

The misuse inspections were performed between May and August of 2011 at 27 locations statewide. A total of 303 CRD/booster inspections of child passengers under the age of eight were performed, including 203 in the 0-3 year old age range and 100 in the 4-7 year old age range. Ninety-nine (99) inspections were performed at seven sites in Stratum 1, 70 inspections at seven sites in Stratum 2, 85 inspections at eight sites in Stratum 3, and 49 inspections at five sites in Stratum 4. Table 6 summarizes the descriptive statistics regarding the inspection locations by

stratum, day of the week, and type of site. Table 7 summarizes the inspection percentages based on vehicle type, type of restraint, position of the child in the vehicle, and age of child.

Table 6. Inspection Descriptive Statistics

Stratum	No. of Sites	Pct. of Sites	No. of Inspections	Pct. of Inspections
Stratum 1	7	25.9%	99	32.7%
Stratum 2	7	25.9%	70	23.1%
Stratum 3	8	29.7%	85	28.1%
Stratum 4	5	18.5%	49	16.1%
Total	27	100.0%	303	100.0%
Day of the Week	No. of Sites	Pct. of Sites	No. of Inspections	Pct. of Inspections
Sunday	1	3.7%	6	2.0%
Monday	1	3.7%	7	2.3%
Tuesday	7	25.9%	64	21.1%
Wednesday	5	18.5%	89	29.4%
Thursday	6	22.2%	74	24.4%
Friday	3	11.1%	30	9.9%
Saturday	4	14.9%	33	10.9%
Total	27	100.0%	303	100.0%
Type of Site	No. of Sites	Pct. of Sites	No. of Inspections	Pct. of Inspections
Shopping Center	5	18.5%	69	22.8%
Daycare	8	29.6%	103	34.0%
Community or Church Event	6	22.2%	54	17.8%
Government Office	1	3.7%	15	5.0%
Permanent Inspection Station	5	18.5%	51	16.8%
Health Care Center or Hospital	2	7.4%	11	3.6%
Total	27	100.0%	303	100.0%

Table 7. Inspection Data Summary

Vehicle Type	No. of Inspections	Pct. of Inspections
Passenger Car	143	47.2%
Sport Utility Vehicle	73	24.1%
Van/Minivan	73	24.1%
Pick-up Truck	14	4.6%
Total	303	100.0%
Type of Restraint	No. of Inspections	Pct. of Inspections
Rear-Facing CRD	72	23.8%
Forward-Facing CRD	132	43.6%
Belt Positioning Booster	93	30.7%
Shield Booster	1	0.3%
Integrated Seat	1	0.3%
Safety Belt	3	1.0%
Unrestrained	1	0.3%
Total	303	100.0%
Position of the Child	No. of Inspections	Pct. of Inspections
Front Passenger	1	0.3%
Front Middle	0	0.0%
Second Row Left	95	31.4%
Second Row Center	60	19.8%
Second Row Right	130	42.9%
Third Row Left	10	3.3%
Third Row Middle	0	0.0%
Third Row Right	7	2.3%
Total	303	100.0%
Age of Child	No. of Inspections	Pct. of Inspections
Less than 1 Year	54	17.8%
1 Year – Less than 2 Years	48	15.8%
2 Years – Less than 3 Years	62	20.5%
3 Years – Less than 4 Years	39	12.9%
4 Years – Less than 5 Years	38	12.5%
5 Years – Less than 6 Years	22	7.3%
6 Years – Less than 7 Years	23	7.6%
7 Years – Less than 8 Years	17	5.6%
Total	303	100.0%

5.0 RESULTS

5.1 Statewide and Stratum-Level Child Restraint Device Use Rates

The statewide child restraint use rates were calculated based upon the procedure described in the previous section. The statewide use rates were found to be 95.0 percent among 0-to-3 year-old children and 43.9 percent among 4-to-7 year-old children as shown in Table 8. These rates are comparable to the use rates observed during the most recent surveys conducted by the WSU-TRG in 2009 and 2010, which showed use rates of 94.9 percent and 44.5 percent among these age groups.

Table 8. Statewide Rates of Appropriate Restraint Use Among Child Passengers

Age Group	Appropriate CRD Use Rate	Standard Error	Relative Error
0-to-3 years old	95.0% ± 1.0%	0.5%	0.5%
4-to-7 years old	43.9% ± 3.2%	1.6%	3.7%

When examining each of the specific categories of child restraint use, 28.8 percent of 0-to-3 year-old children were restrained in rear-facing child safety seats and 66.2 percent were in forward-facing safety seats. Among 4-to-7 year-olds, approximately 7.8 percent of children were restrained in front-facing child safety seats, 15.6 percent were observed in high-back boosters, and 20.6 percent were in backless boosters as shown in Table 9. The percentage of children ages 0-to-3 traveling completely unrestrained was 1.4 percent while the percentage of unrestrained children was 8.5 percent among 4-to-7 year-olds.

Table 9. Statewide Rates of Restraint Use by Type Among Child Passengers

Age Group	Rear-Facing CRD	Forward-Facing CRD	High Back Booster	Backless Booster	Safety Belt Only	Not Restrained
Ages 0-to-3	28.8% ± 6.4%	66.2% ± 15.0%	0.4% ± 0.8%	0.8% ± 0.6%	2.5% ± 0.5%	1.4% ± 0.4%
Ages 4-to-7	0.2% ± 0.9%	7.8% ± 1.5%	15.6% ± 3.0%	20.6% ± 4.1%	47.2% ± 9.7%	8.5% ± 1.6%

When examining child restraint device use by stratum, the use rates among 0 to 3 year-olds ranged from 95.8 percent in Stratum 2 to 93.2 percent in Stratum 3. Among 4 to 7 year-olds, the use rates were highest in Stratum 1 (49.1 percent) and lowest in Stratum 4 (39.4 percent). These results are reflected in Table 10.

Table 10. Child Restraint Use Summary by Stratum

Stratum	Age 0-3		Age 4-7	
	Use Rate	Standard Error	Use Rate	Standard Error
Stratum 1	94.6% ± 1.9%	1.0%	49.1% ± 5.9%	3.0%
Stratum 2	95.8% ± 1.7%	0.9%	40.7% ± 6.0%	3.0%
Stratum 3	93.2% ± 2.7%	1.4%	47.6% ± 7.2%	3.6%
Stratum 4	95.7% ± 1.7%	0.9%	39.4% ± 6.7%	3.4%

5.2 Child Restraint Use Rates by Location, Vehicle, and Driver Characteristics

This section provides details of the (unweighted) child restraint use rates based upon vehicle and driver characteristics among the 5,861 children observed as a part of these surveys. Comparisons are provided with respect to each characteristic, as well as with respect to prior studies on child restraint device use.

Table 11 presents child restraint use rates by type of site. Use was highest at day care centers and lowest at elementary schools. These findings are consistent with expectations since daycare centers are generally visited by more 0-to-3 year-old children while elementary schools generally include more 4-to-7 year-old child passengers. The use rates were relatively similar among shopping centers, fast food restaurants, and general recreation sites.

Table 11. Child Restraint Use Summary by Site Type

Location Type	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
Day Care	215	225	95.6%	111	174	63.8%
Elementary School	101	110	91.8%	140	421	33.3%
Shopping Center	2051	2149	95.4%	824	1831	45.0%
Fast Food	75	81	92.6%	39	95	41.1%
General Recreation	337	363	92.8%	180	412	43.7%

Child restraint device use was highest among vans/minivans and sport utility vehicles as shown in Table 12. 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 previous surveys [6,18].

When examining seating position, 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 noteworthy as Michigan requires that children less than 4 years of age not be seated in the front seat if other seating options are available. Though not prohibited, this seating position is also not recommended for 4-to-7 year-old children. Subsequent public awareness and educational campaigns targeted toward this issue may be warranted.

Table 12. Child Restraint Use Summary by Vehicle Characteristics

Vehicle Type	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
Passenger Car	1325	1423	93.1%	514	1389	37.0%
Sport Utility Vehicle	727	751	96.8%	378	740	51.1%
Van/Minivan	640	660	97.0%	367	659	55.7%
Pickup Truck	87	94	92.6%	35	145	24.1%
Child Passenger Seating Position	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
First Row - Center	6	10	60.0%	0	20	0.0%
First Row - Right	16	26	61.5%	19	372	5.1%
Second Row - Left	1067	1129	94.5%	502	1025	49.0%
Second Row - Center	591	616	95.9%	100	267	37.5%
Second Row - Right	1081	1126	96.0%	623	1170	53.2%
Third Row - Left	5	5	100.0%	22	37	59.5%
Third Row - Center	3	4	75.0%	2	9	22.2%
Third Row - Right	10	12	83.3%	26	33	78.8%

Table 13 illustrates the rate of child restraint device use by various driver characteristics. The use rates within each age group were higher among vehicles with female drivers in comparison to male drivers. This is consistent with the results of prior studies conducted in Michigan [6,18].

Use rates by age group were also similar to previous studies as 30-to-59 year old drivers were generally more likely to restrain target age child passengers in child restraints. Child restraint use was lowest among older drivers (age 60 and above). Interestingly, younger drivers (less than 30 years of age) were most likely to restrain 0-to-3 year-old child passengers appropriately, but were less likely to restraint older children appropriately [21]. Drivers of Asian/Pacific Islander and Caucasian descent were most likely to restrain child passengers in CRDs.

Table 13. Child Restraint Use Summary by Driver Characteristics

Driver Gender	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
Male	767	811	94.6%	383	955	40.1%
Female	2012	2117	95.0%	911	1978	46.1%
Driver Age	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
16 to 29	858	898	95.5%	178	438	40.6%
30 to 59	1854	1954	94.9%	1073	2385	45.0%
60 or above	67	76	88.2%	44	110	40.0%
Driver Race	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
Caucasian	2303	2412	95.5%	1102	2323	47.4%
African American	306	342	89.5%	108	411	26.3%
Asian/Pacific Islander	86	88	97.7%	50	92	54.3%
Hispanic	84	86	97.7%	34	107	31.8%
Native American	0	0	--	0	0	--
Driver Restraint	Age 0-3 Properly Restrained	Age 0-3 Observed	Proper Use Rate (Age 0-3)	Age 4-7 Properly Restrained	Age 4-7 Observed	Proper Use Rate (Age 4-7)
Belted Appropriately	2692	2828	95.2%	1258	2811	44.8%
Not Belted Appropriately	57	100	57.0%	36	122	29.5%

Finally, child restraint device use was significantly lower among vehicles where the drivers were not belted appropriately. The use rate of 0-to-3 year-old children in vehicles where the driver was belted was 95.2 percent, compared to only 57.0 percent among cases where the driver was not belted appropriately. Similarly, use rates among 4-to-7 year-old children were significantly higher when drivers were appropriately restrained (44.8 percent compared to 29.5 percent).

5.3 Misuse Rates

The inspection data were utilized to compute the statewide misuse rate, as well as the misuse rate for each stratum, restraint type, and age group. As stated previously, a CRD/booster seat was considered to be “misused” if one or more of the itemized misuse characteristics was observed during the inspection or if no CRD/booster was utilized. Table 14 shows the statewide misuse rate in addition to the misuse rate broken down by stratum, CRD type (rear-facing, forward-facing, and booster seats only), and age group.

Table 14. CRD Correct Use and Misuse Rates

Category	No. of Inspections	Correct Use Rate	Misuse Rate
Type of CRD			
Rear-Facing	72	13.9%	86.1%
Forward Facing	132	24.2%	75.8%
Belt Positioning Booster Seat	93	39.8%	60.2%
Age Group			
0 - 3	203	19.7%	80.3%
4 - 7	100	39.0%	61.0%
Stratum			
Stratum 1	99	29.3%	70.7%
Stratum 2	70	20.0%	80.0%
Stratum 3	85	28.2%	71.8%
Stratum 4	49	24.5%	75.5%
Statewide (Unweighted)	303	26.1%	73.9%

Statewide, only 26.1 percent of the inspections of the restraint characteristics of children under age 8 showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. The remaining 73.9 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses), which represents the overall unweighted statewide misuse rate for children under the age of eight. The overall misuse rate for children under the age of four was 80.3 percent, while the overall misuse rate for children ages four through seven was 61.0 percent. Stratum 1 showed the lowest misuse rate at 70.7 percent, while Stratum 2 showed the highest misuse rate at 80.0 percent. Rear-facing CRDs had an overall misuse rate of 86.1 percent, which was higher than the 75.8 percent overall misuse rate for

forward-facing CRDs. As expected, the lowest observed misuse rates were for children seated in booster seats, as the misuse rate was 60.2 percent.

Itemized misuse rates were also computed based on several different characteristics of the CRD use and installation and restraint of the child within the CRD. Table 15 provides a summary of the correct and incorrect CRD selection and position percentages based on the child’s age, height and weight, orientation of the CRD within the vehicle.

Table 15. CRD Selection and Position Characteristics

CRD Characteristic	Percent Correct	Percent Incorrect
Restraint appropriate for child’s age	89.8%	10.2%
Restraint appropriate for child’s height	93.7%	6.3%
Restraint appropriate for child’s weight	90.8%	9.2%
CRD facing proper direction for child’s age/weight	97.3%	2.7%
Seat intended to be used in direction installed	98.0%	2.0%
CRD installed on a forward-facing vehicle seat	100.0%	0.0%

Table 15 shows that the CRD selection and orientation were typically appropriate for the child’s age, height, and weight. The most common CRD selection misuse was inappropriate seat selection based on age. Table 16 displays the types of seats utilized by each age group.

Table 16. CRD Selection by Age of Child

Age	Rear-Facing CRD		Forward-Facing CRD		Booster Seat		Seat Belt	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
0 - 1	50	93%	4	7%	0	0%	0	0%
1 - 2	20	42%	27	56%	1	2%	0	0%
2 - 3	2	3%	56	92%	3	5%	0	0%
3 - 4	0	0%	25	66%	13	34%	0	0%
4 - 5	0	0%	15	39%	22	59%	0	0%
5 - 6	0	0%	2	9%	20	91%	0	0%
6 - 7	0	0%	3	14%	19	83%	1	4%
7 - 8	0	0%	0	0%	15	88%	2	12%

Note: cases of premature transitioning into the next restraint level based on age are shown in bold

It can be observed from Table 16 that approximately one-third of three-year old children were seated in booster seats. This finding indicates that children are often prematurely transitioned into a booster seat. The premature transition from booster seat to the vehicle's seat belt was less of an issue as 12 percent of 7 year olds were not using a booster seat. The premature transitioning from rear-facing CRD to forward facing CRD for children under the age of 1 was even less prevalent as only 7 percent of children under the age of 1 were seated in a forward-facing CRD. The remaining itemized misuse rates were separated into rear-facing CRD misuses and forward-facing CRD misuses and are summarized in Table 17. Itemized booster seat misuse rates are summarized in Table 18.

Table 17. CRD Installation and Restraint Characteristics

CRD Characteristic	Rear-Facing CRDs (n=72)		Forward-Facing CRDs (n=132)	
	Percent Correct	Percent Incorrect	Percent Correct	Percent Incorrect
Harness straps tight (1 in or less slack)	31.9%	68.1%	34.4%	65.6%
Harness retainer clip in proper location	47.2%	52.8%	61.8%	38.2%
CRD installation tight (1 in or less lateral sway)	48.5%	51.5%	58.1%	41.9%
Seatbelt/LATCH properly locked and tight	63.6%	36.4%	63.7%	36.3%
Proper space between CRD and vehicle seat	65.3%	34.7%	76.3%	23.7%
Shoulder harness straps in proper location	80.6%	19.4%	77.9%	22.1%
Proper belt path/LATCH connector path used	81.9%	18.1%	89.4%	10.6%
Harness straps flat	84.3%	15.7%	80.2%	19.8%
CRD at the proper angle	85.9%	14.1%	95.4%	4.6%
Only one vehicle system used to attach CRD	87.5%	12.5%	91.7%	8.3%
Internal harness buckled	88.9%	11.1%	92.4%	7.6%
Harness retainer clip attached and threaded correctly	88.9%	11.1%	93.9%	6.1%
Crotch strap flat	90.3%	9.7%	86.8%	13.2%
Seatbelt/LATCH strap buckled/attached	93.1%	6.9%	95.5%	4.5%
Tether routed properly over/under headrest	N/A	N/A	96.9%	3.1%
Tether strap flat	N/A	N/A	93.8%	6.2%
Tether strap tight (1 inch or less slack)	N/A	N/A	84.4%	15.6%

Note: boldface indicates a common misuse (i.e., greater than 40% misuse).

Table 18. Booster Seat Installation and Restraint Characteristics

Booster Seat Characteristic	Percent Correct	Percent Incorrect
Backless Booster: Vehicle seat back high enough to restrain child’s head	57.0%	43.0%
Seat belt tight	68.8%	31.2%
Shoulder belt properly positioned over shoulder and chest	71.0%	29.0%
Proper space between booster back and vehicle seat back	76.3%	23.7%
Shoulder belt flat	80.6%	19.4%
Lap belt properly positioned across hips and upper thighs	82.8%	17.2%
Lap belt flat	82.8%	17.2%
3-point lap-shoulder belt used	97.8%	2.2%

Note: boldface indicates a common misuse (i.e., greater than 40% misuse). Data represents 93 booster seat inspections.

The most common misuse for both rear-facing and forward-facing CRDs was that the harness straps, which restrain the child within the CRD, were not of the proper tightness (i.e., 1 inch of slack or less). For the rear-facing CRDs, 68.1 percent of the CRDs did not have the harness tight enough, while 65.6 percent of the forward-facing CRDs did not have the harness tight enough. A common reason given by drivers for not tightening the harness properly was that they did not want the harness to cause discomfort to the child – particularly for infants in rear-facing seats. The most common booster seat misuse was the inappropriate use of backless boosters when the child’s head was not adequately supported by the vehicle’s seat back. Other common CRD misuses included:

- Improper positioning of the harness retainer clip, which was often too low on the child.
- Seat installation was too loose, allowing for excessive lateral sway of the CRD.

5.4 Risk Priority Values for CRD Misuses

The risk priority values for the rear-facing CRDs and forward-facing CRDs were calculated as described earlier in this report and are shown in Tables 19 and 20, respectively. As shown in these tables, the rear-facing CRD misuses resulted in an average risk priority number per CRD of 12.5, which was greater than the value of 10.2 observed during the 2009 CRD inspections. The forward-facing CRDs average risk priority number of 3.9 was much lower than that for rear-facing CRDs, but was slightly higher than the value of 3.2 observed during the 2009 inspections. A risk priority number of 4.0 and above indicates a negative impact on the protective capabilities of the CRD during an automobile crash. Thus, the 12.5 average risk priority number for rear-

facing CRDs indicated that the majority of the rear-facing CRDs that were inspected have reduced protective capabilities if involved in an automobile crash.

Table 19. Rear-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Rear-Facing CRD Misuse	Severity Score [29]	Percent Occurrence	Risk Priority Number
Harness too loose (≥ 4 fingers)	6.7	25.0%	167.5
Shoulder harness straps were too high	6.3	18.1%	114.0
Seatbelt routed incorrectly	9.0	11.1%	99.9
Internal harness was not buckled	10.0	9.7%	97.0
Harness retainer clip was too low	2.0	44.4%	88.8
Harness too loose (3 fingers)	4.3	15.3%	65.8
CRD was reclined at improper angle	3.0	14.1%	42.3
Harness too loose (2 fingers)	1.7	20.8%	35.4
Space between CRD and vehicle seat 6"	7.0	4.2%	29.4
Space between CRD and vehicle seat 3"	4.0	6.9%	27.6
Space between CRD and vehicle seat 5"	6.0	4.2%	25.2
Shoulder harness straps were twisted	2.7	8.6%	23.2
Space between CRD and vehicle seat 4"	5.0	4.2%	21.0
Seatbelt/LATCH was not buckled	7.0	2.8%	19.6
Harness retainer clip was not attached	2.3	5.6%	12.9
Space between CRD and vehicle seat 2"	3.0	4.2%	12.6
Space between CRD and vehicle seat 1"	1.0	11.1%	11.1
Crotch strap was twisted	3.5	1.4%	4.9
Harness retainer clip was too high	2.5	0%	0
Total Risk Priority Number for Rear-Facing CRDs			898.2
Average Risk Priority Number per CRD			12.5

Table 20. Forward-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Forward-Facing CRD Misuse	Severity Score [29]	Percent Occurrence	Risk Priority Number
Harness too loose (≥ 4 fingers)	6.3	19.1%	120.3
Internal harness was not buckled	10.0	6.1%	61.0
Harness retainer clip was too low	1.5	33.6%	50.4
Harness too loose (3 fingers)	3.7	12.2%	45.1
Shoulder harness straps were too low	2.3	18.3%	42.1
Harness too loose (2 fingers)	1.3	29.8%	38.7
Space between CRD and vehicle seat 1"	2.0	14.5%	29.0
Space between CRD and vehicle seat 3"	5.0	4.6%	23.0
Crotch strap was twisted	3.5	6.2%	21.7
CRD was reclined at improper angle	4.6	4.6%	21.2
Shoulder harness straps were twisted	1.3	15.3%	19.9
Space between CRD and vehicle seat 2"	4.0	3.8%	15.2
Seatbelt/LATCH was not buckled	6.0	1.5%	9.0
Tether routed incorrectly	9.0	0.8%	7.2
Shoulder harness straps were too high	1.7	3.1%	5.3
Space between CRD and vehicle seat 4"	6.0	0.8%	4.8
Harness retainer clip was not attached	2.0	1.5%	3.0
Harness retainer clip was too high	2.5	0%	0
Total Risk Priority Number for Forward-Facing CRDs			516.9
Average Risk Priority Number per CRD			3.9

In addition to providing a relative comparison between the severity of misuses between the rear-facing CRDs and forward facing CRDs, these tables also show the type of misuse that should be emphasized on correcting based on the risk priority number. The most problematic misuse for both rear-facing and forward-facing CRDs was excessive harness slack. An improperly tightened harness may potentially allow for the child to eject from the CRD in the event of a crash. Other problematic issues based on highest risk priority numbers included:

- Internal harness not buckled – An unbuckled harness will likely lead to the child being ejected from the seat in the event of a frontal impact.
- Harness retainer clip positioned too low on the child – A low harness retainer clip may also allow for the child to be ejected from the CRD in the event of a crash.
- Shoulder harness straps routed incorrectly – Shoulder harness straps should be at or below the child’s shoulders for rear-facing CRDs and at or above the shoulder for forward-facing CRDs.
- Excessive space between the CRD and the vehicle’s seat back – Extra space between the CRD and the vehicle’s seat back is a general indicator of a loose CRD installation that may cause excessive movement of the CRD during a crash.

5.5 LATCH Utilization

The inspectors also noted whether or not the LATCH system was available within the vehicle and, if so, whether or not the LATCH anchors were being utilized to restrain the CRD. Table 21 presents data on utilization of the LATCH system that was obtained from the inspections.

Table 21. LATCH Availability and Utilization

CRD Type	Pct. of Vehicles Equipped with LATCH	Pct. of Equipped Vehicles Using LATCH	Pct. of All Vehicles Using LATCH
Rear-Facing	68.1%	63.3%	43.1%
Forward-Facing	72.7%	65.6%	47.7%
Total	71.1%	64.8%	46.1%

The LATCH system was utilized to secure the CRD in 46.1 of the inspected vehicles, even though 71.1 percent of all inspected vehicles were LATCH equipped. Although they greatly simplify the CRD attachment process, LATCH was utilized in only 64.8 percent of equipped vehicles. Only small differences were observed between the LATCH utilization for rear-facing versus forward-facing CRDs. Both the percent of vehicles equipped with LATCH and the percent of LATCH utilization have increased from recent inspections.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine the statewide rates of appropriate child restraint device use and misuse among child passengers ages 0-to-7. The child restraint use rates were determined through a direct observation survey conducted at daycare centers, elementary schools, fast food restaurants, shopping centers, and recreational areas throughout the State of Michigan. Misuse rates were determined through on-site inspections conducted at a similar set of locations, in addition to large inspection events.

The use rate survey showed that children ages 0-to-3 were restrained in a rear or forward facing CRD in 95.0 percent of the statewide observations, while children ages 4-to-7 were restrained in an appropriate booster seat or CRD in 43.9 percent of the statewide observations. These usage rates were similar to the results from the most recent surveys, which were conducted in 2009 and 2010 for these age groups, respectively. Though the statewide misuse rate of CRDs has decreased slightly since the most recent inspections, it remains relatively high at 73.9 percent.

There were several areas where child restraint use was above or below the statewide average. Child restraint use was highest among daycare sites, which is indicative of the fact that the children attending daycare are generally younger and child restraint device use has been shown to decrease as age increases. This may also reflect that parents who bring their children to daycare have greater knowledge or concern regarding appropriate child restraint devices. Child restraint use was lowest among passenger cars and pickup trucks, particularly when children were seated in the front seat. Male drivers were less likely to restrain children in booster seats, as were drivers age 60 and above. 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 [28], 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.

Several conclusions were also drawn with respect to the common and high-risk CRD and booster seat misuses. The most common misuse for both rear-facing and forward-facing CRDs was that the harness straps, which restrain the child within the CRD, were not of the proper tightness (i.e., one inch of slack or less). Another common misuse was the improper positioning of the harness retainer clip, which was often too low on the child. The inspections also revealed a prevalence of loose seat installations, which was defined as lateral sway of the seat that was greater than one inch when pulled. In general, children were typically seated in the appropriate type of seat based upon their age, weight, and height, with the exception of three-year old children, who frequently had been prematurely transitioned into a booster seat.

In terms of risk priority number, the most high-risk misuse for both rear-facing and forward-facing CRDs was excessive harness slack, which increases the likelihood for a child to be ejected from the CRD in the event of a crash. Other problematic issues based on the highest risk priority numbers included: internal harness not buckled, harness retainer clip positioned too low on the child, shoulder harness straps routed incorrectly, and excessive space between the CRD and the vehicle's seat back.

To ensure proper CRD and booster seat use, parents must be provided with child restraint education and training periodically throughout their child's growth and development, particularly when a new CRD is utilized or modification to the current CRD becomes necessary. For example, the installation of a CRD for a newborn is drastically different than that for a three-year old child. The following age/development stages often necessitate a new CRD or modification to the current CRD:

- Birth (first use of CRD, which must be rear facing with a 45 degree incline)
- Between age 6 months and 12 months (switch from infant carrier to larger rear-facing CRD with 60 degree incline)
- Age 12 months and 20 pounds (switch from rear-facing CRD to forward-facing CRD)
- Age 4 and 40 pounds (switch to booster seat)
- Age 8 or 4'9" tall (switch to safety belt)

Several educational/training opportunities are available to parents. Hospitals typically provide basic hands-on training of CRD and booster seat installation and use for parents of newborns upon discharge from the hospital. Day care facilities often provide basic child restraint education, but do not have the staff to provide full inspection or training. There are many locations throughout the State of Michigan where parents can have their CRD or booster seat inspected by certified individuals. NHTSA-certified inspectors are often available at most fire stations and police stations, although appointments may be required. The non-profit organization SafeKids USA sponsors several CRD/booster seat inspection/training events statewide. These events have one or more NHTSA certified inspectors on-site to inspect the CRD installation and inform the parents if they are using an incorrect restraint for their child or if the device has been recalled. The inspectors will also show the parents how to properly install the CRD/booster seat in the vehicle and how to properly restrain the child in the seat. Parents should be encouraged to have their CRD/booster seat inspected by a NHTSA-certified inspector anytime a new CRD/booster is utilized, a change to the existing installation or internal restraint is needed, or after the child has experienced substantial growth or development. Parents should also be informed of the benefits of the LATCH system, which simplifies correct attachment of the CRD to the vehicle.

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APPENDIX I – LIST OF DAYCARE CENTERS OBSERVED

Stratum	County	Location Name	Address
1	Ingham	Educational Child Care Center	1715 W. Main St, Lansing , MI 48915
1	Kalamazoo	Tutor Time	6500 Constitution, Portage, MI, 49024
1	Oakland	Goodison Child Care Center	4461 Collins Rd. Rochester, MI 48306
1	Washtenaw	Kindercare	2300 South Huron Parkway, Ann Arbor, MI 48104
1	Washtenaw	Dorothy's Daycare	7265 Merritt Rd, Ypsilanti, MI 48197
2	Macomb	Kindercare	33300 Ryan Road, Sterling Heights, MI 48310
2	Ottawa	Cottonwood Day Care	1101 Cypress Dr., Jenison, MI 49428
2	Ottawa	Daily Shepherd Child Care	1481 Baldwin St., Jenison, MI 49428
3	Calhoun	Little Friends Daycare	1305 Olive St, Battle Creek, MI 49017
3	Genessee	Little People's Playhouse	6218 Kids Lane, Flushing, MI 48433
3	Saginaw	MCCC-Kindercare	928 W. Ardussi, Frankenmuth, MI 48734
3	St. Clair	Kid's Connection	301 N 6th St, St. Clair, MI 48079
3	St. Clair	Marysville Children's Center	901 Michigan St., Marysville, MI 48040
4	Wayne	Nanny's Nursery (Infants)	21085 Goddard, Taylor, MI 48180
4	Wayne	Sugar N' Spice	16555 Wyoming, Detroit, MI 48221
4	Wayne	The Learning Tree	32955 Plymouth Rd., Livonia, MI 48150
4	Wayne	Meadowbank Child Daycare	2122 Dix Highway, Lincoln Park, MI 48146

APPENDIX II – LIST OF ELEMENTARY SCHOOLS OBSERVED

Stratum	County	Location Name	Address
1	Ingham	Averill Elementary	3102 Averill Dr, Lansing, MI 48911
1	Ingham	St. Thomas Aquinas School	915 Alton Rd, East Lansing, MI 48823
1	Ingham	Woodworth Elementary	212 Pennsylvania St, Leslie, MI 49251
1	Kalamazoo	Parchment Northwood Elementary	600 Edison Street, Kalamazoo, MI 49004
1	Oakland	Green Elementary	4500 Walnut Lake Road, West Bloomfield, MI 48323
1	Oakland	Upton Elementary	4400 Mandalay Ave, Royal Oak, MI 48073
1	Oakland	Dolson Elementary	56775 Rice Street, New Hudson, MI 48165
2	Grand Traverse	Kingsley Elementary	311 Clark Street, Kingsley, MI 49649
2	Kent	Dutton Elementary School	3820 68th Street SE., Caledonia MI 49316
2	Macomb	Harwood Elementary	4900 Southlawn Drive, Sterling Heights, MI 48310
2	Macomb	Briarwood Elementary	14100 Leisure Drive, Warren, MI 48088
2	Midland	Adams Elementary	1005 Adams Drive, Midland, MI 48642
2	Midland	Siebert School	5700 Siebert Street, Midland, MI 48642
2	Ottawa	Rosewood School	2370 Tyler Street, Jenison, MI 49428
3	Genesee	Dieck Elementary	2239 Van Vleet Rd, Swartz Creek, MI 48473
3	Genesee	Hill Elementary	404 Aloha St, Davison, MI 48423
3	Genesee	Morrish Elementary	5055 Maple Rd, Swartz Creek, MI 48473
3	Genesee	Syring Elementary	5300 Oakview Drive, Swartz Creek, MI 48473
3	Lapeer	Mayfield Elementary	302 Plum Creek Rd, Lapeer, MI 48446
3	Monroe	St. Patrick Elementary	2970 West Labo Road, Carleton, MI, 48117
3	Saginaw	Lorenz C. List School	805 E Genesee St, Frankenmuth, MI 48734
3	Saginaw	Shields Elementary	6900 Stroebel Rd, Saginaw, MI 48609
3	St. Clair	Washington Elementary	905 16th St, Marysville, MI 48040
4	Wayne	Christ the Good Shephard School	1590 Riverbank St, Lincoln Park, MI 48146
4	Wayne	Macdowell Elementary	4201 W. Outer Drive, Detroit, MI 48221
4	Wayne	Myers Elementary	16201 Lauren Drive, Taylor, MI 48180
4	Wayne	Barton Elementary	8530 Joy Road, Detroit, MI 48204
4	Wayne	Burns Elementary	14350 Terry St, Detroit, MI 48227
4	Wayne	Gallimore Elementary	8375 N. Sheldon Rd, Canton, MI 48187
4	Wayne	Garfield Elementary	10218 Arthur St, Livonia, MI 48150

**APPENDIX III – LIST OF FAST FOOD RESTAURANTS, SHOPPING CENTERS, AND
RECREATIONAL SITES OBSERVED**

Stratum	County	Location Name	Address
1	Ingham	Eastwood Towne Center	1500 Lake Lansing Rd., Lansing, MI 48840
1	Ingham	Target	4890 Marsh Rd, Okemos, MI 48864
1	Kalamazoo	Community Presbyterian Church	2131 Alamo Ave, Kalamazoo, MI 49006
1	Kalamazoo	Harding's Market	5161 W. Main St., Kalamazoo, MI 49009
1	Kalamazoo	Meijer	5800 Gull Rd., Kalamazoo, MI 49048
1	Kalamazoo	The CrossRoads	6650 S. Westnedge Ave, Portage, MI 49024
1	Kalamazoo	West Main Shopping Center	5161 W. Main St., Kalamazoo, MI 49009
1	Oakland	Detroit Zoo	8450 W. Ten Mile Rd, Royal Oak, MI 48067
1	Oakland	Great Lakes Crossing	4000 Baldwin Rd, Auburn Hills, MI 48326
1	Oakland	Hess Hathaway Park	825 Williams Lake Rd Waterford, MI 48327
1	Oakland	Holiday Market	1203 S Main, Royal Oak, MI 48067
1	Oakland	Kmart	29101 John R Road, Madison Heights, MI 48071
1	Oakland	Kroger	23675 Greenfield Road, Southfield, MI 48075
1	Oakland	Kroger	8920 W 8 Mile Rd, Ferndale, MI 48220
1	Oakland	McDonalds	2985 Walton Blvd., Rochester Hills, MI, 48309
1	Oakland	McDonalds	423 W. 11 Mile, Royal Oak, MI, 48067
1	Washtenaw	Arborland Mall	3645 Washtenaw, Ann Arbor, MI 48104
1	Washtenaw	Briarwood Mall	100 Briarwood Circle, Ann Arbor, MI 48108
1	Washtenaw	McDonalds	5550 W. Michigan Ave, Ypsilanti, MI, 48197

Stratum	County	Location Name	Address
2	Allegan	First Baptist Church	404 W. Bridge St., Plainwell, MI 49080
2	Allegan	Meijer	1195 M-89, Plainwell, MI 49080
2	Allegan	United Methodist Church	223 E. Allegan St., Otsego, MI 49078
2	Allegan	Walmart	412 Oaks Crossing, Plainwell, MI 49080
2	Bay	Bay City Mall	4101 East Wilder Road, Bay City, MI 48706
2	Bay	Kroger	2910 Center Ave, Essexville, MI 48732
2	Eaton	Burger King	7416 W Saginaw Highway, Lansing MI 48917
2	Eaton	Kroger	6430 W Saginaw Hwy, Lansing, MI 48917
2	Eaton	Lansing Mall	5662 West Saginaw Highway, Lansing, MI 48917
2	Eaton	McDonald	7240 W. Saginaw Highway, Lansing, MI 48917
2	Eaton	McDonalds	5225 N Grand River Ave, Lansing, MI, 48917
2	Eaton	Meijer	5125 West Saginaw Highway Lansing, MI 48917
2	Eaton	Meijer	730 E. Saginaw Hwy, Grand Ledge MI 48837
2	Eaton	Walmart	409 N. Marketplace Blvd, Lansing MI 48917
2	Grand Traverse	Grand Traverse Mall	3200 S. Airport Road W, Traverse City, MI 49684
2	Jackson	Jackson Crossing	1092 Jackson Crossing, Jackson, MI 49204
2	Jackson	McDonalds	6011 Ann Arbor Rd., Jackson MI 49201
2	Jackson	Meijer	2777 Airport Rd, Jackson MI 49202
2	Jackson	Target	1076 Jackson Xing, Jackson, MI 49202
2	Jackson	Walmart	1700 W Michigan Ave Jackson, MI 49202
2	Kent	Centerpointe Mall	3665 28th Street SE, Grand Rapids, MI 49512
2	Kent	Meijer	2425 Alpine NW, Grand Rapids, MI 49544
2	Kent	Meijer	4542 Kenowa Ave SW, Grandville, MI 49418
2	Kent	Meijer	5500 Clyde Park Ave SW, Wyoming, MI 49509
2	Kent	Rivertown Crossings	3700 RiverTown Parkway, Grandville, MI 49418
2	Livingston	Meijer	3883 E Grand River Avenue, Howell MI 48843
2	Livingston	Meijer	8650 W. Grand River Ave, Brighton, MI 48116
2	Livingston	Tanger Outlet	1475 North Burkhart Road, Howell, MI 48843
2	Macomb	Babies R Us	32233 Gratiot Ave, Roseville, MI 48066
2	Macomb	Chuckie Cheese's	31920 Gratiot Avenue, Roseville, MI 48066
2	Macomb	Lakeside Mall	14000 Lakeside Circle, Sterling Heights, MI 48312
2	Macomb	Stony Creek MetroPark	4300 Main Park Road, Shelby Township, MI 48316
2	Macomb	Value Center Mall	37155 Harper, Clinton Township MI 48036
2	Macomb	Walmart	28804 Gratiot Ave, Roseville, MI 48066
2	Monroe	McDonalds	1001 S. Monroe St, Monroe, MI 48161
2	Ottawa	Meijer	746 E 16th St, Holland, MI 49423
2	Ottawa	Sams Club	2190 North Park Drive, Holland, MI 49424

Stratum	County	Location Name	Address
3	Berrien	McDonald	2020 Pipestone Rd, Benton Harbor MI 49022
3	Berrien	Target	960 Fairplain Dr., Benton Harbor MI 49022
3	Calhoun	Lakeview Square	5775 Beckley Rd, Battle Creek, MI 49015
3	Calhoun	Meijer	6405 B Drive North, Battle Creek, MI 49014
3	Genesee	Birch Run Outlets	12240 S. Beyer Rd., Birch Run, MI 48415
3	Genesee	Genesys Health Park	1 Genesys Pkwy, Grand Blanc, MI 48439
3	Genesee	Kmart	1145 N Belsay Rd, Burton, MI 48509
3	Genesee	Kroger	2629 W Pierson Rd, Flint MI 48504
3	Genesee	Kroger	3288 Corunna Rd, Flint MI 48532
3	Genesee	McDonalds	6460 W. Pierson Rd., Flushing, MI 48433
3	Genesee	Toys R US	3250 S Linden Rd, Flint MI 48507
3	Genesee	Wal-Mart	6170 S Saginaw Rd, Grand Blanc, MI 48439
3	Monroe	Mall Of Monroe	2121 North Monroe St, Monroe, MI 48162
3	Monroe	Meijer	1700 Telegraph Rd., Monroe, MI 48162
3	Monroe	Walmart	2155 N Telegraph Rd, Monroe, MI 48162
3	Muskegon	Meijer	5300 Harvey St., Muskegon, MI 49444
3	Muskegon	Westshore Plaza	1650 E. Sherman Blvd, Muskegon, MI 49444
3	Saginaw	Fashion Square Mall	4787 Bay Rd., Saginaw, MI 48604
3	Saginaw	Mcdonalds	2745 Bay Rd, Saginaw, MI, 48603
3	Saginaw	Meijer	3360 Tittabawassee Rd, Saginaw, MI 48604
3	Saginaw	Meijer	3413 Tittabawassee Rd., Saginaw, MI 48604
3	Saginaw	Meijer	8400 Gratiot Rd, Saginaw, MI 48609
3	Saginaw	Target	2772 Tittabawassee Rd, Saginaw, MI 48604
3	Saginaw	Walmart	5650 Bay Rd, Saginaw, MI 48604
3	Shiawassee	Meijer	2591 E M-21, Corunna MI 48817
3	St. Clair	Meijer	305 S. Range Rd, Marysville MI 48040
3	Tuscola	North Star Bank	1100 E. Caro Rd, Caro, MI 48723
3	Tuscola	Walmart	1121 E. Caro Rd., Caro, MI 48723
3	Van Buren	Village Market	407 S. State St., Gobles MI 49055
3	Van Buren	Wagoners	24064 Mc Gillen, Mattawan MI 49071

Stratum	County	Location Name	Address
4	Wayne	Belle Isle	Belle Isle - Detroit, MI
4	Wayne	Detroit Children's Museum	6134 Second Ave, Detroit, MI 48202
4	Wayne	Fairlane Green	3464 Fairlane Dr., Allen Park, MI 48101
4	Wayne	Greenfield Village	20900 Oakwood Blvd, Dearborn, MI 48124
4	Wayne	Kroger	15255 Michigan Avenue, Dearborn, MI 48124
4	Wayne	Kroger	23303 Michigan Avenue, Dearborn, MI 48124
4	Wayne	Kroger	7000 Monroe Blvd, Taylor, MI 48180
4	Wayne	Laurel Park Mall	37700 West Six Mile Road, Livonia, MI 48152
4	Wayne	Laurel Park Place	37560 6 Mile Road, Livonia, MI 48152
4	Wayne	McDonald's	4235 Woodward Ave, Detroit, MI 48201
4	Wayne	Meijer	13000 Middlebelt Rd. Livonia, Michigan 48150
4	Wayne	Meijer	3565 Fairlane Dr., Allen Park, MI 48101
4	Wayne	Meijer	45001 Ford Rd, Canton, MI 48187
4	Wayne	Southland Center	23000 Eureka Rd, Taylor, MI 48180
4	Wayne	Walmart	29574 7 Mile Road, Livonia, MI 48152-1910
4	Wayne	Walmart	5851 Mercury Dr, Dearborn, MI 48124
4	Wayne	Westland Public Library	6123 Central City Pkwy, Westland, MI 48185
4	Wayne	Westland Shopping Center	35000 W. Warren, Westland, MI 48185

APPENDIX IV – LIST OF INSPECTION LOCATIONS

Strata	Date	Location	Address	County
1	5/21/2011	Ferndale Foods	600 W 9 Mile Rd, Ferndale, MI 48220	Oakland
1	5/22/2011	United Hope Methodist	26275 Northwestern Highway, Southfield, MI	Oakland
1	6/23/2011	Packard Health Fair	3174 Packard Rd, Ann Arbor, MI 48108	Washtenaw
1	6/24/2011	Target	5350 W. Main St., Kalamazoo, MI 49009	Kalamazoo
1	6/28/2011	Educational Child Care Center	1715 W. Main St., Lansing, MI 48915	Ingham
1	6/29/2011	Northville First Care	777 W. Eight Mile Rd., Northville, MI 48167	Oakland
1	7/15/2011	Dorothy's Discovery Daycare	7265 Merritt, Ypsilanti, MI 48197	Washtenaw
2	6/9/2011	Wyoming Fire Dept	1250 36th St, Wyoming, MI 49509	Kent
2	6/20/2011	Walmart	45400 Marketplace Blvd, Chesterfield, MI 48051	Macomb
2	6/23/2011	Grand Rapids Fire Dept	2541 Kalamazoo Ave, Grand Rapids, MI 49507	Kent
2	7/5/2011	Holland Twp Fire Dept.	12640 James St., Holland, MI 49424	Ottawa
2	7/7/2011	Spectrum Health Child Center	1697 Michigan St., Grand Rapids, MI 49503	Kent
2	7/8/2011	Algoma Fire Dept	10820 Edgerton, Rockford, MI 49319	Kent
2	8/18/2011	LESA Health Event	1425 W. Grand River, Howell, MI 48843	Livingston
3	6/14/2011	Mobility Works	8175 Gratiot Rd, Saginaw, MI 48609	Saginaw
3	7/13/2011	MCCC - KinderCare	928 W. Ardussi, Frankenmuth, MI 48734	Saginaw
3	7/16/2011	Genesys Health Park	1 Genesys Pkwy, Grand Blanc, MI 48439	Genesee
3	7/19/2011	Kid's Connection	301 N. 6th St, St. Clair, MI 48079	St. Clair
3	7/20/2011	North Star Bank	1100 E. Caro Rd, Caro, MI 48723	Tuscola
3	7/20/2011	Marysville Children's Center	901 Michigan Ave, Marysville, MI 48040	St. Clair
3	8/9/2011	Graff Chevrolet	9009 E. Lansing Rd., Durand, MI 48867	Shiawassee
3	8/16/2011	Flint Fire Department	310 E. 5th St., Flint, MI 48502	Genesee
4	5/14/2011	Brightmoor Community Center	14451 Burt Road, Detroit, MI 48223	Wayne
4	6/4/2011	2nd Ebenezer Church	14601 Dequindre, Detroit MI 48203	Wayne
4	6/22/2011	Nanny's Nursery	9529 Pardee, Taylor, MI 48180	Wayne
4	7/12/2011	Nanny's Nursery Infants	21085 Goddard, Taylor, MI 48180	Wayne
4	8/25/2011	Detroit Leadership Academy	13550 Virgil St., Detroit, MI 48223	Wayne

APPENDIX V – INSPECTION FORM

CHILD RESTRAINT DEVICE INSPECTION FORM (applies to child occupants under the age of 8)

Vehicle/Observation#: _____ Date: ____/____/20 ____ Time of Day: ____ am / pm Weather: _____ Observer's Name: _____

Location Name: _____ Address: _____

Notes: Use 1 form for each child occupant observed age 4 and under. Complete page one first. For occupants who are restrained, complete all questions on the second page.

Vehicle Type: Passenger car SUV Van/minivan Pick-up truck

Make: _____ Model: _____ Year: _____

Is Vehicle LATCH Equipped? Yes No

Restrained Child Seating Position (circle number where child is seated):

	First Row	Second Row	Third Row	
Front of Vehicle	3	6	9	Cargo Area
	2	5	8	
	D	4	7	

Other Children Seating Position (circle numbers where children under age of 12 were seated):

	First Row	Second Row	Third Row	
Front of Vehicle	3	6	9	Cargo Area
	2	5	8	
	D	4	7	

Age (fill in): _____ yrs OR _____ (mo if < 2 yr)

Weight (fill in and then circle category): _____ <20 lbs 20-39 lbs 40-80 lbs 81+ lbs

Height: _____ (in inches)

Driver Age: 16 - 29 30 - 59 60+
 Driver Gender: Male Female

Driver Race:
 Caucasian
 African American
 Asian or Pacific Islander
 Hispanic
 Native American

Restraint:

- Rear-Facing CRD
- Forward-Facing CRD
- Belt Positioning Boosters (BPP)
- Shield Booster
- Integrated Seat
- Seat Belt
- Unrestrained (If unrestrained circle and stop the observation)

Law and Best Practices:

- 1. Child restrained in accordance with State Law? Yes No
 (Children up to age 4 must be properly buckled in a car set while riding in a motor vehicle.)
- 2. Is child riding in a back seat (2nd or 3rd row)? Yes No NA

CRD Selection and Child Position (All seats)

- 1. Restraint appropriate for child's age? Yes No
- 2. Restraint appropriate for child's height? Yes No
- 3. Restraint appropriate for child's weight? Yes No
- 4. CRD facing proper direction for child's age/weight? Yes No NA for SB
- 5. Seat intended to be used in the direction it is installed? Yes No NA for SB
- 6. CRD installed on a forward-facing vehicle seat? Yes No NA for SB

If child is in the front seat answer the following questions:

- 7. Does the vehicle have a passenger airbag? Yes No
- 8. If there is an airbag, is it turned off? Yes No Don't Know
- 9. If the airbag is on, is the child at least 12" away from the airbag? Yes No Don't Know
- 10. If the airbag is on, is the child facing forward? Yes No Don't Know

For restrained occupants, is restraint use correct?

- Yes (All CRD & Child Position questions and all Page 2 questions answered "Yes" or "N/A.")
- No (1 or more CRD & Child Position questions answered "No" and/or 1 or more Page 2 questions answered "No.")
- Don't know (1 or more CRD Selection & Child Position questions answered "Don't know" and/or 1 or more Page 2 questions answered "Don't know." Or observer unable to complete entire observation.)

FOR FRONT-FACING CRDS

Position/Installation in Vehicle

1. Is the seat reclined properly (upright against the seat back)?
2. Is the CRD installation tight (1-inch rule when checked at base of seat)?
3. What is the space between the CRD back and vehicle seat back (in inches)?

Harness

4. Is internal CRD crotch harness buckled?
5. How tight are the shoulder harness straps (in fingers)?
6. Where is the harness retainer clip positioned when buckled?
7. Where do the shoulder harness straps rout into the CRD?

8. Are the shoulder harness straps flat (not twisted)?
9. Is the harness retainer clip attached and orientated properly?
10. Is crotch strap flat (not twisted)?

Locking/Attachment

11. What vehicle system is used to attach CRD?
 12. Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?
 13. If the vehicle seatbelt is used, is the seatbelt locked (pull on lap belt)?
 14. Is vehicle seatbelt flat (not twisted)?
 15. Is the proper belt path/lower strap connector path used?
- Tether (Only If Used)**
16. Is the tether routed under an adjustable head restraint or over a non-adjustable head restraint?
 17. Is tether strap flat (not twisted)?

18. How much slack is in the tether strap (in inches)?

FOR INTEGRATED SEATS (usually in Minivans)

1. Is the harness or SB buckled?
2. Is the shoulder belt properly positioned over shoulder, collar bone, & chest?
3. Is the shoulder belt flat (not twisted)?
4. Is the lap belt properly positioned across the hips/upper thighs?
5. Is the lap belt flat (not twisted)?

6. How tight is the harness?

- 1 Yes 2 No
- 1 Yes 2 No 3 NA

- 0 inches 1 inch
- 2 inches 3 inches
- 4 inches NA

- 1 Yes 2 No

- 1 finger 2 fingers
- 3 fingers 4 fingers NA

- 1 Proper (at armpit level)
- 2 Too high
- 3 Too low
- 4 NA

- 1 Proper (at or above shoulders)
- 2 Too high (above head)
- 3 Too low (below shoulders)

- 1 Yes 2 No 3 NA
- 1 Yes 2 No 3 NA
- 1 Yes 2 No 3 NA

- 1 SB 2 Lower LATCH Anchors
- 3 Both 4 None

- 1 Yes 2 No 3 NA

- 1 Yes 2 No
- 1 Yes 2 No

- 0 inches 1 inch 2 inches
- 3 inches 4 inches 5 inches

- 1 Yes 2 No
- 1 Yes 2 No 3 NA

- 0 inches 1 inch 2 inches
- 3 inches 4 inches NA

FOR REAR-FACING CRDS

Position/Installation in Vehicle

1. What is the seat incline (estimated from horizontal)?
2. Is the CRD installation tight (1-inch rule when checked at base of seat)?
3. What is the space between the CRD back and base of the vehicle seat?

Harness

4. Is internal CRD crotch harness buckled?
5. How tight are the shoulder harness straps (in fingers)?
6. Where is the harness retainer clip positioned when buckled?
7. Where do the shoulder harness straps rout into the CRD?

8. Is the harness retainer clip attached and orientated properly?
9. Are the shoulder harness straps flat (not twisted)?

10. Is crotch strap flat (not twisted)?

Locking/Attachment

11. What vehicle system is used to attach CRD?
12. Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?
13. If the vehicle seatbelt is used, is the seatbelt locked (pull on lap belt)?
14. Is vehicle seatbelt flat (not twisted)?
15. Is the proper vehicle seatbelt path/lower strap connector path used?

FOR BOOSTER SEATS (BPB)

Vehicle Seatbelt

1. Is a proper lap and shoulder belt (3-point) system used?
2. Is the shoulder belt properly positioned over shoulder, collar bone, & chest?
3. Is the lap belt properly positioned across the hips/upper thighs?
4. Is the shoulder belt flat (not twisted)?
5. Is the lap belt flat (not twisted)?
6. Is the seat belt tight (not loose)?

Position in Vehicle

7. If a backless BPB is being used, is the vehicle seat back high enough to restrain the child's head (vehicle seat back reaches child's ear height)?
8. What is the space between the BPB back and vehicle seat back (in inches)?

- 1 -45° 2 -60° 3 <35° 4 >70°
- 1 Yes 2 No 3 NA

- 0 inches 1 inch
- 2 inches 3 inches
- 4 inches 5 inches
- 6 inches NA

- 1 Yes 2 No

- 1 finger 2 fingers
- 3 fingers 4 fingers
- NA

- 1 Proper (at armpit level)
- 2 Too high
- 3 Too low
- 4 NA

- 1 Proper (at or below shoulders)
- 2 Too high (above shoulders)

- 1 Yes 2 No 3 NA
- 1 Yes 2 No 3 NA

- 1 Yes 2 No 3 NA

- 1 SB 2 Lower LATCH Anchors
- 3 Both 4 None

- 1 Yes 2 No 3 NA
- 1 Yes 2 No 3 NA
- 1 Yes 2 No 3 NA

- 1 Yes 2 No
- 1 Yes 2 No 3 NA

- 1 Yes 2 No 3 NA

- 0 inches 1 inch
- 2 inches 3 inches
- 4 inches NA