



# FINAL REPORT

## 2013 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 48202

Date: September 2013



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16. Abstract This study reports the results of the 2013 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, fast food restaurants, shopping centers, and recreational areas throughout Michigan. Misuse rates were determined through on-site inspections conducted at daycares and inspection events. The use rate survey, conducted between July and August of 2013, showed statewide child restraint use rates of 93.6 percent among zero to three year-old children and 42.4 percent among four to seven year-olds. Restraint use was highest at daycare centers among four to seven year-olds and use rates were comparable at most of the site types among zero to three year-olds. Use rates were the lowest at recreational sites (for all target-aged children) in comparison to the other site 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 while child restraint use was lowest in vehicles with drivers age 60 and above. Only 25.1 percent of the statewide inspections of the restraint characteristics of children under age eight showed correct utilization of the child restraint device. The most common misuse for rear-facing child restraint devices was the seat not being inclined at the proper angle. Rear-facing and forward-facing child restraint devices were also commonly found to have issues with the harness retainer clip position (typically too low) and excessive slack in the harness strap. The most common booster seat misuse was the improper positioning of the shoulder belt with respect to the shoulder and chest of the child. Approximately 20 to 25 percent of children had been prematurely transitioned into the next type of restraint. This includes placing a child in a forward-facing child restraint device prior to the age of two or a booster seat prior to the age of four years.			
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## 1.0 INTRODUCTION

Motor vehicle crashes are one of the leading causes of death and injury for children under 8 years of age. From 2008 to 2012, a total of 31,603 child passengers under the age of 8 were involved in traffic crashes in the state of Michigan [1]. Among those child-aged vehicle occupants for whom restraint use information was recorded, only 22,704 (71.8 percent) were restrained in some type of child specific restraint, either a child restraint device or a belt-positioning booster seat. Amongst the children restrained in some type of child safety seat, 206 (0.9 percent) suffered fatal (K) or incapacitating (A) injuries. This was lower than the 1.2 percent of children who sustained such injuries while restrained with just a safety belt and the 2.67 percent of children who suffered K or A injuries while improperly or completely unrestrained [1]. Prior research confirms 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 for 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 the proper CRD is used and the risk of head or brain injuries is reduced by 75 percent [3].

In recent years, the State of Michigan has experienced increases in the use of CRDs among children under four years of age from 74.5 percent in 1997 to 95.0 percent in 2011 [4-6]. In spite of these gains, over half of the children under the age of four who were killed in traffic crashes from 2008 to 2012 were improperly or completely unrestrained [1]. Although non-restraint of a child passenger presents obvious safety implications, many of the children killed in these crashes may also have been improperly restrained within a functional CRD.

The improper use of CRDs may expose a child to a heightened risk of injury when involved in a crash. 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 and securely installed in the vehicle using seatbelts or a Lower Anchors and Tethers for Children (LATCH) restraint system, and (3) the child is properly and securely restrained in the device. 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]. The most recent study performed by the WSU-TRG in 2011 found the three most common CRD misuses were 1) excessive slack in the harness straps; 2) improper positioning of the harness retainer clip; and 3) CRD not properly secured to the vehicle [6]. This is concerning as loose harnesses and improper attachment of the CRD to the vehicle have been identified among the most severe forms of CRD misuse [7,8].

While restraint use has increased dramatically among children under the age of four, restraint use among four to seven 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 of the state law and best practice regarding the benefits of booster seats compared to seat belts alone, in addition to differences in risk perception among parents [10-16]. Following the enactment of statewide legislation in July 2008, booster seat use was found to increase substantially in Michigan [17,18]. However, the most recent survey (2011) found greater than half of four to seven year-old child passengers continue to travel while inappropriately restrained [6].

## **2.0 STUDY OBJECTIVES**

The purpose of this study was to determine the rates of child restraint device use and misuse among zero to seven 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 as well as help to 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.

The proposed study built off of the methodologies from previous surveys, such as the 2009, 2010, and 2011 studies conducted by the WSU-TRG [5,6,17,18], in order to accurately and efficiently estimate the rates of use and misuse of CRDs and booster seats 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 eight who were seated in a CRD. Each device was inspected for type of seat, location in the vehicle, direction of placement, attachment to the vehicle, and the placement and restraint of the child in the device. Such data may assist the Office of Highway Safety Planning 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 for use by the state of Michigan to develop targeted educational and public awareness programs to positively impact child safety. This portion of the study resulted 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 was 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 2011 surveys and involves collecting data from a random sample of target age children at daycare centers, fast food restaurants, recreational sites, 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-aged groups of children were required as a part of this study: (a) children from zero to three years of age; and (b) children from ages four to seven. In order to ensure the representativeness of the sample, these observations were to be diverse in terms of geographic coverage, vehicle mix, and the socioeconomic characteristics of the drivers. To ensure such representativeness while maintaining data collection efficiency, sites were sampled from 25 counties representing nearly 83 percent of the target population (children ages zero to seven). The counties were similar to those included in the 2009, 2010, and 2011 surveys [5,6,17,18]. The 2012 county census estimates for children ages zero to three and four to seven are provided in Table 1 [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 target sample size of 300 children was established for the inspections of misuse.

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 CRD and booster seat use have been shown to be related to the driver's safety belt use by previous studies [5,6,17,18]. 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-aged child passengers, including daycare centers, fast food restaurants, recreational sites, 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-aged 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), and Appendix II (Fast Food Restaurants, Shopping Centers, and Recreational Sites).

**Table 1. 2012 Michigan Population Estimates of Children Ages Zero to Three and Four to Seven by County**

County	Population Ages 0 to 3	Percent of Statewide Population Age 0-3	Cumulative Percentage of Age 0-3 Population	Population Ages 4 to 7	Percent of Statewide Population Age 4-7	Cumulative Percentage of Age 4-7 Population
Allegan	5,609	1.2%	1.2%	6,121	1.3%	1.3%
Berrien	7,676	1.7%	2.9%	7,819	1.6%	2.9%
Calhoun	6,591	1.4%	4.4%	7,125	1.5%	4.3%
Clare	1,395	0.3%	4.7%	1,410	0.3%	4.6%
Clinton	3,188	0.7%	5.4%	3,957	0.8%	5.4%
Eaton	4,640	1.0%	6.4%	4,903	1.0%	6.4%
Genesee	20,544	4.5%	10.9%	22,033	4.5%	10.9%
Grand Traverse	3,939	0.9%	11.7%	4,109	0.8%	11.8%
Ingham	12,742	2.8%	14.5%	12,664	2.6%	14.4%
Isabella	2,840	0.6%	15.2%	2,844	0.6%	15.0%
Jackson	7,140	1.6%	16.7%	7,788	1.6%	16.6%
Kalamazoo	11,934	2.6%	19.3%	12,625	2.6%	19.1%
Kent	34,811	7.6%	27.0%	35,772	7.3%	26.5%
Livingston	7,138	1.6%	28.5%	8,743	1.8%	28.3%
Macomb	36,863	8.1%	36.6%	40,508	8.3%	36.6%
Midland	3,489	0.8%	37.4%	3,950	0.8%	37.4%
Monroe	6,718	1.5%	38.9%	7,264	1.5%	38.9%
Muskegon	8,687	1.9%	40.8%	8,986	1.8%	40.7%
Oakland	53,037	11.6%	52.4%	57,969	11.9%	52.6%
Ottawa	13,561	3.0%	55.4%	15,132	3.1%	55.7%
Saginaw	9,135	2.0%	57.4%	9,636	2.0%	57.7%
St. Clair	6,785	1.5%	58.8%	7,740	1.6%	59.3%
Van Buren	3,924	0.9%	59.7%	3,968	0.8%	60.1%
Washtenaw	14,653	3.2%	62.9%	15,350	3.1%	63.2%
Wayne	92,395	20.3%	83.2%	94,324	19.3%	82.6%
<b>Sample Total</b>	<b>379,434</b>	<b>83.2%</b>		<b>402,740</b>	<b>82.6%</b>	
<b>Statewide Total</b>	<b>456,189</b>	<b>100.0%</b>		<b>487,725</b>	<b>100.0%</b>	

Site selection for the misuse inspections was largely based upon the methodology of the 2011 study [6]. In the 2011 study, inspections were performed at daycare centers, permanent inspection stations, and various organized events, including those held at shopping centers, community or church festivals, or health care facilities. Several of the high-yield inspection sites from the 2011 study were again contacted to determine their willingness to participate in the 2013 study.

**Table 2. Counties Utilized for Direct Observation Survey, by Stratum**

<b>Stratum 1</b>	<b>Stratum 2</b>	<b>Stratum 3</b>	<b>Stratum 4</b>
Ingham	Allegan	Berrien	Macomb
Kalamazoo	Calhoun	Clare	Wayne
Oakland	Eaton	Clinton	
Washtenaw	Grand Traverse	Genesee	
	Jackson	Isabella	
	Kent	Muskegon	
	Livingston	Saginaw	
	Midland	St. Clair	
	Monroe	Van Buren	
	Ottawa		

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 III.

### **3.2 Observer Training**

Two targeted training programs specific to this project were conducted during the spring of 2013: (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 May of 2013.

Classroom training for the inspections was conducted on May 1, 2013 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 the inspectors were accurately assessing CRD/booster seat misuse.

Classroom training for the direct observation survey of child restraint use was conducted on May 3, 2013. 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 June 24<sup>th</sup> and July 3<sup>rd</sup>. Observers were paired up for the field training, and each pair of data collectors was sent to various types of locations (e.g., recreational sites, shopping centers, etc.) and their performance was monitored to ensure consistency among observers. This included comparing the number of target-aged children 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 Direct Observation Survey**

During weekday surveys, the data collection schedule was arranged such that observations could be conducted at a fast food restaurant at the start of the day, followed by destination locations en route to a daycare center scheduled to be visited later the same day. Each daycare center was researched to determine exact start and end times, and other locations (e.g., shopping centers, fast food restaurants, recreation centers) were also researched 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 recreation centers.

During the use surveys, several factors were assessed as a part of data collection. For all vehicles identified to have a zero to seven 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 neither gender nor ethnicity of the child passenger would impact the use of child restraint devices, so these data were not collected.

At sites where traffic volumes were relatively low, data were also collected from slow moving vehicles on the adjacent street. Otherwise, vehicles were observed at the exit of the observation site. The vehicles were categorized into four groups: passenger vehicles, sport utility vehicles, vans/minivans, or pickup trucks. Driver restraint use was categorized as belted, not belted, or unknown. An age assessment was required for each child passenger under age eight, in addition to their restraint use and seating position in the vehicle. The seven restraint categories for each child were: not belted, belted, unknown, front-facing child safety seat, rear-facing child safety seat, high-back booster, or backless booster.

<input type="checkbox"/> SAME VEHICLE AS PREVIOUS				<input type="checkbox"/> OBSERVED ON ADJACENT STREET			
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"/> Belted		<input type="checkbox"/> 16-29		<input type="checkbox"/> Male		<input type="checkbox"/> White	
<input type="checkbox"/> Not Belted		<input type="checkbox"/> 30-59		<input type="checkbox"/> Female		<input type="checkbox"/> Black	
<input type="checkbox"/> Unknown		<input type="checkbox"/> 60+		<input type="checkbox"/> Unknown		<input type="checkbox"/> Other	
		<input type="checkbox"/> Unknown				<input type="checkbox"/> Unknown	
CHILD PASSENGER							
RESTRAINT USE:			AGE:		SEATING POSITION:		
<input type="checkbox"/> Belted			<input type="checkbox"/> Rear-Facing CSS		<input type="checkbox"/> 0 to 3		
<input type="checkbox"/> Not Belted			<input type="checkbox"/> Front-Facing CSS		<input type="checkbox"/> 4 to 7		
<input type="checkbox"/> Unknown			<input type="checkbox"/> High-Back Booster		D <input type="checkbox"/> <input type="checkbox"/>		
			<input type="checkbox"/> Backless Booster		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		

Figure 1. Sample Data Collection Form

### 3.4 Data Collection Procedures for Inspections

One portion of the data collection involved visual and hands-on inspection of the child restraint devices for children under the age of eight. The same driver data were collected as for the CRD 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 noted.

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 approximately 2/3 of the CRDs inspected during the 2011 study. Other severe CRD misuses monitored included: internal harness not buckled, not buckling or adequately securing the seatbelt or attaching the LATCH anchor, improper routing of the seatbelt when restraining the CRD to the vehicle seat, shoulder harness straps routed incorrectly, harness retainer clips positioned too low, 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 IV.

### 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 zero to three 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 four to seven year-olds, “appropriate” use included high-back and backless boosters, as well as forward-facing child safety seats. A limited number of four to seven 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 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:

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

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 zero to three and four to seven 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 can then be calculated using the following formula:

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

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 rates using the following equation:

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

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

### **3.5.3 Misuse Rate Determination**

The CRD/booster misuse rates for each stratum and statewide were determined 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 [7], which were developed by CRD safety experts [8]. A severity score of ‘10’ indicates a misuse of the highest severity and a severity score of ‘0’ indicates 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 [7].

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 July 2, 2013 and Saturday, August 17, 2013. During this observation period, a total of 10,207 observations of zero to seven year-old child passengers were conducted at daycare centers, fast food restaurants/shopping centers, recreation centers/other locations, as well as on streets adjacent to these locations throughout the 25-county sample. Observations were relatively evenly distributed between each of the four strata, with each accounting for 23.4 percent to 26.8 percent of the total observations. Summary statistics detailing the results of the child restraint use survey are provided in Tables 3-5.

**Table 3. Summary of Observations by Stratum and Site Type**

<b>Stratum</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
Stratum 1	1026	26.4%	1578	25.0%
Stratum 2	1042	26.8%	1902	30.1%
Stratum 3	912	23.5%	1283	20.3%
Stratum 4	908	23.4%	1555	24.6%
<b>Total</b>	<b>3888</b>	<b>100.0%</b>	<b>6318</b>	<b>100.0%</b>
<b>Site Type</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
Daycare	387	9.95%	299	4.73%
Fast Food/Shopping Center	933	24.00%	1641	25.97%
Recreation/Other	418	10.75%	709	11.22%
Adjacent Street	2150	55.30%	3669	58.07%
<b>Total</b>	<b>3888</b>	<b>100.00%</b>	<b>6318</b>	<b>100.00%</b>

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, 8.9 percent of four to seven year-old children were observed in the first row of seating. While this is a slight decrease from 2011, 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 5.4 percent of zero to three year-old children were restrained in the front seat. The Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics (AAP) recommend that children less than 13 years of age not be seated in the front seat if other alternatives are available.

**Table 4. Summary of Observations by Vehicle Characteristics**

<b>Vehicle Type</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
Passenger Car	2193	56.0%	3372	53.4%
Sport Utility Vehicle	1009	26.0%	1615	25.6%
Van/Minivan	600	15.4%	1037	16.4%
Pickup Truck	86	2.2%	294	4.7%
<b>Child Passenger Seating Position</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
First Row - Center	11	0.3%	19	0.3%
First Row - Right	199	5.1%	544	8.6%
Second Row - Left	1410	36.3%	2286	36.2%
Second Row - Center	648	16.7%	851	13.5%
Second Row - Right	1573	40.5%	2541	40.2%
Third Row - Left	18	0.5%	27	0.4%
Third Row - Center	12	0.3%	17	0.3%
Third Row - Right	17	0.4%	33	0.5%

Table 5 presents data on the number of children observed by various driver characteristics, including gender, age, race, and belt use. Overall, approximately 62.1 percent of children were traveling with a female driver and this proportion was higher among zero to three year-olds in comparison to four to seven year-olds. The vast majority of children (57.9 percent) were traveling with a driver in the 30-to-59 year old age group and approximately 81.0 percent of the children observed were traveling with a Caucasian driver. Among zero to three year-old children, 93.8 percent were traveling with a driver who was appropriately belted while 94.6 percent of four to seven year-old children were traveling with an appropriately restrained driver.

**Table 5. Summary of Observations by Driver Characteristics**

<b>Driver Gender</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
Male	1446	37.2%	2413	38.2%
Female	2437	62.7%	3891	61.6%
Unknown	5	0.1%	14	0.2%
<b>Driver Age</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
16-29	1833	47.2%	1799	28.5%
30-59	1932	49.7%	4177	66.1%
60+	115	3.0%	323	5.1%
Unknown	8	0.2%	19	0.3%
<b>Driver Race</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
White	3166	81.4%	5091	80.6%
Black	454	11.7%	731	11.6%
Other	248	6.4%	448	7.1%
Unknown	20	0.5%	48	0.8%
<b>Driver Belt Use</b>	<b>Number of Children 0-3 Years Old Observed</b>	<b>Percent of Total Sample</b>	<b>Number of Children 4-7 Years Old Observed</b>	<b>Percent of Total Sample</b>
Belted	3648	93.8%	5977	94.6%
Not Belted	140	3.6%	202	3.2%
Unknown	100	2.6%	139	2.2%

#### **4.2 Child Restraint Device Inspections**

The misuse inspections were performed between May and August of 2013 at 25 locations statewide. A total of 402 CRD/booster inspections of child passengers under the age of eight were performed, including 279 in the zero to three year old age range and 121 in the four to seven year old age range. Eighty-two (82) inspections were performed at five sites in Stratum 1, 100 inspections at seven sites in Stratum 2, 122 inspections at seven sites in Stratum 3, and 98 inspections at six 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**

<b>Stratum</b>	<b>No. of Sites</b>	<b>Pct. of Sites</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Stratum 1	5	20.0%	82	20.4%
Stratum 2	7	28.0%	100	24.9%
Stratum 3	7	28.0%	122	30.3%
Stratum 4	6	24.0%	98	24.4%
<b>Total</b>	25	100.0%	402	100.0%
<b>Day of the Week</b>	<b>No. of Sites</b>	<b>Pct. of Sites</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Sunday	0	0.0%	0	0.0%
Monday	2	8.0%	40	10.0%
Tuesday	3	12.0%	39	9.7%
Wednesday	5	20.0%	97	24.1%
Thursday	5	20.0%	69	17.2%
Friday	3	12.0%	55	13.7%
Saturday	7	28.0%	102	25.4%
<b>Total</b>	25	100.0%	402	100.0%
<b>Type of Site</b>	<b>No. of Sites</b>	<b>Pct. of Sites</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Shopping Center	3	12.0%	50	12.4%
Daycare	6	24.0%	105	26.1%
Community or Church Event	6	24.0%	130	32.3%
Permanent Inspection Station	7	28.0%	88	21.9%
Health Care Center or Hospital	3	12.0%	29	7.2%
<b>Total</b>	25	100.0%	402	100.0%

**Table 7. Inspection Data Summary**

<b>Vehicle Type</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Passenger Car	146	36.3%
Sport Utility Vehicle	145	36.1%
Van/Minivan	83	20.6%
Pick-up Truck	28	7.0%
<b>Total</b>	<b>402</b>	<b>100.0%</b>
<b>Type of Restraint</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Rear-Facing CRD	123	30.6%
Forward-Facing CRD	158	39.3%
Belt Positioning Booster	121	30.1%
<b>Total</b>	<b>402</b>	<b>100.0%</b>
<b>Position of the Child</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Front Passenger	1	0.3%
Front Middle	1	0.3%
Second Row Left	141	35.3%
Second Row Center	75	18.8%
Second Row Right	170	42.5%
Third Row Left	5	1.3%
Third Row Middle	3	0.8%
Third Row Right	4	1.0%
Missing	2	0.5%
<b>Total</b>	<b>402</b>	<b>100.0%</b>
<b>Age of Child</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Less than 1 Year	96	24.0%
1 Year – Less than 2 Years	61	15.3%
2 Years – Less than 3 Years	57	14.3%
3 Years – Less than 4 Years	65	16.3%
4 Years – Less than 5 Years	34	8.5%
5 Years – Less than 6 Years	43	10.8%
6 Years – Less than 7 Years	31	7.8%
7 Years – Less than 8 Years	13	3.3%
Missing	2	0.5%
<b>Total</b>	<b>402</b>	<b>100.0%</b>

## 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 93.6 percent among zero to three year-old children and 42.4 percent among four to seven year-old children as shown in Table 8. These rates are comparable to the use rates observed during the most recent survey conducted by the WSU-TRG in 2011, which showed use rates of 95.0 percent and 43.9 percent among these age groups [6].

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

Age Group	Appropriate CRD Use Rate	Standard Error
0-to-3 years old	93.6% ± 1.39%	0.71%
4-to-7 years old	42.4% ± 2.47%	1.26%

When examining each of the specific categories of child restraint use, 31.5 percent of zero to three year-old children were restrained in rear-facing child safety seats and 62.3 percent were in forward-facing safety seats. Among four to seven year-olds, approximately 14.2 percent of children were restrained in front-facing child safety seats, 18.9 percent were observed in high-back boosters, and 9.2 percent were in backless boosters as shown in Table 9. The percentage of children ages zero to three traveling completely unrestrained was 1.8 percent while the percentage of unrestrained children was 5.7 percent among four to seven 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	31.5%	62.3%	0.9%	0.2%	3.0%	1.8%
Ages 4-to-7	0.1%	14.2%	18.9%	9.2%	51.8%	5.7%

When examining child restraint device use by stratum, the use rates among zero to three year-olds ranged from 92.7 percent in Stratum 4 to 95.5 percent in Stratum 3. Among four to seven 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	94.0% ± 2.63%	1.34%	49.1% ± 6.04%	3.08%
Stratum 2	93.1% ± 2.53%	1.29%	40.7% ± 3.78%	1.93%
Stratum 3	95.5% ± 1.88%	0.96%	47.6% ± 5.94%	3.03%
Stratum 4	92.7% ± 2.98%	1.52%	39.4% ± 4.19%	2.14%

**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 10,207 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. Proper use rates for zero to three year-olds were the highest on streets adjacent to the observation sites as well and at fast food restaurants/shopping centers. Proper use was the lowest at recreation sites/other locations. For children from ages four to seven, use rates were highest at daycare centers and the lowest at recreational sites/other locations. The proper use rates were relatively similar among fast food restaurants/shopping centers and on the streets adjacent to all of these locations.

**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)
Daycare Center	362	387	93.54%	187	299	62.54%
Fast Food/Shopping Center	877	933	94.00%	698	1641	42.54%
Recreation/Other	381	418	91.15%	281	709	39.63%
Adjacent Street	2028	2150	94.33%	1501	3669	40.91%

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, such as income or education level, which may influence restraint use. It should also be noted a significant number of children in these types of vehicles were not clearly visible due to tinted windows. Consequently, this may have resulted in a downward bias in the statewide use rate. Proper

restraint use was lowest among pickup trucks and passenger cars, consistent with results of the previous surveys [6,18].

**Table 12. Child Restraint Use Summary by Vehicle Characteristics**

<b>Vehicle Type</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
Passenger Car	2023	2193	92.3%	1226	3372	36.4%
Sport Utility Vehicle	967	1009	95.8%	771	1615	47.7%
Van/Minivan	575	600	95.8%	587	1037	56.6%
Pickup Truck	83	86	96.5%	83	294	28.2%
<b>Child Passenger Seating Position</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
First Row - Center	11	11	100.0%	3	19	15.8%
First Row - Right	178	199	89.5%	162	544	29.8%
Second Row - Left	1330	1410	94.3%	1009	2286	44.1%
Second Row - Center	604	648	93.2%	343	851	40.3%
Second Row - Right	1481	1573	94.2%	1114	2541	43.8%
Third Row - Left	16	18	88.9%	14	27	51.9%
Third Row - Center	12	12	100.0%	6	17	35.3%
Third Row - Right	16	17	94.1%	16	33	48.5%

Table 13 illustrates the rate of child restraint device use by various driver characteristics. The use rates within each child 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]. Analysis by driver age group found 30 to 59 year-old drivers were generally more likely to properly restrain zero to three year-old passengers, while 16 to 29 year-old drivers were more likely to properly restrain four to seven year-olds. Child restraint use was lowest among vehicles with older drivers (age 60 and above). Drivers of Caucasian descent were most likely to restrain child passengers in CRDs.

**Table 13. Child Restraint Use Summary by Driver Characteristics**

<b>Driver Gender</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
Male	1343	1446	92.9%	969	2413	40.2%
Female	2300	2437	94.4%	1687	3891	43.4%
Unknown	5	5	100.0%	11	14	78.6%
<b>Driver Age</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
16-29	1709	1833	93.2%	815	1799	45.3%
30-59	1829	1932	94.7%	1723	4177	41.3%
60+	102	115	88.7%	115	323	35.6%
Unknown	8	8	100.0%	14	19	73.7%
<b>Driver Race</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
White	3036	3166	95.9%	2292	5091	45.0%
Black	384	454	84.6%	202	731	27.6%
Other	209	248	84.3%	149	448	33.3%
Unknown	19	20	95.0%	24	48	50.0%
<b>Driver Restraint</b>	<b>Age 0-3 Properly Restrained</b>	<b>Age 0-3 Observed</b>	<b>Proper Use Rate (Age 0-3)</b>	<b>Age 4-7 Properly Restrained</b>	<b>Age 4-7 Observed</b>	<b>Proper Use Rate (Age 4-7)</b>
Belted Appropriately	3444	3648	94.4%	2543	5977	42.6%
Not Belted Appropriately	115	140	82.1%	75	202	37.1%
Unknown	89	100	89.0%	49	139	35.3%

Finally, child restraint device use was significantly lower among vehicles where the drivers were not belted appropriately. The use rate of zero to three year-old children in vehicles where the driver was belted was 94.4 percent, compared to only 82.1 percent among cases where the driver was not belted appropriately. Similarly, use rates among four to seven year-old children were significantly higher when drivers were appropriately restrained (42.6 percent compared to 37.1 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**

<b>Category</b>			
<b>Type of CRD</b>	<b>No. of Inspections</b>	<b>Correct Use Rate</b>	<b>Misuse Rate</b>
Rear-Facing	123	12.2%	87.8%
Forward Facing	158	22.8%	77.2%
Belt Positioning Booster Seat	121	41.3%	58.7%
<b>Age Group</b>			
0 - 3	279	13.6%	86.4%
4 - 7	121	52.1%	47.9%
<b>Stratum</b>			
Stratum 1	82	36.6%	63.4%
Stratum 2	100	21.0%	79.0%
Stratum 3	122	22.9%	77.1%
Stratum 4	98	22.4%	77.6%
<b>Statewide (Unweighted)</b>	<b>402</b>	<b>25.1%</b>	<b>74.9%</b>

Statewide, only 25.1 percent of the inspections of the restraint characteristics of children under age eight showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. The remaining 74.9 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 86.4 percent, while the overall misuse rate for children ages four through seven was 47.9 percent. Stratum 1 showed the lowest misuse rate at 63.4 percent. Rear-facing CRDs had an overall misuse rate of 87.8 percent, which was higher than the 77.2 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 58.7 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, weight, and 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	85.3%	14.7%
Restraint appropriate for child's height	90.3%	9.7%
Restraint appropriate for child's weight*	97.1%	2.9%
CRD facing proper direction for child's age/weight*	87.2%	12.8%
Seat intended to be used in direction installed*	98.9%	1.1%
CRD installed on a forward-facing vehicle seat	100.0%	0.0%

\*Includes rear and forward facing CRDs only. Booster seats are not included.

Table 15 shows 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	93	77%	<b>3</b>	<b>2%</b>	0	0%	0	0%
1 - 2	26	21%	<b>33</b>	<b>21%</b>	<b>2</b>	<b>2%</b>	0	0%
2 - 3	2	2%	46	29%	<b>7</b>	<b>6%</b>	0	0%
3 - 4	0	0%	51	33%	<b>14</b>	<b>12%</b>	0	0%
4 - 5	0	0%	13	8%	21	17%	0	0%
5 - 6	0	0%	6	4%	37	31%	0	0%
6 - 7	0	0%	4	3%	27	22%	0	0%
7 - 8	0	0%	0	0%	13	11%	0	0%

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 23 percent of children were prematurely transitioned into a forward-facing CRD prior to the age of two, which is the minimum age recommended by AAP [21]. It should be noted the AAP increased the minimum recommended age for transitioning from a rear-facing to forward-facing CRD from one year to two years in March 2011. This may partially explain the relatively high proportion of one year-old children seated in a forward facing CRD. Similarly, 20 percent of children are prematurely transitioned into a booster seat, which should not occur until the child has reached at least four years of age. Itemized booster seat misuse rates are summarized in Table 17. The remaining itemized misuse rates were separated into rear-facing CRD misuses and forward-facing CRD misuses and are summarized in Table 18.

**Table 17. Booster Seat Installation and Restraint Characteristics**

<b>Booster Seat Characteristic</b>	<b>Percent Correct</b>	<b>Percent Incorrect</b>
<b>Shoulder belt properly positioned over shoulder and chest</b>	63.6%	<b>36.4%</b>
Shoulder belt flat	79.3%	20.7%
Backless Booster: Vehicle seat back high enough to restrain child's head	82.8%	17.2%
Lap belt flat	83.5%	16.5%
Seat belt tight	84.3%	15.7%
Proper space between booster back and vehicle seat back	86.0%	14.0%
3-point lap-shoulder belt used	91.7%	8.3%
Lap belt properly positioned across hips and upper thighs	95.0%	5.0%

Note: boldface indicates a common misuse (i.e., greater than 30 percent misuse). Data represents 121 booster seat inspections.

**Table 18. CRD Installation and Restraint Characteristics**

<b>CRD Characteristic</b>	<b>Rear-Facing CRDs (n=123)</b>		<b>Forward-Facing CRDs (n=158)</b>	
	<b>Percent Correct</b>	<b>Percent Incorrect</b>	<b>Percent Correct</b>	<b>Percent Incorrect</b>
<b>CRD at the proper angle</b>	53.7%	<b>46.3%</b>	94.9%	5.1%
<b>Harness retainer clip in proper location</b>	57.6%	<b>42.4%</b>	56.5%	<b>43.5%</b>
<b>Harness straps tight (1 in or less slack)</b>	66.9%	<b>33.1%</b>	63.2%	<b>36.8%</b>
CRD installation tight (1 in or less lateral sway)	72.4%	27.6%	82.2%	17.8%
No excess space between CRD and vehicle seat	82.1%	17.9%	78.3%	21.7%
Shoulder harness straps route into CRD at proper height	84.7%	15.3%	71.4%	28.6%
Harness straps flat	88.1%	11.9%	80.5%	19.5%
Only one vehicle system used to attach CRD	90.2%	9.8%	92.4%	7.6%
Proper belt path/LATCH connector path used	94.0%	6.0%	98.7%	1.3%
Seatbelt/LATCH properly locked and tight	94.3%	5.7%	98.1%	1.9%
Seatbelt/LATCH strap buckled/attached	94.3%	5.7%	98.1%	1.9%
Crotch strap flat	95.8%	4.2%	92.2%	7.8%
Internal harness buckled	95.9%	4.1%	96.8%	3.2%
Harness retainer clip fastened and properly oriented	98.3%	1.7%	87.7%	12.3%
Tether routed properly over/under headrest	N/A	N/A	84.2%	15.8%
Tether strap flat	N/A	N/A	85.7%	14.3%
Tether strap tight (1 inch or less slack)	N/A	N/A	95.0%	5.0%

Note: boldface indicates a common misuse (i.e., greater than 30 percent misuse).

The most common misuse for rear-facing CRDs was the seat not being inclined at the proper angle. The incline for children under six months of age is 45 degrees, which increases to 60 degrees (from horizontal) after six months of age. Greater than 46 percent of the rear-facing CRDs were not positioned at the appropriate incline based on the age of the child. Rear-facing and forward-facing CRDs were both found to have issues with the harness retainer clip position (typically too low) and excessive slack in the harness strap. Greater than 42 percent of the rear-facing CRDs and 43 percent of the forward facing CRDs did not have the harness retainer clip at the proper armpit level. Further, greater than 33 percent and 36 percent of rear-facing and forward facing CRDs, respectively, had excess harness slack. A common reason given by drivers for not tightening the harness properly was 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 shoulder belt not being properly positioned over the shoulder and chest of the child. Other common CRD misuses included:

- Seat installation was too loose, allowing for excessive lateral sway of the CRD;
- Excess space between the CRD and the vehicle seat-back; and
- Shoulder harness straps routed into the CRD at an improper height with respect to the shoulders of the child.

#### **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 7.6. The forward-facing CRDs average risk priority number of 6.9 was slightly lower than for rear-facing CRDs. 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 average risk priority numbers for rear- and forward-facing CRDs indicate a majority of the CRDs inspected have protective capabilities that may be compromised if involved in an automobile crash.

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

<b>Rear-Facing CRD Misuse</b>	<b>Severity Score [7,8]</b>	<b>Percent Occurrence</b>	<b>Risk Priority Number</b>
CRD was reclined at improper angle	3	46.3%	138.9
Harness too loose (≥4 fingers)	6.7	16.1%	107.9
Shoulder harness straps were too high	6.3	15.3%	96.4
Harness retainer clip was too low	2	39.8%	79.6
Seatbelt routed incorrectly	9	6.0%	54.0
Space between CRD and vehicle seat 6"	7	7.3%	51.1
Internal harness was not buckled	10	4.1%	41.0
Seatbelt/LATCH was not buckled	7	5.7%	39.9
Harness too loose (3 fingers)	4.3	7.6%	32.7
Shoulder harness straps were twisted	2.7	11.9%	32.1
Space between CRD and vehicle seat 2"	3	5.7%	17.1
Harness too loose (2 fingers)	1.7	9.3%	15.8
Crotch strap was twisted	3.5	4.2%	14.7
Space between CRD and vehicle seat 3"	4	2.4%	9.6
Space between CRD and vehicle seat 5"	6	1.6%	9.6
Space between CRD and vehicle seat 1"	1	8.1%	8.1
Harness retainer clip was too high	2.5	2.5%	6.3
Space between CRD and vehicle seat 4"	5	0.8%	4.0
Harness retainer clip was not attached	2.3	1.7%	3.9
<b>Average Risk Priority Number per Rear-Facing CRD</b>			<b>7.6</b>

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

<b>Forward-Facing CRD Misuse</b>	<b>Severity Score [7,8]</b>	<b>Percent Occurrence</b>	<b>Risk Priority Number</b>
Tether routed incorrectly	9	15.8%	142.2
Harness too loose (≥4 fingers)	6.3	14.5%	91.4
Shoulder harness straps were too low	2.3	27.9%	64.2
Harness retainer clip was too low	1.5	42.2%	63.3
Space between CRD and vehicle seat 3"	5	8.3%	41.5
Space between CRD and vehicle seat 4"	6	6.4%	38.4
Internal harness was not buckled	10	3.2%	32.0
Harness too loose (3 fingers)	3.7	7.8%	28.9
Space between CRD and vehicle seat 2"	4	7.0%	28.0
Crotch strap was twisted	3.5	7.8%	27.3
Space between CRD and vehicle seat 1"	2	12.7%	25.4
Shoulder harness straps were twisted	1.3	19.5%	25.4
Harness retainer clip was not attached	2	12.3%	24.6
CRD was reclined at improper angle	4.6	5.1%	23.5
Harness too loose (2 fingers)	1.3	14.5%	18.9
Seatbelt/LATCH was not buckled	6	2.0%	12.0
Harness retainer clip was too high	2.5	0.6%	1.5
Shoulder harness straps were too high	1.7	0.0%	0.0
<b>Average Risk Priority Number per Forward-Facing CRD</b>			<b>6.9</b>

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 types of misuse that should be emphasized on correcting based on the risk priority number. The most problematic misuse for rear-facing CRDs is the improper seat incline. As previously stated, the proper rear-facing CRD incline is 45 degrees for children younger than six months and 60 degrees for children older than six months. The most problematic misuse for forward-facing CRDs is the improper routing of the top tether with respect to the vehicle headrest. The second 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:

- 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.
- 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
- 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 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	78.0%	59.4%	46.3%
Forward-Facing	73.9%	56.9%	42.0%
<b>Total</b>	<b>75.4%</b>	<b>57.3%</b>	<b>43.2%</b>

The LATCH system was utilized to secure the CRD in 43.2 of the inspected vehicles, even though 75.4 percent of all inspected vehicles were LATCH equipped. Although they greatly simplify the CRD attachment process, LATCH was utilized in only 57.3 percent of equipped vehicles. Only small differences were observed between the LATCH utilization for rear-facing versus forward-facing CRDs. The percent of vehicles equipped with LATCH has increased slightly from the 2011 inspections, while the percent of LATCH utilization has decreased slightly.

### 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 from ages zero to seven. The child restraint use rates were determined through a direct observation survey conducted at daycare centers, fast food restaurants, shopping centers, and recreational areas throughout the state of Michigan. Misuse rates were determined through in-vehicle inspections conducted at daycare centers, permanent inspection stations,

and various organized events, including those held at shopping centers, community or church festivals, or health care facilities.

## **6.1 Conclusions**

The use rate survey showed children ages zero to three were restrained in a rear or forward facing CRD in 93.6 percent of the statewide observations, while children ages four to seven were restrained in an appropriate booster seat or CRD in 42.4 percent of the statewide observations. These usage rates were similar to the results from the most recent surveys, which were conducted in 2009 and 2011 for these age groups, respectively. The statewide CRD/booster seat misuse rate was 74.9 percent, which is also similar to the 2011 inspections.

Child restraint use was highest on adjacent streets of observation locations and daycare centers for zero to three year-olds and four to seven year-olds, respectively. 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 [22], which show 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 common CRD and booster seat misuses. The most common misuse for rear-facing CRDs was the seat not being inclined at the proper angle. Rear-facing and forward-facing CRDs were also commonly found to have issues with the harness retainer clip position (typically too low) and excessive slack in the harness strap. The most common booster seat misuse was the improper positioning of the shoulder belt with respect to the shoulder and chest of the child. Approximately 20 to 25 percent of children had been prematurely transitioned into the next type of restraint, including switching to a forward-facing CRD prior to the age of two, or a booster seat, prior to the age of four years.

In terms of risk-priority number [7,8], the most high-risk misuse for rear-facing CRDs is the improper seat incline/recline. The most problematic misuse for forward-facing CRDs is the improper routing of the top tether with respect to the vehicle headrest. Other high-risk CRD issues for both rear- and forward-facing seats included excessive harness slack, shoulder harness straps routed incorrectly, harness retainer clip positioned too low on the child, and excessive space between the CRD and the vehicle's seat-back.

## 6.2 Recommendations

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 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 six months and 12 months (switch from infant carrier to larger rear-facing CRD with 60 degree incline from horizontal)
- Age 24 months (switch from rear-facing CRD to forward-facing CRD)
- Age four and 40 pounds (switch to booster seat)
- Age 8 or 4'9" tall (switch to safety belt in rear vehicle seat until age 13)

Parents should also be encouraged to follow the current NHTSA CRD transitioning guidelines, which advise keeping children in each restraint type, including rear-facing, forward-facing and booster seats, for as long as possible before moving them up to the next type of restraint [23]. Particular emphasis should be placed on educating parents as to the appropriate timing for transitioning from rear- to forward-facing. The rear-facing position reduces stresses to the neck and spine to infants and reduces the likelihood of severe injury during a crash. With the AAP's March 2011 increase in the minimum age for transitioning from rear to forward facing from one year of age to two years [21], it is likely many parents are not yet aware of this increase.

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**

<b>Stratum</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
1	Ingham	Kid Time Child Development Center	3320 S Pennsylvania Ave, Lansing, MI 48910
1	Ingham	Tutor Time	2273 Club Meridian Dr, Okemos, MI 48864
1	Kalamazoo	Child Development Center	6325 Oakland Dr, Portage, MI 49024
1	Oakland	Gingellville Early Childhood Center	4375 S Baldwin Rd, Lake Orion, MI 48359
1	Oakland	Great Beginnings Day Care	35912 W 12 Mile Rd, Farmington Hills, MI 48331
1	Oakland	The Learning Experience	5660 New King Dr, Troy, MI 48098
1	Oakland	ToddlerTime	15705 W 10 Mile Rd, Southfield, MI 48075
1	Oakland	Whitney Bloomfield Nursery	4500 Airline Dr, West Bloomfield, MI 48323
1	Washtenaw	Tutor Time	2373 Oak Valley Dr, Ann Arbor, MI 48105
2	Eaton	Happy Elephant Child Care	4010 W Michigan Ave, Lansing, MI 48917
2	Jackson	ABC Academy Preschool	3210 Lansing Rd, Jackson, MI 49202
2	Kent	Appletree Christian Learning Center	2142 3 Mile Rd NW, Grand Rapids, MI 49544
2	Kent	Appletree Christian Learning Center	1953 Monroe Ave NW, Grand Rapids, MI 48505
2	Midland	Kids 1st Child Development Center	1621 E Wheeler St, Midland, MI 48642
2	Ottawa	Appletree Christian Learning Center	2935 Port Sheldon St, Hudsonville, MI 49426
2	Ottawa	Cottonwood Day Care	1101 Cypress Dr, Jenison, MI 49428
3	Genesee	Grand Akidemy Development Center	10811 S Saginaw St, Grand Blanc, MI 48439
3	Genesee	Little People's Playhouse	6218 Kids Ln, Flushing, MI 48433
3	Saginaw	St Stephen Day Care	1320 Malzahn St, Saginaw, MI 48602
3	St. Clair	Kid's Connection	301 N 6th Street, St Clair, MI 48079
3	St. Clair	Marysville Children Center	901 Michigan Ave, Marysville, MI 48040
4	Macomb	Creative Child Inc.	4320 E 12 Mile Rd, Warren, MI 48092
4	Wayne	Dearborn Christian Daycare Center	922 Beech Daly Rd, Dearborn Heights, MI 48127
4	Wayne	Nanny's Nursery	9529 Pardee Rd, Taylor, MI 48180
4	Wayne	Nanny's Nursery Infants	21085 Goddard Rd, Taylor, MI 48180
4	Wayne	Northville First Care	777 W 8 Mile Rd, Northville, MI 48167
4	Wayne	Rainbow Child Care Center	16200 Hubbard Dr, Dearborn, MI 48126
4	Wayne	Tutor Time	951 N Canton Center Rd, Canton, MI 48187
4	Wayne	Tutor Time	15225 N Haggerty Rd, Plymouth Township, MI 48170

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

<b>Stratum</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
1	Ingham	Burger King	3311 S Martin Luther King Junior Blvd, Lansing, MI 48910
1	Ingham	East Lansing Family Aquatic Center	6400 Abbot Rd, East Lansing, MI 48823
1	Ingham	Hawk Island County Park	1601 E Cavanaugh Rd, Lansing, MI 48910
1	Ingham	Kroger	921 W Holmes Rd, Lansing, MI 48910
1	Ingham	McDonald's	2040 Okemos Rd, Okemos, MI 48864
1	Ingham	McDonald's	3135 S Martin Luther King Junior Blvd, Lansing, MI 48910
1	Ingham	McDonald's	3477 Okemos Rd, Okemos, MI 48864
1	Ingham	Meridian Mall	1982 W Grand River Ave, Okemos, MI 48864
1	Ingham	Potter Park Zoo	1301 S Pennsylvania Ave, Lansing, MI 48912
1	Ingham	Walmart	3225 Towne Centre Blvd, Lansing Charter Township, MI 48912
1	Ingham	Wendy's	3621 S Martin Luther King Junior Blvd, Lansing, MI 48910
1	Kalamazoo	Cross Roads Mall	6650 S Westnedge Ave, Portage, MI 49024
1	Kalamazoo	Harding's Market	5161 W Main St, Kalamazoo, MI 49009
1	Kalamazoo	McDonald's	5394 W Main St, Kalamazoo, MI 49009
1	Kalamazoo	McDonald's	6925 S Westnedge Ave, Portage, MI 49002
1	Kalamazoo	McDonald's	8050 Portage Rd, Portage, MI 49002
1	Kalamazoo	Meijer	5800 Gull Rd, Kalamazoo Township, MI 49001
1	Oakland	Chipotle	6753 Orchard Lake Rd, West Bloomfield Township, MI 48322
1	Oakland	Detroit Zoo	8450 W 10 Mile Rd, Royal Oak, MI 48067
1	Oakland	Great Lakes Crossing	4000 Baldwin Rd, Auburn Hills, MI 48326
1	Oakland	Halsted Village	37550 W 12 Mile Rd, Farmington Hills, MI 48331
1	Oakland	High Point Shopping Center	20901 Haggerty Rd, Novi, MI 48375
1	Oakland	Kendallwood Shopping Center	W 12 Mile Rd, Farmington Hills, MI 48334
1	Oakland	McDonald's	21000 Greenfield Rd, Oak Park, MI 48237
1	Oakland	McDonald's	21050 Haggerty Rd, Novi, MI 48375
1	Oakland	McDonald's	31325 Orchard Lake Rd, Farmington Hills, MI 48334
1	Oakland	McDonald's	3950 Baldwin Rd, Auburn Hills, MI 48326
1	Oakland	McDonald's	4819 Rochester Rd, Troy, MI 48083
1	Oakland	McDonald's	37555 W 12 Mile Rd, Farmington Hills, MI 48331
1	Oakland	Orchard Mall	6445 Orchard Lake Rd, West Bloomfield Township, MI 48322
1	Oakland	Qdoba Mexican Grill	31367 Orchard Lake Rd, Farmington Hills, MI 48334
1	Oakland	Wendy's	130 Brown Rd, Auburn Hills, MI 48326
1	Washtenaw	Ann Arbor Children's Museum	220 E Ann St, Ann Arbor, MI 48104
1	Washtenaw	Arborland Shopping Center	3600 Washtenaw Ave, Ann Arbor, MI 48104
1	Washtenaw	Burger King	725 Victors Way, Ann Arbor, MI 48108
1	Washtenaw	McDonald's	3325 Washtenaw Ave, Ann Arbor, MI 48104

<b>Stratum</b>	<b>County</b>	<b>Locatin Name</b>	<b>Address</b>
2	Allegan	McDonald's	1218 Michigan 89, Plainwell, MI 49080
2	Allegan	Meijer	1195 Michigan 89, Plainwell, MI 49080
2	Calhoun	McDonald's	812 W Columbia Ave, Battle Creek, MI 49015
2	Calhoun	Walmart	6020 B Dr N, Battle Creek, MI 49014
2	Eaton	Burger King	214 Lansing Rd, Charlotte, MI 48813
2	Eaton	Burger King	523 S Waverly Rd, Lansing, MI 48917
2	Eaton	Lansing Mall	5662 W Saginaw Hwy, Lansing, MI 48917
2	Eaton	McDonald's	4015 W Saginaw Highway, Lansing, MI 48917
2	Eaton	Meijer	1167 E Clinton Trail, Charlotte, MI 48813
2	Eaton	Walmart	1680 Packard Hwy, Charlotte, MI 48813
2	Eaton	Walmart	409 N Marketplace Blvd, Lansing, MI 48917
2	Grand Traverse	Culver's	101 U.S. 31 , Traverse City, MI 49684
2	Grand Traverse	Garfield Township Fire Dept.	3000 Albany St, Traverse City, MI 49684
2	Grand Traverse	Grand Traverse Mall	3200 S Airport Rd W, Traverse City, MI 49684
2	Grand Traverse	Great Wolf Lodge	3575 U.S. 31, Traverse City, MI 49684
2	Grand Traverse	Traverse City State Park	1132 U.S. 31, Traverse City, MI 49686
2	Kent	Burger King	2672 Alpine Ave NW, Grand Rapids, MI 49544
2	Kent	John Ball Zoo	1300 W Fulton St, Grand Rapids, MI 49504
2	Kent	McDonald's	2652 Alpine Ave NW, Grand Rapids, MI 49544
2	Kent	Meijer	2425 Alpine Ave NW, Grand Rapids, MI 49541
2	Kent	Meijer	4542 Kenowa Ave SW, Grandville, MI 49418
2	Kent	Rivertown Crossings	3700 RiverTown Pkwy, Grandville, MI 49418
2	Livingston	Kensington Metropolitan Park	13000 Highbride Dr, Brighton, MI 48114
2	Livingston	Meijer	3883 E Grand River Ave, Howell, MI 48843
2	Livingston	Meijer	8650 W Grand River Ave, Brighton, MI 48116
2	Livingston	Tanger Outlets	1475 N Burkhart Rd, Howell, MI 48855
2	Livingston	Walmart	3850 E Grand River Ave, Howell, MI 48843
2	Midland	Burger King	6730 Eastman Ave, Midland, MI 48642
2	Midland	McDonald's	1711 S Saginaw Rd, Midland, MI 48640
2	Midland	Midland Mall	6820 Eastman Ave, Midland, MI 48642
2	Monroe	Kohl's	2323 N Telegraph Rd, Monroe, MI 48162
2	Monroe	McDonald's	14530 Laplaisance Rd, Monroe, MI 48161
2	Monroe	Meijer	1700 Telegraph Rd, Monroe, MI 48162
2	Monroe	Sterling State Park	2792 State Park Rd, Frenchtown Charter Township, MI 48162
2	Monroe	Walmart	2150 N Telegraph Rd, Monroe, MI 48162
2	Ottawa	Burger King	4555 32nd Ave, Hudsonville, MI 49426
2	Ottawa	McDonald's	1865 Baldwin St, Jenison, MI 49428
2	Ottawa	McDonald's	4596 32nd Ave, Hudsonville, MI 49426
2	Ottawa	Meijer	550 Baldwin St, Jenison, MI 49428

<b>Stratum</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
3	Berrien	Burger King	2035 Michigan 139, Benton Harbor, MI 49022
3	Berrien	Target	960 Fairplain Dr, Benton Harbor, MI 49022
3	Berrien	Walmart	1400 Mall Dr, Benton Harbor, MI 49022
3	Berrien	Wendy's	1986 Michigan 139, Benton Harbor, MI 49022
3	Clare	Subway	402 McEwan St, Clare, MI 48617
3	Clare	Willow Classic Ladies Apparel	420 N McEwan St, Clare, MI 48617
3	Clinton	McDonald's	920 S US27, St Johns, MI 48879
3	Clinton	Walmart	1165 Superior Dr, St Johns, MI 48879
3	Genesee	Burger King	11325 S Saginaw St, Grand Blanc, MI 48439
3	Genesee	Flint Children's Museum	1602 University Ave, Flint, MI 48504
3	Genesee	McDonald's	2145 South Linden Rd, Flint Township, MI 48532
3	Genesee	McDonald's	4131 W Pierson Rd, Flint Township, MI 48532
3	Genesee	Walmart	4313 W Corunna Rd, Flint Township, MI 48532
3	Genesee	Walmart	6170 S Saginaw Rd, Grand Blanc, MI 48439
3	Isabella	McDonald's	1804 S Mission St, Mt Pleasant, MI 48858
3	Isabella	Walmart	4730 Encore Blvd, Mt Pleasant, MI 48858
3	Muskegon	Mercy Health Center	1212 E Sherman Blvd, Muskegon, MI 49444
3	Muskegon	Mercy Health Partners	1500 Sherman Blvd, Muskegon, MI 49444
3	Muskegon	Michigan's Adventure	4750 Whitehall Rd, Muskegon, MI 49445
3	Muskegon	Muskegon Fire Department	770 Terrace St, Muskegon, MI 49440
3	Muskegon	Sam's Club	1707 E Sherman Blvd, Muskegon, MI 49445
3	Muskegon	Watkins Pharmacy	1391 E Sherman Blvd, Muskegon, MI 49444
3	Muskegon	Westshore Plaza	1979 E Sherman Blvd, Muskegon, MI 49444
3	Saginaw	Birch Run Outlets	12240 S Beyer Rd, Birch Run, MI 48415
3	Saginaw	Burger King	4930 State St, Saginaw, MI 48603
3	Saginaw	Children's Zoo	1730 S Washington Ave, Saginaw, MI 48601
3	Saginaw	Fashion Square Mall	4787 Bay Rd, Saginaw, MI 48604
3	Saginaw	McDonald's	2930 Tittabawassee Rd, Saginaw, MI 48604
3	Saginaw	McDonald's	5008 State St, Saginaw Charter Township, MI 48603
3	Saginaw	Meijer	3413 Tittabawassee Rd, Saginaw, MI 48604
3	Saginaw	Zehnder's Splash Village	1365 S Main St, Frankenmuth, MI 48734
3	St. Clair	Burger King	3100 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Kentucky Fried Chicken	1501 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Marysville Municipal Park	1436 River Rd, Marysville, MI 48040
3	St. Clair	McDonald's	1925 Gratiot Blvd, Marysville, MI 48040
3	St. Clair	Meijer	205 S Range Rd, Marysville, MI 48040
3	St. Clair	Taco Bell	3000 Gratiot Blvd, Marysville, MI 48040
3	Van Buren	South Beach Park	Water St, South Haven, MI 49090
3	Van Buren	Wendy's	3383 73rd St, South Haven, MI 49090

<b>Stratum</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
4	Macomb	Lakeside Mall	14000 Lakeside Cir, Sterling Heights, MI 48312
4	Macomb	McDonald's	13640 Southcove Dr, Sterling Heights, MI 48313
4	Macomb	McDonald's	30837 Schoenherr Rd, Warren, MI 48088
4	Macomb	McDonald's	47475 Van Dyke Ave, Utica, MI 48317
4	Macomb	Metro Beach Metroparks	31300 Metropolitan Pkwy, Harrison Township, MI 48045
4	Macomb	Stony Creek Metropark	4300 Main Park Dr, Shelby Township, MI 48316
4	Macomb	Universal Shopping Center	28582 Dequindre Rd, Warren, MI 48092
4	Wayne	Babies R Us	20111 Haggerty Rd, Northville, MI 48167
4	Wayne	Costco	20000 Haggerty Rd, Livonia, MI 48152
4	Wayne	Dunkin Donuts	4345 S Telegraph, Dearborn Heights, MI 48125
4	Wayne	Eureka Plaza	23475 Eureka Rd, Taylor, MI 48180
4	Wayne	Fairlane Green	3565 Fairlane Dr, Allen Park, MI 48101
4	Wayne	Greenfield Village	20900 Oakwood Blvd, Dearborn, MI 48124
4	Wayne	Kroger	23303 Michigan Ave, Dearborn, MI 48124
4	Wayne	Laurel Park Mall	37700 W Six Mile Rd, Livonia, MI 48152
4	Wayne	McDonald's	11800 Middlebelt Rd, Livonia, MI 48150
4	Wayne	McDonald's	13158 Ford Rd, Dearborn, MI 48126
4	Wayne	McDonald's	18787 Northline Rd, Southgate, MI 48195
4	Wayne	McDonald's	19311 Farmington Rd, Livonia, MI 48152
4	Wayne	McDonald's	23333 Eureka Rd, Taylor, MI 48180
4	Wayne	McDonald's	39555 Six Mile Rd, Northville, MI 48168
4	Wayne	McDonald's	39700 Five Mile Rd, Plymouth, MI 48170
4	Wayne	McDonald's	4145 S Telegraph Rd, Dearborn Heights, MI 48125
4	Wayne	McDonald's	45510 Michigan Ave, Canton, MI 48188
4	Wayne	Meijer	13000 Middlebelt Rd, Livonia, MI 48150
4	Wayne	Meijer	14640 Pardee Rd, Taylor, MI 48180
4	Wayne	Meijer	45001 Ford Rd, Canton, MI 48187
4	Wayne	Northville Village Shopping Center	17101 Haggerty Rd, Northville, MI 48167
4	Wayne	Panera	22208 Michigan Ave, Dearborn, MI 48124
4	Wayne	Pizza Hut	44995 Ford Rd, Canton, MI 48187
4	Wayne	Southland Center	23000 Eureka Rd, Taylor, MI 48180
4	Wayne	Subway	23229 Outer Dr, Allen Park, MI 48101
4	Wayne	Walmart	29574 7 Mile Rd, Livonia, MI 48152

**APPENDIX III – LIST OF INSPECTION LOCATIONS**

<b>Stratum</b>	<b>Date</b>	<b>Location</b>	<b>Address</b>	<b>County</b>
1	6/14/13	Target	5350 W Main St, Kalamazoo, MI 49009	Kalamazoo
1	7/24/13	Whitney Bloomfield Nursery	4500 Arline Dr, Orchard Lake Village, MI 48323	Oakland
1	5/18/13	Vineyard Children's Center	2275 Platt Rd, Ann Arbor, MI 48104	Washtenaw
1	6/25/13	Scio Township Fire Department	1055 N Zeeb Rd, Ann Arbor, MI 48103	Washtenaw
1	7/31/13	Northville First Care	777 W 8 Mile Rd, Northville, MI 48167	Wayne
2	7/11/13	First Baptist Church	1110 S Cochran Ave, Charlotte, MI 48813	Eaton
2	5/24; 7/26	Traverse City Fire Station #11 (Garfield Twp.)	3000 Albany St, Traverse City, MI 49684	Grand Traverse
2	6/14/13	Jackson County Fairgrounds	200 W Ganson St, Jackson, MI 49202	Jackson
2	6/13/13	Cutlerville Fire Department	11 68th St, Cutlerville, MI 49548	Kent
2	6/13/13	Wyoming Fire Station #1	1500 Burton St SW, Wyoming, MI 49509	Kent
2	6/27/13	Grand Rapids Fire Department	2541 Kalamazoo Ave SE, Grand Rapids, MI 49507	Kent
2	6/26/13	Livingston County Health Department	2300 E Grand River Ave, Howell, MI 48843	Livingston
3	5/18/13	Genesys Health Park	1 Health Park, Grand Blanc, MI 48439	Genesee
3	8/17/13	Babies "R" Us - Flint	3274 S Linden Rd, Flint, MI 48507	Genesee
3	6/19/13	Hillsdale County Fairgrounds	115 S Broad St, Hillsdale, MI 49242	Hillsdale
3	7/22/13	Muskegon Fire Department	770 Terrace St, Muskegon, MI 49440	Muskegon
3	7/18/13	Kid's Connection	301 N 6th St, St Clair, MI 48079	St. Clair
3	7/23/13	Marysville Children's Center	901 Michigan Ave, Marysville, MI 48040	St. Clair
3	7/20/13	Three Rivers Health Track	701 S Health Pkwy, Three Rivers, MI 49093	St. Joseph
4	5/11/13	Babies "R" Us – Sterling Heights	12050 Hall Rd, Sterling Heights, MI 48313	Macomb
4	8/10/13	Chesterfield Township Fire Station #3	33991 23 Mile Rd, Chesterfield Township, MI 48047	Macomb
4	7/13/13	After Christ Christian Center	3331 Fenkell St, Detroit, MI 48238	Wayne
4	7/15/13	Nanny's Nursery	9529 Pardee Rd, Taylor, MI 48180	Wayne
4	7/31/13	Nanny's Nursery Infants	21085 Goddard Rd, Taylor, MI 48180	Wayne
4	8/13/13	Detroit Leadership Academy	13550 Virgil St, Detroit, MI 48223	Wayne

## APPENDIX IV – INSPECTION FORM

### CHILD RESTRAINT DEVICES INTERVIEW FORM (for child occupants under the age of 8)

Vehicle #: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/20\_\_\_\_ Time of Day: \_\_\_\_ am / pm Weather: \_\_\_\_\_ Observer's Name: \_\_\_\_\_  
 Location Name: \_\_\_\_\_ Address: \_\_\_\_\_  
 Instructions: Use one form for each child occupant age 7 and under. Complete page 1 first. Complete the second page for children seated in a CRD or BPB.

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): \_\_\_\_\_ lbs

Height: \_\_\_\_\_ (feet or inches, please indicate)

Driver Age:  16 - 29  Male  Female  
 (Approx.)  30 - 59  Female  
 60+

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

- Restraint:**
- Rear-Facing CRD
  - Forward-Facing CRD
  - Belt Positioning Boosters (BPB)
  - Seat Belt (Stop the observation now)
  - Unrestrained (Stop the observation now)

**Restraint Device Selection and Child Position:**

1. Is CRD appropriate for child's height?  Yes  No

*Rear Facing:* Head must not be less than 1 inch from top edge of CRD

*Forward Facing:* 1) Top of the ears must not reach the top of the CRD &

2) Shoulders must not be above the top harness slots

*All Boosters:* Seat belt must cross at shoulders and not across neck or face

*Backless Booster:* 1) Vehicle seat back must be higher than child's ears or 2) the vehicle seat must have a head restraint.

2. Please record the maximum weight limit displayed on the seat: \_\_\_\_\_ lbs

3. Is the seat an infant carrier?  Yes  No

4. Is CRD intended to be used in the direction it is installed?  Yes  No

5. Is CRD installed on a forward-facing vehicle seat?  Yes  No

**For Children Seated in Front Seats Only:**

6. Does the vehicle have a passenger airbag?  Yes  No

7. If there is an airbag, is it turned off?  Yes  No  Don't Know

8. If the airbag is on, is the child at least 12" away from the airbag?  Yes  No  Don't Know

9. If the airbag is on, is the child facing forward?  Yes  No  Don't Know

**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 maximum space between the CRD and the vehicle seat back?

**Harness**

4. Is internal CRD harness completely buckled at the waist?
  - IF BUCKLED:
    - (a) How tight are the shoulder harness straps (pinch and fingers)?
      - 1 Yes 2 No
      - 2 Yes 3 No
      - 3 0 inches 1 inch
      - 4 2 inches 3 inches 4 inches
    - (b) Is the harness retainer clip fastened and orientated correctly?
      - 1 Yes 2 No 3 No Clip
      - 4 Proper (at armpit level)
      - 5 Too low
      - 6 Too high
    - (c) Where is the harness retainer clip positioned when buckled?
      - 1 Proper (at or above shoulders)
      - 2 Too high (above ears)
      - 3 Too low (below shoulders)
    - (d) Where do the shoulder harness straps rout into the CRD?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (e) Are the shoulder harness straps flat (not twisted)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (f) Is crotch strap flat (check if buckle button is facing outward)?
      - 1 SB 2 Lower LATCH Anchors
      - 3 Both 4 None

**Locking/Attachment**

5. Which vehicle system is used to attach CRD to the vehicle?
  - IF ATTACHED:
    - (a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (b) If the vehicle seatbelt is used, is the seatbelt locked (pull on shoulder belt)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (c) Is the vehicle seatbelt or LATCH strap flat (not twisted)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (d) Is the proper seatbelt path or LATCH strap connector path used (path nearest the vehicle's seat)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (e) If a metal locking clip is used, is it positioned near the buckle?
      - 1 Yes 2 No
      - 3 Yes 4 No

**Tether (Only If Used)**

6. Is the tether routed under an adjustable head restraint or over a non-adjustable head restraint?
7. Is tether strap flat (not more than one twist)?
8. When pinched, how much slack is in the tether strap (in inches)?
  - 1 inch 2 inches
  - 3 inches 4 inches 5 inches

**FOR REAR-FACING CRDs**

**Position/Installation in Vehicle**

1. What is the seat incline (estimated from horizontal)?
  - 1  $-45^{\circ}$  2  $-60^{\circ}$  3  $-83^{\circ}$  4  $>70^{\circ}$
  - 5 Yes 6 No
2. Is the CRD installation tight (1-inch rule when checked at base of seat)?
  - 0 in 1 in 2 in 3 in
  - 4 in 5 in 6 in
3. What is the maximum space between the CRD and the vehicle seat back?
  - 1 Yes 2 No
  - 3 No slack when pinched
  - 4 finger 5 fingers
  - 6 fingers 7 fingers

**Harness**

4. Is internal CRD harness completely buckled at the waist?
  - IF BUCKLED:
    - (a) How tight are the shoulder harness straps (pinch and fingers)?
      - 1 Yes 2 No
      - 3 No slack when pinched
      - 4 finger 5 fingers
      - 6 fingers 7 fingers
    - (b) Is the harness retainer clip attached and orientated correctly?
      - 1 Yes 2 No
      - 3 Proper (at armpit level)
      - 4 Too high 5 Too low
    - (c) Where is the harness retainer clip positioned when buckled?
      - 1 Proper (at or below shoulders)
      - 2 Too high (above shoulders)
    - (d) Where do the shoulder harness straps rout into the CRD?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (e) Are the shoulder harness straps flat (not twisted)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (f) Is crotch strap flat (check if buckle button is facing outward)?
      - 1 SB 2 Lower LATCH Anchors
      - 3 Both 4 Neither

**Locking/Attachment**

5. Which vehicle system is used to attach CRD to the vehicle?
  - IF ATTACHED:
    - (a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (b) If the vehicle seatbelt is used, is the seatbelt locked (pull on shoulder belt)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (c) Is vehicle seatbelt or LATCH strap flat (not twisted)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (d) Is the proper vehicle seatbelt path/lower strap connector path used (path nearest the vehicle's seat)?
      - 1 Yes 2 No
      - 3 Yes 4 No
    - (e) If a metal locking clip is used, is it positioned near the buckle?
      - 1 Yes 2 No 3 Not Used
      - 4 Yes 5 No

**FOR BOOSTER SEATS (BPB)**

**Vehicle Seatbelt**

1. Is a proper lap and shoulder belt (3-point) system used?
  - 1 Yes 2 No
  - 3 Yes 4 No
2. Is the shoulder belt properly positioned over shoulder, collar bone, & chest?
  - 1 Yes 2 No
  - 3 Yes 4 No
3. Is the lap belt properly positioned across the hips/upper thighs?
  - 1 Yes 2 No
  - 3 Yes 4 No
4. Is the shoulder belt flat (not twisted)?
  - 1 Yes 2 No
  - 3 Yes 4 No
5. Is the lap belt flat (not twisted)?
  - 1 Yes 2 No
  - 3 Yes 4 No
6. Is the seat belt tight (not loose)?
  - 1 Yes 2 No
  - 3 Yes 4 No
7. **HIGH BACK ONLY:** Is vehicle seatbelt routed properly through the booster seat?

**Position in Vehicle**

8. 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)?
  - 1 Yes 2 No
  - 3 High-back BPB
9. What is the space between the BPB back and vehicle seat back (in inches)?
  - 0 in 1 in 2 in
  - 3 in 4 in