

2009 Survey of Child Restraint Device Use and Misuse in Michigan

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16. Abstract This study reports the results of the 2009 Survey of Child Restraint Device (CRD) Use and Misuse in Michigan. There were two portions of this study including an observational survey and an interview/inspection survey of the restraint characteristics for children under the age of four. The observational surveys consisted of observing vehicles with child passengers under the age of four as they passed through an intersection or driveway. For the observation survey, 391 sites were visited and 2,960 observations were obtained. This resulted in a child restraint device usage rate of 94.2 percent in the State of Michigan. The interview/inspection portion consisted of conducting interviews/inspections at fast-food restaurants, day care centers, shopping areas, and car seat check events. For this portion of the study, 34 sites were visited and 248 interviews/inspections were conducted. The interview/inspection results showed that 77.8 percent of the CRDs were being used incorrectly. The most common and problematic misuses were associated with the CRD harness straps not being tight enough on the child and the harness retainer clip being positioned too low. Rear-facing CRDs were more commonly and more severely misused than forward-facing CRDs. The CRD usage rate has increased since 2007, while the misuse rate has decreased during that time. Utilization of LATCH lower anchors remains relatively low at 46.5 percent of LATCH equipped vehicles.			
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1.0 INTRODUCTION

Motor vehicle crashes are one of the leading causes of death and injury among children under the age of four nationwide. The use of child restraint devices (CRDs) can greatly reduce the risk of serious injury to children involved in crashes when compared to nonuse or restraint by seatbelts alone. An evaluation of the effectiveness of the proper use of CRDs found that the risk of serious injury for children between 12 and 47 months of age was 78 percent lower for children seated in forward facing CRDs than children restrained in seat belts alone [1]. To alleviate child fatalities and injuries suffered in automobile crashes, a law was passed in Michigan in 1982 making child restraint device use mandatory for children under the age of four.

According to the U.S. Census Bureau July 2006 population estimates, there were approximately 509,000 children under the age of four residing in Michigan, representing 5.04 percent of the total Michigan population [2]. In 2006, eight children under the age of four were killed in automobile crashes in Michigan and an additional 738 children of the same age group were injured [3]. In spite of Michigan's mandatory CRD usage law, in 2006, 50 percent of the children under the age of four that were killed and 28 percent of those injured were not restrained in a CRD, perhaps due to the drivers' financial constraints or unfamiliarity with the Michigan CRD law.

Perhaps an even more alarming statistic is that 50 percent of the children killed and 72 percent of the children injured in crashes during 2006 were seated in a CRD at the time of the crash [3]. This is a potential indication that many of children killed or injured during automobile crashes may have been improperly restrained in the CRD, as supported by recent OHSP studies (2005, 2007) that have shown roughly 70 to 80 percent of CRDs used in Michigan are used incorrectly [4,5].

Improper CRD use 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 installed in the vehicle using seatbelts or a LATCH system, and (3) the child is properly restrained in the device. Misuse or non-use of CRDs may stem from the parent or driver's lack of knowledge regarding the potential safety risks for children traveling in a vehicle without proper restraint or a lack of training on the proper

use of CRDs. Typical CRD misuses include: improper CRD installation, use of inappropriately sized CRDs (based on height and weight of the child), and improper use of the CRD harness/buckle system to restrain the child.

In order to assess the impact of the Michigan CRD usage law, in 1997 the Michigan Office of Highway Safety Planning (OHSP) funded a statewide survey of CRD use and misuse in Michigan. In the 1997 survey, conducted by the University of Michigan-Transportation Research Institute (UMTRI), direct observation surveys of child restraint devices use and misuse were performed at pediatric medical facilities and day care centers [6]. The results of the 1997 UMTRI survey estimated that 74.5 percent of children, age four years and younger, were restrained in a safety seat when traveling in a motor vehicle. In terms of misuse, some form of improper use was observed in 88.5 percent of the CRD installations.

In 2005, OHSP funded another statewide survey of CRD use and misuse in Michigan. This study, conducted by the Wayne State University-Transportation Research Group (WSU-TRG), found that, out of 1,560 observations, 79.7 percent of children ages four and under were restrained in a CRD [4]. In addition, 147 driver interviews were conducted which included the physical inspection of a restrained child. These inspections found that only 28.6 percent of the CRDs were installed correctly. Of the 71.4 percent of the devices that were incorrectly installed, the most common problems were incorrect fastening of the tether or harness. This finding was similar to a 2002 NHTSA child restraint inspection study performed in six states, which found critical issues with 72.6 percent of child restraint systems used by children under 80 pounds [7]. Similar to the 2005 WSU study, the most common misuses in the NHTSA study were loose belt attachment and loose harness straps.

A similar CRD use and misuse study was performed in 2007 for the OHSP by the WSU-TRG. This study found a 91.8 percent CRD usage rate out of 1,963 observations of children under the age of four, an improvement of 12.1 percent from 2005 [5]. The 2007 Michigan CRD usage rates were slightly higher than the 2007 national child restraint usage rate of 89 percent for children under the age of eight [8]. CRD usage rates were found to be higher for children riding with belted drivers compared to unbelted drivers both in Michigan and nationwide in 2007. A 92 percent CRD usage rate was observed for belted drivers both in Michigan and nationwide.

Nationwide, unbelted drivers showed a much lower rate of CRD use at 61 percent, although unbelted drivers in Michigan showed 86 percent CRD usage.

The 2007 WSU-TRG study found that out of the 300 interviews/inspections of children ages four and under restrained in a CRD (inclusive of booster seats), 80.1 percent of the CRDs were installed incorrectly [5]. This represented an 8.7 percent increase in the misuse rate from 2005 [4]. Please note that the 2005 sample (n = 147) was approximately one-half the size of the 2007 sample (n = 300). There are several potential causes of CRD misuse in Michigan, including lack of installation knowledge/education on the part of the driver, complexity of use, and a lack of financial resources to obtain an appropriate CRD for the child being restrained.

Certain types of CRD misuses are more hazardous than others. Previous research has identified the most severe misuses (i.e., greatest hazards) associated with CRD misuse are belt slack and loose harnesses [9]. A 2002 Canadian study utilized severity scores to quantify the relative hazard posed by various common misuses [10]. Various types of misuses were assigned a severity score on a scale from 0 to 10 with 10 indicating the most negative impact on safety with severity scores of four or more impacting the effectiveness of the CRD during an automobile crash. Different scores were generated for forward-facing and rear-facing CRDs.

In 1999, the LATCH system (Lower Anchors and Tethers for Children) was designed to make CRD installation easier by eliminating the need to use safety belts to secure the CRD and are mandatory equipment in all vehicles assembled after September of 2002. Vehicles equipped with the LATCH system have lower anchors that are built into the backseat of the vehicle along with top tethers to easily secure CRDs. The 2005 WSU-TRG study investigated the use of the LATCH system in vehicles and found that while 57.1 percent of the vehicles had LATCH available, it was utilized in only 32.6 percent of the vehicles although it was used correctly in 83.1 percent of these cases [4]. The 2007 study also reported that LATCH systems were underutilized in vehicles equipped with the devices [5]. A 2005 NHTSA study found that the majority of underutilization occurred because of lack of knowledge of the LATCH system (i.e., not knowing they were available, not knowing what they were for, not knowing how to properly use them, etc) [11].

1.1 Study Purpose and Objectives

The overall purpose of this project was to determine the levels of CRD use and misuse for children under the age of four in Michigan and to determine changes in CRD use and misuse that have occurred since the 2005 and 2007 observational studies. Such information is important to assist agencies in identifying targeted educational efforts to help reduce the levels of misuse or non-use of CRDs.

The following are the specific objectives for this study:

1. Conduct an observational survey of CRD use in Michigan for passengers under the age of four.
2. Conduct interviews/inspections of the restraint characteristics of passengers under the age of four to determine CRD misuse.
3. Determine overall rates of CRD use and misuse in Michigan.
4. Determine the severity of misuse and identify patterns of common and severe misuse.
5. Compare the current results with results from the 2007 and 2005 studies.
6. Identify educational programs that may help reduce CRD misuse.

1.2 Study Area

The study area for this project included the 31 most populous counties for children under the age of four, representing an estimated 88.64 percent of the population of children under the age of four in the State of Michigan.

2.0 METHODOLOGY

The methodologies used in previous child restraint device use and misuse surveys were examined to determine their appropriateness in addressing the needs of the Office of Highway Safety Planning (OHSP) and the State of Michigan. Similar study designs were reviewed including previous observation surveys of safety belt use in Michigan, in addition to the NHTSA safety belt observation guidelines [12]. Two separate data collection methodologies were utilized: 1.) direct observation surveys of CRD use and non-use for passengers under the age of four and 2.) interviews and inspections to determine rate and severity of CRD misuse for passengers under the age of four.

2.1 Observational Surveys

NHTSA does not require states to conduct child safety restraint observational studies and thus, does not provide any recommended procedure for conducting such surveys. However, NHTSA does have published guidelines for conducting safety belt surveys [12]. The NHTSA safety belt survey guidelines require the inclusion of counties representing at least 85 percent of the state's population. However, instead of basing county selection on the total county population, the selection of counties was based upon the population of children under the age of four, as this would be more indicative of the travel patterns of children seated in CRDs. Thus, CRD observation locations were selected from the most populous 31 counties representing 88.64 percent of children under the age of four in the State of Michigan. The list of counties used in the observational surveys along with population of children under the age of four for each county in 2006 (most recent year available) and the percent of Michigan's population under the age of four for each county is shown in Table 1 [2].

Table 1. U.S. Census Bureau Data for Children Under the Age of Four in Michigan by County, 2006 [2]

County Name	Population Under Age Four (2006)	Percent	Cumulative Percent
Wayne	109,922	21.60%	21.60%
Oakland	60,169	11.82%	33.42%
Macomb	40,003	7.86%	41.28%
Kent	36,785	7.23%	48.50%
Genesee	24,017	4.72%	53.22%
Washtenaw	16,634	3.27%	56.49%
Ingham	14,275	2.80%	59.29%
Ottawa	13,960	2.74%	62.04%
Kalamazoo	12,222	2.40%	64.44%
Saginaw	10,222	2.01%	66.45%
Muskegon	9,079	1.78%	68.23%
Jackson	8,368	1.64%	69.87%
Berrien	8,350	1.64%	71.51%
Saint Clair	8,204	1.61%	73.13%
Livingston	8,106	1.59%	74.72%
Calhoun	7,294	1.43%	76.15%
Monroe	6,980	1.37%	77.52%
Allegan	5,943	1.17%	78.69%
Bay	4,948	0.97%	79.66%
Lenawee	4,853	0.95%	80.62%
Eaton	4,731	0.93%	81.55%
Lapeer	4,196	0.82%	82.37%
Van Buren	4,153	0.82%	83.19%
Grand Traverse	3,849	0.76%	83.94%
Midland	3,783	0.74%	84.68%
Saint Joseph*	3,702	0.73%	85.41%
Shiawassee	3,493	0.69%	86.10%
Montcalm*	3,394	0.67%	86.77%
Ionia*	3,384	0.66%	87.43%
Clinton*	3,285	0.65%	88.08%
Isabella*	2,856	0.56%	88.64%
Total Michigan	509,000	100.00%	100.00%

* Utilized for observational surveys performed during Pre- and Post-CIOT only

The 31 candidate counties were partitioned into four strata for the CRD survey based upon historical safety belt use rates in a manner similar to that used for the *Click It or Ticket* (CIOT) safety belt surveys. The decision to utilize safety belt usage rates as a proxy for CRD use in the strata partitioning process is supported by several studies that have shown positive correlation between adult safety belt use and CRD use [4,5,6,8] Thus, the strata for this study were defined as follows:

- Strata 1: (4 counties) Ingham, Washtenaw, Kalamazoo, Oakland
- Strata 2: (10 counties) Allegan, Bay, Eaton, Grand Traverse, Jackson, Kent, Livingston, Macomb, Midland, Ottawa
- Strata 3: (16 counties) Berrien, Calhoun, Clinton, Genesee, Ionia, Isabella, Lapeer, Lenawee, Muskegon, Monroe, Montcalm, Saginaw, St. Clair, Shiawassee, St. Joseph, Van Buren
- Strata 4: (1 county) Wayne

The minimum number of total child passenger observations required for the direct observation surveys was determined by using the sample size equation for a binomial proportion (i.e., CRD usage versus non usage rate), assuming an error rate of 1 percent, a probability of Type I error of 5% ($\alpha = 0.05$), and a CRD usage rate of 91.8 percent (based on 2007 CRD usage rate surveys). The equation for minimum total sample size for the CRD direct observation surveys is given as follows [13]:

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

Where: n = minimum sample size for CRD direct observation surveys

E = error rate (1 percent assumed)

p = 0.918 (2007 CRD usage rate for Michigan)

$z_{\alpha/2} = 1.96$ for $\alpha = 0.05$

Using the assumed CRD usage rate of 91.8 percent, the minimum number of observations required for a 1 percent error at a 95 percent level of confidence is 2,892. This minimum sample

size is nearly 50 percent larger than the 2007 CRD observational survey sample size and 85 percent larger than the 2005 CRD sample size [4,5] and represents 0.57 percent of the estimated 2006 population of children under the age of four in Michigan. The minimum number of locations per strata was computed based on 20 observations of child passengers per hour per location using two observers. This assumption is supported by previous CRD surveys [5,6] and pilot data collection efforts performed in 2008 by the WSU-TRG. Based on the assumption of 20 observations per hour using two observers per location, the number of direct observational study locations needed to produce the minimum required number of observations is 145. The target number of observation sites needed for each stratum was then computed based on the proportion of the total population under the age of four for all strata. The approximate number of observation sites for each stratum is shown in Table 2.

Table 2. Target Number of CRD Observation Sites by Stratum

Stratum	Total Population Under Four Years (2006)	Percent of Population Under Four Years	Target Number of CRD Observational Survey Sites
Stratum 1	103,300	22.9%	33
Stratum 2	130,476	28.9%	42
Stratum 3	107,462	23.8%	35
Stratum 4	109,922	24.4%	35
Total (All Strata)	451,160	100.0%	145

To economize travel resources, the CRD observations were performed in conjunction with the Pre- and Post-CIOT safety belt observational surveys performed in April, May, and June 2009 and with the booster seat observational surveys performed in June and July 2009. A dedicated observer was utilized to obtain CRD observations during the Pre- and Post-CIOT surveys. Two observers were utilized to obtain both booster seat and CRD observations during the booster seat data collection. The CRD observations that were obtained in conjunction with the Pre- and Post-CIOT observations were performed at randomly selected public roadway intersections. The CRD observations that were obtained in conjunction with the booster seat observations were performed at randomly selected sites that were near destinations typically frequented by young children. These sites included entrances to fast-food restaurants, shopping centers, grocery stores, and day

care centers, in addition to public roadway intersections that were near such establishments. CRD observations were performed for each day of the week and each hour of the day between 7:00 am and 7:00 pm. For time-sensitive locations, such as day care centers, CRD observations were only performed on weekdays during periods of pick-up and drop-off. A list of all CRD observation locations is provided in Appendix I. For more information on the site-selection process, please refer to the 2009 CIOT safety belt observation report and the 2009 booster seat report, which were prepared for the OHSP by the WSU-TRG.

2.2 Interviews/Inspections

The methodology for determining the locations for the interview/inspection portion of this project was largely based upon the methodology of the 2007 study of child restraint use. In the 2007 study, interviews/inspections were performed at fast-food restaurants, shopping centers, grocery stores, and day care centers. Several of the high yield inspection sites from the 2007 study were again contacted to determine their willingness to participate in the CRD inspections for this study. Several new locations were also contacted, including locations that yielded a high number of child passengers during the June/July 2009 direct observational survey. Low-yield sites and locations with previously uncooperative management were not contacted. Inspection data were also collected at several externally-organized car seat check events at various locations throughout Michigan. Multiple sites were often chosen for the same day to overcome issues with low-yield sites and uncooperative management or security personnel. Scheduling multiple sites also helped economize travel resources when performing inspections at locations with very time-specific arrivals/departures of children, such as day care centers.

The county strata assignments for the CRD interviews/inspections were identical to those used in the CRD direct observation surveys. However, the minimum necessary sample size for the inspection of the restraint use characteristics of passengers under the age of four was much smaller due to the time and human resources necessary to perform the interviews. Thus, a 5 percent error rate was assumed as reasonable for determining the minimum sample of inspections. The total sample size for the inspections was determined using Equation 1, assuming a 5 percent error rate, a probability of Type I error at $\alpha = 0.05$, and a CRD misuse rate of 80.1 percent (based on 2007 CRD usage rate surveys). Thus, the minimum total number of CRD inspections for passengers under age four was determined to be 245, which was 6.5 percent

greater than the 230 inspections for passengers under age four obtained in the 2007 study [5]. The target number of inspections needed for each stratum was computed based on the proportion of the total population under age four for all strata, which is shown in Table 3. Please note that inspections were performed for passengers that were 4 years and older only if drivers requested an inspection. However, these inspections did not count towards the 245 minimum sample and were not included in the analysis. A list of all CRD interview/inspection locations is provided in Appendix II.

Table 3. Target Number of CRD Interviews/Inspections by Stratum

Stratum	Total Population Under Four Years (2006)	Percent of Population Under Four Years	Target Number of CRD Inspections
Stratum 1	103,300	22.9%	56
Stratum 2	130,476	28.9%	71
Stratum 3	107,462	23.8%	58
Stratum 4	109,922	24.4%	60
Total (All Strata)	451,160	100.0%	245

3.0 OBSERVER AND INTERVIEWER TRAINING

Several staff members from the WSU-TRG participated in the observational surveys and the interview data collection efforts. Prior to performing the actual observational surveys for the study, the data collectors participated in multiple in-classroom training and field training sessions that were performed periodically throughout the study period. Classroom training for the CRD observers was performed in conjunction with the booster seat observer training and occurred on the following dates: October 30th, 2008; December 4th, 2008; April 3rd, 2009; and June 15th, 2009. The classroom training emphasized accurate determination of the age and type of restraint for target age children. Several photographs of target age children were utilized to train the observers in accurate age estimation and written examinations were administered to assess the observers' age estimation capabilities. Multiple field training exercises were performed and reliability and repeatability were assessed by comparing the results of observations made within and between pairs of observers.

Members of the WSU-TRG who were responsible for conducting the interview/inspections participated in a formal training session at the WSU-TRG headquarters on April 18th, 2009. The training session was performed by Mr. Richard Costello, who is a NHTSA certified Child Passenger Safety Technician Instructor with an up-to-date certification (Certificate ID I-558517). 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. Hands-on refresher training for the inspectors was provided periodically throughout the data collection period.

4.0 DATA COLLECTION

4.1 Observational Surveys

Observational field data collection began in April 2009 and continued through July 2009. The interviews/inspection field data collection began in May 2009 and continued through August 2009. Reasonable attempts were made to collect a similar number of child passenger observations for all the study sites. In some cases, observers stayed for up to an additional 60-minutes in an attempt to achieve a minimum sample size, although at several locations, this was not achieved.

The initial CRD observational data collection efforts were coordinated with the Pre- and Post-CIOT safety belt observational surveys in April, May, and June of 2009. Similar to the 2005 and 2007 CRD observational studies, an adequate sample size was not obtained from the CIOT surveys. Therefore, CRD observational data were also collected during the booster seat observations during June and July of 2009.

During the observation portion of the data collection, several factors were assessed. The driver of each vehicle and children under the age of four were observed for safety belt usage and child restraint device usage, respectively. The driver and child passenger characteristics were categorized based on gender, race, and estimated age. The race categories included Caucasian, African American, Asian or Pacific Islander, Hispanic, and Native American. The age categories for the driver included 16-29, 30-59, and 60+. The vehicle type categories included passenger vehicle, sport utility vehicle, van or minivan, and pick-up trucks. A sample observation form can be found in Appendix III.

Communication was always maintained between the field data collection team and the supervisors to help alleviate any issues that may have arisen during field data collection. The data was immediately compiled and coded into computer spreadsheets upon returning to the WSU-TRG headquarters. Quality control checks were made continuously by the project supervisor. Comparisons were made between the observed rates and the expected child restraint use rates in order to identify any unexpected deviations in the data. Spot-checks were also performed to ensure that data entry was being performed correctly. Observational retraining was performed periodically throughout the study period.

4.2 Interviews/Inspections

The interview portion of the data collection involved visual and hands-on inspection of the child restraint devices for children under the age of four. Data on the driver included gender, age and race. Data on the children included age, height, and weight. The vehicle types were noted so that they could be classified by passenger vehicle, sport utility vehicle, van or minivan, or pick-up truck. The child restraint device was inspected for type, location in the vehicle, direction of placement, attachment to the vehicle, and placement of the child in the device. Each child restrained in a CRD was inspected for several common CRD misuses, as well as the degree or extent of each misuse. The errors in restraining children properly were carefully recorded along with descriptive notes. A sample interview form can be found in Appendix III.

5.0 DATA ANALYSIS

The CRD observational data for children under the age of four were analyzed to compute the CRD use rate. The CRD use rate was computed based on the percent of observed children under the age of four that were seated in either a forward-facing or rear-facing CRD. Children under the age of four that were seated in booster seats, belted, or unrestrained were considered as non-users of CRDs. Rates for child restraint device use were determined for each stratum and each county, in addition to the weighted and unweighted statewide averages. The standard error and 95 percent confidence interval for the estimate of child restraint device use were calculated both statewide and by stratum.

5.1 Statewide CRD Use Rate Calculation

In order to determine the statewide CRD seat use rate, a procedure was utilized similar to that of previous studies, including the previous direct observation surveys of seatbelt use [14,15,16,17].

First, the CRD use rate at each of the observation locations was calculated as shown here:

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

where:

g_{ij} = CRD rate for children under the age of four at location i in stratum j

b_{ij} = number of children under the age of four restrained in CRD at location i in stratum j

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

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

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

Once the CRD use rates were determined within each stratum, the statewide CRD 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 CRD use rate for children under the age of four

p_j = population of children under the age of four in stratum j

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

5.2 Statewide CRD Use Variance Calculation

Upon obtaining estimates of the CRD use rates for each of the four strata, the variance for each stratum was determined using a simplified version of Cochran's equation [18]:

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

where:

Var_j = variance for stratum j

n_j = number of sampled observation locations in stratum j

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

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

where:

Var_{TOTAL} = statewide variance in CRD use for children under the age of four

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

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

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

5.3 Misuse Rate Determination

CRD misuse rates for children under the age of four were determined for each stratum and statewide based on the interview/inspection data. A CRD 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 taken from the study conducted in Canada in 2002 [10], which were

developed by CRD safety experts [19]. 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 [10].

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 risk priority numbers were compared with those observed in the 2007 CRD inspections. The weighted average severity score per rear-facing and forward-facing CRD was also determined.

6.0 RESULTS

6.1 Observational Surveys

Observational surveys were performed at 401 sites, 391 of which yielded at least one observation of a child passenger under the age of four. The total number of observations of passengers under the age of four was 2,960. Table 4 provides the descriptive statistics for the observational surveys based on day of the week, time of day, and type of location.

Table 4. Statewide Descriptive Statistics – Day of Week, Time of Day, and Location Type

Day of Week	No. of Sites Observed	Percent of Sites	Total No. of Observations	Percent of Observations
Sunday	50	12.8%	363	12.3%
Monday	56	14.3%	440	14.9%
Tuesday	64	16.3%	454	15.3%
Wednesday	66	16.9%	553	18.7%
Thursday	66	16.9%	494	16.7%
Friday	57	14.6%	451	15.2%
Saturday	32	8.2%	205	6.9%
Total	391	100.0%	2960	100.0%
Time of Day	No. of Sites Observed	Percent of Sites	Total No. of Observations	Percent of Observations
7 am – 8 am	10	2.6%	69	2.3%
8 am – 9 am	48	12.3%	301	10.2%
9 am – 10 am	28	7.1%	178	6.0%
10 am – 11 am	45	11.5%	296	10.0%
11 am – 12 pm	37	9.5%	312	10.5%
12 pm – 1 pm	43	11.0%	296	10.0%
1 pm – 2 pm	31	7.9%	289	9.8%
2 pm – 3 pm	49	12.5%	391	13.2%
3 pm – 4 pm	30	7.7%	234	7.9%
4 pm – 5 pm	46	11.8%	380	12.8%
5 pm – 6 pm	17	4.3%	145	4.9%
6 pm – 7 pm	7	1.8%	69	2.3%
Total	391	100.0%	2960	100.0%
Location Type	No. of Sites Observed	Percent of Sites	Total No. of Observations	Percent of Observations
Roadside	194	49.6%	1375	46.5%
Fast-Food	51	13.0%	296	10.0%
Day Care	52	13.4%	364	12.3%
Shopping	94	24.0%	925	31.2%
Total	391	100.0%	2960	100.0%

Table 4 shows that roadside locations accounted for slightly less than half the sites and slightly less than half of the total observations. The destination sites (i.e., fast-food, day cares, shopping centers) accounted for slightly more than half of the sites and slightly more than half of the total observations. The average yield was 7.6 observations per site. The highest-yield locations were shopping centers at 9.8 observations per site, followed by roadside locations at 7.1 observations per site, day care centers at 7.0 observations per site, and fast-food restaurants at 5.8 observations per site. Note that the yield calculations do not account for variations in the average observation time per site for each of the location types.

Table 5 summarizes the overall statewide CRD use rate, broken down by restraint type. Of the 2,960 observations of passengers under the age of four, the total number seated in a rear-facing or forward-facing CRD was 2,782, while 178 were either seated in a booster, belted, or unrestrained. Children seated in forward facing child seats accounted for 2212 (74.7 percent) of the total observations, while children seated in rear facing child seats accounted for 570 (19.3 percent) of the observations. Thus, forward-facing CRDs were observed at approximately four times the frequency of rear-facing CRDs. A lower observation frequency for rear-facing CRDs was expected because rear-facing CRDs are typically only used for children under one year old.

Table 5. Statewide Restraint Use Summary for Passengers Under the Age of Four

Child Restraint Type	No. of Observations	Percent
Not Belted	44	1.4%
Belted	77	2.6%
Shoulder Belt Behind Back	5	0.2%
Shoulder Belt Under Arm	14	0.5%
High-Back Booster	33	1.1%
Backless Booster	5	0.2%
Total Not Seated in CRD	178	6.0%
Forward Facing Child Seat	2212	74.7%
Rear Facing Child Seat	570	19.3%
Total Seated in CRD	2,782	94.0%
Total Observations	2,960	100.0%

Table 6 summarizes the CRD use rate along with the standard error and 95 percent confidence interval for each stratum and statewide, which were computed based on the procedure described in section 5. Both the unweighted and weighted statewide CRD use rates were computed. The relative weights were computed based on the particular stratum’s proportion of the under four population for all counties included in the observational surveys.

Table 6. Statewide CRD Use Rate for Child Passengers under the Age of Four

Stratum	CRD Use Rate (95% Confidence Interval)	Standard Error
Stratum 1	95.4% ± 1.9	1.0%
Stratum 2	96.6% ± 2.1	1.1%
Stratum 3	94.8% ± 1.9	1.0%
Stratum 4	89.4% ± 2.9	1.5%
Statewide Unweighted	94.0% ± 1.1%	0.6%
Statewide Weighted	94.2% ± 1.1%	0.6%

The unweighted statewide CRD use rate for child passengers under the age of four was **94.0 percent**. The weighted statewide CRD use rate for child passengers under the age of four was **94.2 percent**. The 95 percent confidence interval for the statewide CRD use rate was ±1.1 percent. Stratum 2 showed the highest CRD use rate at 96.6 percent, followed by Stratum 1 (95.4 percent), Stratum 3 (94.8 percent), and Stratum 4 (89.4 percent). Table 7 summarizes the CRD use by county and by strata.

Table 7. CRD Use by Stratum and County

Stratum 1	Total No. of Child Passengers Under Age Four	No. of Child Passengers Seated in CRD	Percent of Child Passengers Seated in CRD
Ingham County	172	159	92.4%
Kalamazoo County	112	109	97.3%
Oakland County	275	264	96.0%
Washtenaw County	143	138	96.5%
Total	702	670	95.4%
Stratum 2			
Allegan County	36	34	94.4%
Bay County	40	36	90.0%
Eaton County	66	63	95.5%
Grand Traverse County	49	46	93.9%
Jackson County	49	49	100.0%
Kent County	107	106	99.1%
Livingston County	49	49	100.0%
Macomb County	161	155	96.3%
Midland County	80	76	95.0%
Ottawa County	43	43	100.0%
Total	680	657	96.6%
Stratum 3			
Berrien County	42	41	97.6%
Calhoun County	86	84	97.7%
Clinton County	23	22	95.7%
Genesee County	180	166	92.2%
Ionia County	31	26	83.9%
Isabella County	3	3	100.0%
Lapeer County	19	19	100.0%
Lenawee County	46	45	97.8%
Monroe County	84	82	97.6%
Montcalm County	14	12	85.7%
Muskegon County	59	56	94.9%
Saginaw County	93	86	92.5%
St. Clair County	42	39	92.9%
St. Joseph County	23	23	100.0%
Shiawassee County	27	26	96.3%
Van Buren County	42	42	100.0%
Total	814	772	94.8%
Stratum 4			
Wayne County (Total)	764	683	89.4%

It was also of value to investigate any relationship between CRD usage and driver safety belt usage, which is shown in Table 8. Table 8 shows the existence of a relationship between driver safety belt use and CRD use, as 94.3 percent of the belted drivers had their child passenger seated in a CRD, while only 70.0 percent of unbelted drivers had their child passenger in a CRD. The overall driver safety belt use rate was 98.6 percent, which was higher than the statewide average, and thus, resulted in a very small sample (40) of drivers that were not belted appropriately.

Table 8. Driver Safety Belt Use vs. CRD Use

CRD Use	Driver Restraint Use			
	Driver Not Belted Appropriately		Driver Belted Appropriately	
	Number	Column Percent	Number	Column Percent
Child Not Seated in CRD	12	30.0%	166	5.7%
Child Seated in CRD	28	70.0%	2754	94.3%
Total	40	100.0%	2920	100.0%

Table 9 shows the impact of other characteristics, including the location type, day of week, time of day, driver gender, driver age, driver race, and vehicle type on the CRD use rate. Fast-food restaurants had the highest CRD use rate at 96.3 percent, while shopping centers had the lowest CRD use rate at 93.1 percent. The highest CRD use rates occurred on Friday and Saturday and during the morning (9am-11am) and early evening (6pm-7pm) hours. The lowest CRD use rates occurred on Tuesday and Wednesday and during the late afternoon (3pm-5pm) hours. Female drivers had a higher CRD use rate (94.4%) than male drivers (92.9%). Drivers between ages 16 and 29 (95.1%) had the highest CRD use rate compared to other age groups. Caucasian drivers had the highest CRD use rate (95.7%) compared to other races. Drivers of sport utility vehicles had the highest CRD use rate (94.9%) while drivers of pick-up trucks had the lowest CRD use rate (82.8%).

The two-way interaction of driver race and gender was also analyzed. Table 10 summarizes CRD use for each race, separated by gender. Table 10 shows evidence of gender disparity in the CRD use rates for all races except Caucasian. For African American and Hispanic drivers, females had a considerably higher CRD use rate than males. For Asian or Pacific Islander drivers, males had a considerably higher CRD use rate than females.

Table 9. CRD Use Summary by Location, Temporal, Demographic, and Vehicle Characteristics

Category	No. of Child Passengers Under Age Four	No. of Child Passengers Seated in CRD	Percent of Child Passengers Seated in CRD
Location Type			
Roadside	1375	1288	93.7%
Fast-Food	296	285	96.3%
Day Care	364	348	95.6%
Shopping	925	861	93.1%
Day of the Week			
Sunday	363	344	94.8%
Monday	440	416	94.5%
Tuesday	454	416	91.6%
Wednesday	553	508	91.9%
Thursday	494	469	94.9%
Friday	451	433	96.0%
Saturday	205	196	95.6%
Time of Day			
7am-8am	69	65	94.2%
8am-9am	301	282	93.7%
9am-10am	178	172	96.6%
10am-11am	296	289	97.6%
11 am-12 pm	312	291	93.3%
12 pm-1 pm	296	278	93.9%
1 pm-2 pm	289	273	94.5%
2 pm-3 pm	391	371	94.9%
3 pm-4 pm	234	211	90.2%
4 pm-5 pm	380	346	91.1%
5 pm-6 pm	145	137	94.5%
6pm-7pm	69	67	97.1%
Driver Gender			
Male	807	750	92.9%
Female	2153	2032	94.4%
Driver Age			
16-29	717	682	95.1%
30-59	2172	2034	93.6%
60+	71	66	93.0%
Driver Race			
Caucasian	2467	2362	95.7%
African American	388	330	85.1%
Asian or Pac. Islander	69	65	94.2%
Hispanic	36	25	69.4%
Vehicle Type			
Passenger Cars	1698	1599	94.2%
Sport Utility Vehicles	605	574	94.9%
Vans/Minivans	593	556	93.8%
Pick-up Trucks	64	53	82.8%

Table 10. CRD Use: Two-Way Interaction of Driver Race and Gender

Race	Gender	No. of Child Passengers Under Age Four	No. of Child Passengers Seated in CRD	Percent of Child Passengers Seated in CRD
Caucasian	Male	659	633	96.1%
	Female	1808	1729	95.6%
African American	Male	113	88	77.9%
	Female	275	242	88.0%
Asian or Pacific Islander	Male	19	19	100.0%
	Female	50	46	92.0%
Hispanic	Male	16	10	62.5%
	Female	20	15	75.0%
Total		2,960	2,782	94.0%

6.2 Interviews/Inspections

The interviews/inspections were performed at 34 locations statewide, which yielded 248 inspections of child passengers under the age of four. Sixty (60) interviews were performed at seven sites in Stratum 1, 75 interviews at 13 sites in Stratum 2, 52 interviews at five sites in Stratum 3, and 61 interviews at nine sites in Stratum 4. Table 11 summarizes the descriptive statistics regarding the interview locations by stratum, day of the week, and type of site. Table 12 summarizes the interview percentages based on vehicle type, type of restraint, position of the child in the vehicle, and age of child. Please note that booster seats were only included in the analysis if the restrained child was under the age of four.

Table 11. Interview/Inspection Descriptive Statistics

Stratum	No. of Sites	Pct. of Sites	No. of Interviews	Pct. of Interviews
Stratum 1	7	20.6%	60	24.2%
Stratum 2	13	38.2%	75	30.2%
Stratum 3	5	14.7%	52	21.0%
Stratum 4	9	26.5%	61	24.6%
Total	34	100.0%	248	100.0%
Day of the Week	No. of Sites	Pct. of Sites	No. of Interviews	Pct. of Interviews
Sunday	1	3.0%	4	1.6%
Monday	3	8.8%	23	9.3%
Tuesday	5	14.7%	52	21.0%
Wednesday	5	14.7%	32	12.9%
Thursday	10	29.4%	59	23.8%
Friday	2	5.9%	15	6.0%
Saturday	8	23.5%	63	25.4%
Total	34	100.0%	248	100.0%
Type of Site	No. of Sites	Pct. of Sites	No. of Interviews	Pct. of Interviews
Fast-Food Restaurants	4	11.8%	16	6.4%
Day Care Centers	12	35.3%	120	48.4%
Shopping Centers	11	32.3%	27	10.9%
Seat Check Events	7	20.6%	85	34.3%
Total	34	100.0%	248	100.0%

Table 12. Interview Data Summary

Vehicle Type	No. of Interviews	Pct. of Interviews
Passenger Car	107	43.1%
Sport Utility Vehicle	79	31.9%
Van/Minivan	53	21.4%
Pick-up Truck	9	3.6%
Total	248	100.0%
Type of Restraint	No. of Interviews	Pct. of Interviews
Rear-Facing CRD	76	30.6%
Forward-Facing CRD	148	59.7%
Belt Positioning Booster	21	8.5%
Shield Booster	1	0.4%
Integrated Seat	1	0.4%
Safety Belt	1	0.4%
Unrestrained	0	0.0%
Total	248	100.0%
Position of the Child	No. of Interviews	Pct. of Interviews
Front Passenger	3	1.2%
Front Middle	1	0.4%
Second Row Left	80	32.3%
Second Row Center	53	21.4%
Second Row Right	104	41.9%
Third Row Left	3	1.2%
Third Row Middle	0	0.0%
Third Row Right	4	1.6%
Total	248	100.0%
Age of Child	No. of Interviews	Pct. of Interviews
Less than 1 Year	64	25.8%
1 Year – Less than 2 Years	70	28.2%
2 Years – Less than 3 Years	56	22.6%
3 Years – Less than 4 Years	58	23.4%
Total	248	100.0%

The interview/inspection data were utilized to compute the statewide misuse rate in addition to the misuse rate for each stratum. As stated previously, a CRD 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. Table 13 shows the statewide misuse rate in addition to the misuse rate broken down by stratum and by CRD type (rear-facing and forward-facing only).

Table 13. CRD Correct Use and Misuse Rates

Category	No. of Interviews	Correct Use Rate	Misuse Rate
Type of CRD			
Rear-Facing	76	19.7%	80.3%
Forward Facing	148	27.0%	73.0%
Stratum			
Stratum 1	60	33.3%	66.7%
Stratum 2	75	16.0%	84.0%
Stratum 3	52	13.5%	86.5%
Stratum 4	61	26.2%	73.8%
Statewide (Unweighted)	248	22.2%	77.8%

Statewide, only 22.2 percent of the inspections of the restraint characteristics of children under age 4 showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. **The remaining 77.8 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses).** Stratum 1 showed the lowest misuse rate at 66.7 percent, while Stratum 3 showed the highest misuse rate at 86.5 percent. Rear-facing CRDs had an overall misuse rate of 80.3 percent, which was higher than the 73.0 percent overall misuse rate for forward-facing CRDs.

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 14 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 14. CRD Selection and Position Characteristics

CRD Characteristic	Percent Correct	Percent Incorrect
Restraint appropriate for child's age	90.7%	9.3%
Restraint appropriate for child's height	89.5%	10.5%
Restraint appropriate for child's weight	92.7%	7.3%
CRD facing proper direction for child's age/weight	94.8%	5.2%
Seat intended to be used in direction installed	99.2%	0.8%
CRD installed on a forward-facing vehicle seat	99.6%	0.4%

Table 14 shows that the CRD selection and orientation were typically appropriate for the child's age, height, and weight. The most commonly observed error with CRD selection was the premature use of a booster seat, based on the child's height, weight, and/or age. The remaining itemized misuse rates were separated into rear-facing CRD misuses and forward-facing CRD misuses and are summarized in Table 15.

Table 15. CRD Installation and Restraint Characteristics

CRD Characteristic	Rear-Facing CRDs		Forward-Facing CRDs	
	Percent Correct	Percent Incorrect	Percent Correct	Percent Incorrect
CRD at the proper angle	89.5%	10.5%	98.6%	1.4%
Only one vehicle system used to attach CRD	97.4%	2.6%	94.6%	5.4%
Internal harness buckled	94.7%	5.3%	97.3%	2.7%
Harness straps tight	26.3%	73.7%	43.2%	56.8%
Shoulder harness straps in proper location	81.6%	18.4%	77.0%	23.0%
Harness straps were flat	89.5%	10.5%	83.8%	16.2%
Harness retainer clip attached and threaded correctly	97.4%	2.6%	92.6%	7.4%
Harness retainer clip in proper location	40.8%	59.2%	60.8%	39.2%
Crotch strap flat	93.4%	6.6%	95.3%	4.7%
Seatbelt/LATCH strap buckled/attached	100.0%	0.0%	99.3%	0.7%
Seatbelt/LATCH strap flat	93.4%	6.6%	87.2%	12.8%
Proper belt path/LATCH connector path used	93.4%	6.6%	95.2%	4.8%
Proper space between CRD and vehicle seat	89.5%	10.5%	77.8%	22.2%
CRD installation tight	74.7%	25.3%	80.6%	19.4%

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. For the rear-facing CRDs, 73.7 percent of the CRDs did not have harnesses tight enough, while 56.8 percent of the forward-facing CRDs did not have the harnesses 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. Another common misuse was the improper positioning of the harness retainer clip, which was often too low on the child.

The risk priority numbers for the rear-facing CRDs and forward-facing CRDs were calculated as described in the data analysis section of this report and are shown in Tables 16 and 17, respectively.

Table 16. Rear-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Rear-Facing CRD Misuse	Severity Score [10]	Percent Occurrence	Risk Priority Number
Harness too loose (≥ 4 fingers)	6.7	36.8%	246.6
Harness retainer clip was too low	2	56.6%	113.2
Shoulder harness straps were too high	6.3	13.2%	83.2
Harness too loose (3 fingers)	4.3	15.8%	67.9
Seatbelt routed incorrectly	9	6.6%	59.4
Internal harness was not buckled	10	5.3%	53.0
Harness too loose (2 fingers)	1.7	21.1%	35.9
CRD was reclined at improper angle	3	10.5%	31.5
Shoulder harness straps were twisted	2.7	10.5%	28.4
Crotch strap was twisted	3.5	6.6%	23.1
Space between CRD and vehicle seat 1"	1	9.2%	9.2
Shoulder harness straps were too low	2.3	3.9%	9.0
Space between CRD and vehicle seat 4"	5	1.3%	6.5
Harness retainer clip was not attached	2.3	2.6%	6.0
Harness retainer clip was too high	2.5	1.3%	3.3
Space between CRD and vehicle seat 6"	7	0.0%	0.0
Space between CRD and vehicle seat 5"	6	0.0%	0.0
Space between CRD and vehicle seat 3"	4	0.0%	0.0
Space between CRD and vehicle seat 2"	3	0.0%	0.0
Seatbelt/LATCH was not buckled	7	0.0%	0.0
Total Risk Priority Number for Rear-Facing CRDs			776.0
Average Risk Priority Number per CRD			10.2

Table 17. Forward-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority

Forward-Facing CRD Misuse	Severity Score [10]	Percent Occurrence	Risk Priority Number
Harness too loose (≥ 4 fingers)	6.3	20.3%	127.9
Harness retainer clip was too low	1.5	31.8%	47.7
Harness too loose (3 fingers)	3.7	12.8%	47.4
Shoulder harness straps were too low	2.3	16.2%	37.3
Space between CRD and vehicle seat 2"	4	8.3%	33.2
Harness too loose (2 fingers)	1.3	23.6%	30.7
Internal harness was not buckled	10	2.7%	27.0
Shoulder harness straps were twisted	1.3	16.2%	21.1
Space between CRD and vehicle seat 1"	2	9.0%	18.0
Space between CRD and vehicle seat 3"	5	3.5%	17.5
Crotch strap was twisted	3.5	4.7%	16.5
Harness retainer clip was not attached	2	7.4%	14.8
Harness retainer clip was too high	2.5	3.4%	8.5
Space between CRD and vehicle seat 4"	6	1.4%	8.4
CRD was reclined at improper angle	4.6	1.4%	6.4
Shoulder harness straps were too high	1.7	3.4%	5.8
Seatbelt/LATCH was not buckled	6	0.7%	4.2
Total Risk Priority Number for Forward-Facing CRDs			472.2
Average Risk Priority Number per CRD			3.2

As shown in the preceding tables, the rear-facing CRD misuses resulted in a total risk priority number of 776.0, which was greater than the forward-facing CRDs risk priority number of 472.2. The average risk priority number was 10.2 per rear-facing CRD and 3.2 per forward-facing CRD. 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 10.2 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.

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 by far 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. Another problematic misuse for both rear- and forward-facing CRDs was the harness retainer clip being 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.

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 18 presents data on utilization of the LATCH system that was obtained from the inspections. The LATCH system was utilized to secure the CRD in 33.6 percent of the inspected vehicles, although 72.4 percent of the inspected vehicles were LATCH equipped. Thus, although they greatly simplify the CRD attachment process, LATCH was utilized in only 46.5 percent of equipped vehicles. Very little difference was observed between the LATCH utilization for rear-facing versus forward-facing CRDs.

Table 18. 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	75.0%	45.6%	34.2%
Forward-Facing	70.9%	47.0%	33.3%
Total	72.4%	46.5%	33.6%

6.3 Statewide CRD Use and Misuse Trends

Table 19 summarizes the findings of the 2009 CRD use and misuse surveys and inspections compared to the findings of the 2005 and 2007 surveys and inspections. The table provides information about the observation and interview portions of the survey. As can be observed in Table 19, the percentage of CRD use has increased from 79.7 percent in 2005, to 91.8 percent in 2007, to 94.2 percent in 2009. The percentage of correct CRD installation has also increased from 19.9 percent in 2007 to 22.2 percent in 2009.

Table 19. Statewide CRD Use and Misuse Trends

Year of Survey	Observation Survey			Interview/Inspections		
	No. of Sites	No. of Observations	Percent CRD Use	No. of Sites	No. of Interviews	Percent Correct CRD Installation
2005	80	1,560	79.7%	27	147	28.6%
2007	98	1,963	91.8%	75	300	19.9%
2009	391	2,960	94.2%	34	248	22.2%

The 2009 study found the rear-facing CRD misuses to result in a total risk priority number of 776.0, while the forward-facing CRD misuses resulted in a total risk priority number of 472.2. In the 2005 study, rear-facing and forward-facing total risk priority numbers were 834.7 and 670.6, respectively. This, in addition to a decrease in the CRD misuse rate, the total risk priority numbers have also decreased since 2007.

The 2009 CRD study found that 72.4 percent of vehicles were LATCH-equipped, while 46.5 percent of the equipped vehicles utilized LATCH. The 2005 CRD study found that 57.1 percent of vehicles were LATCH-equipped although only 32.6 percent of the equipped vehicles utilized LATCH. Thus, the percent of LATCH-equipped vehicles has increased since 2005 and the percent of equipped vehicles utilizing LATCH has also increased.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The CRD use rate in Michigan has increased over the past several years to a weighted statewide rate of 94.2 percent in 2009. The CRD usage rate trend mirrors the increases in safety belt usage rates. The current increase in CRD use rate may have been partially due to the increased attention paid to proper child restraint brought on by the new Michigan booster seat law enacted in July 2008 and the associated advertising campaign. Unfortunately, although the statewide CRD misuse rate has decreased since 2007, it still remains at a relatively high level of 77.8 percent.

To ensure proper CRD 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)
- Between age 6 months and 12 months (switch from infant carrier to larger rear-facing CRD)
- 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 restraint for parents of newborns upon discharge from the hospital. Day care facilities often provide basic CRD education, but do not have the staff to provide full inspection of the CRD or parental training. There are many locations throughout the State of Michigan where parents can have their CRD inspected by certified individuals. NHTSA-certified CRD 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 inspection/training events statewide. These events have one or more NHTSA certified CRD inspectors and trainers on-site to inspect the CRD installation and inform the parents if they are using an incorrect CRD for their child or if the CRD has been recalled. The inspectors will also show the parents how to properly install the CRD in the vehicle and how to properly restrain the child in the CRD. Parents should be encouraged to have their CRD inspected by a NHTSA-certified inspector anytime a new CRD is utilized, a change to the existing CRD 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 – COMPLETE LISTING OF OBSERVATION SITES

DAY CARE CENTERS

Stratum	County	Name of Day Care Center	Address
1	Ingham	Educational Child Care Center	1715 W. Main St., Lansing, MI 48915
1	Ingham	Little Rainbows	2443 Olds Rd., Leslie, MI 49251
1	Ingham	Helping Hands Day Care	2727 W. Holmes Rd., Lansing, MI 48911
1	Ingham	Small Folks Development Center	3140 S. Pennsylvania Ave., Lansing, MI 48910
1	Ingham	Spartan Child Development Center	1730 Crescent Rd., East Lansing, MI 48823
1	Kalamazoo	Child Development Center - Borgess	1521 Gull Rd., Kalamazoo, MI 49048
1	Oakland	Rochester Hills Public Library	500 Olde Towne Rd., Rochester, MI 48307
1	Oakland	Goodison Child Care Center, Inc.	4461 Collins Rd., Rochester, MI 48306
1	Oakland	Farmington Hills Nursery School	25225 Middlebelt Rd., Farmington Hills, MI 48336
1	Oakland	Carpenter School - Latch Key	2290 Flintridge St., Orion, MI 48359
1	Oakland	Whitney Bloomfield Inc.	4500 Arline Dr., Orchard Lake, MI 48323
1	Oakland	Red Apple Pre-School	28117 Milford Rd., New Hudson, MI 48165
1	Oakland	Art Start Montessori Academy	31195 W. 13 Mile Rd., Farmington Hills, MI 48334
1	Oakland	Brookfield Academy - Troy Campus	3950 Livernois Ave., Troy, MI 48083
1	Washtenaw	Chelsea Com. Hosp. Children's Center	14600 Old US 12, Chelsea, MI 48118
2	Allegan	Appletree Christian Learning Center	909 Dix St., Otsego, MI 49078
2	Jackson	Spring Arbor Cherubs Preschool	120 E. Main St., Spring Arbor, MI 49283
2	Kent	Appletree Christian Learning Center	732 52nd St., Lowell, MI 49331
2	Livingston	Lakeland Montessori School	5520 M-36, Pinckney, MI 48143
2	Livingston	Garden Gate School	2100 Progressive Dr., Hartland, MI 48353
2	Macomb	Richmond Early Learning Center	68560 Stoecker Ln., Richmond, MI 48062
2	Macomb	Warren Woods Childcare	14000 Thirteen Mile Rd., Warren, MI 48088
2	Macomb	Kinder Care Learning Center #821	33300 Ryan Rd., Sterling Heights, MI 48310
2	Midland	Heaven's Elect Day Care	3305 Ridgecrest Dr., Suite B, Midland, MI 48642
2	Midland	Michigan Child Care Centers, Inc.	1184 James Savage Rd., Midland, MI 48640
2	Ottawa	Daily Shepherd Child Care	1481 Baldwin St., Jenison, MI 49428
2	Ottawa	Appletree Christian Learning Center	11272 Edgewater Dr., Allendale, MI 49401
3	Berrien	The Children's Center, Inc.	324 E. Dewey St., Ste. 107, Buchanan, MI 49107
3	Calhoun	Little Friends Day Care	1305 Olive St., Battle Creek, MI 49017
3	Calhoun	Child Development Center - Lakeview	55 Arbor St., Battle Creek, MI 49015
3	Genesee	Bethel Child Care Center	6029 Lapeer Rd., Burton, MI 48509
3	Genesee	Mulberry Bush Child Care	5182 N. Elms Rd., Flushing, MI 48433
3	Genesee	Honey Bear Child Care	5171 S. Linden Rd., Swartz Creek, MI 48473
3	Lapeer	Family Circle Children's Learning Center	2266 N. Lapeer Rd., Lapeer, MI 48446
3	Monroe	Carleton Country Day School	12707 Maxwell Rd., Carleton, MI 48117
3	Saginaw	KinderKare Child Center	928 W. Ardussi, Frankenmuth, MI 48734
3	Saginaw	Adventure Land Day Care	3111 Barnard Rd., Saginaw, MI 48603
3	St. Clair	Marysville Children's Center	901 Michigan Ave., Marysville, MI 48040
3	St. Clair	Nu-Nu'S Nursery and Daycare	1714 Holland Ave., Port Huron, MI 48060
3	St. Clair	Kids Connection	301 N. 6th St., St. Clair, MI 48079
4	Wayne	Peter Rabbit Day Care Center, Inc.	5901 Cadieux Ave., Detroit, MI 48224
4	Wayne	Sugar N Spice Nursery School	16555 Wyoming St., Detroit, MI 48221
4	Wayne	Northville First Care	777 W. Eight Mile Rd., Northville, MI 48167
4	Wayne	Children's Corner Center Learning II	16901 Schoolcraft St., Detroit, MI 48227
4	Wayne	Meadow Bank Day Care	2122 Dix Hwy., Lincoln Park, MI 48146
4	Wayne	Blossoming Child Development Center	4919 Elmhurst St., Detroit, MI 48204
4	Wayne	Childtime Children's Center	34203 Ford Rd., Westland, MI 48185
4	Wayne	The Learning Tree - South	32955 Plymouth Rd., Livonia, MI 48150
4	Wayne	Order of the Fisherman Ministry Headstart	10025 Grand River Ave., Detroit, MI 48204
4	Wayne	Plymouth/Canton Montessori	45245 Joy Rd., Canton, MI 48187
4	Wayne	Sunrise 2 Sunset Child Development	18708 Telegraph Rd., Brownstown, MI 48174
4	Wayne	Nanny's Nursery School	9529 Pardee Rd., Taylor, MI 48180
4	Wayne	Beard Early Childhood Center	840 Waterman St., Detroit, MI 48209
4	Wayne	Henry Ford Kids Child Care Center	1110 Seward St., Detroit, MI 48202
4	Wayne	Christ the King's Early Childhood Center	16700 Pennsylvania Rd., Southgate, MI 48195

FAST FOOD RESTAURANTS

Strata	County	Name of Site	Address
1	Kalamazoo	McDonalds	3320 S. Westnedge Ave., Kalamazoo, MI 49008
1	Kalamazoo	McDonalds	6355 S. Westnedge Ave., Portage, MI 49002
1	Kalamazoo	McDonalds	224 W. Kalamazoo Ave., Kalamazoo, MI 49007
1	Kalamazoo	McDonalds	830 Riverview Dr., Kalamazoo, MI 49001
1	Oakland	McDonalds	808 Rochester Rd., Rochester, MI 48307
1	Oakland	McDonalds	2985 Walton Blvd., Rochester Hills, MI 48309
1	Oakland	McDonalds	141 N. Telegraph Rd., Waterford, MI 48328
1	Oakland	McDonalds	22100 Pontiac Trail, South Lyon, MI 48178
1	Oakland	McDonalds	22525 Woodward Ave., Ferndale, MI 48220
1	Oakland	McDonalds	423 W. 11 Mile Rd., Royal Oak, MI 48067
1	Oakland	McDonalds	1212 W. Maple Rd., Troy, MI 48084
1	Oakland	McDonalds	2829 W. 14 Mile Rd., Royal Oak, MI 48073
1	Washtenaw	McDonalds	1535 S. Main St., Chelsea, MI 48118
1	Washtenaw	McDonalds	5550 W. Michigan Ave., Ypsilanti, MI 48197
2	Eaton	McDonalds	5225 N. Grand River Ave., Lansing, MI 48917
2	Gd.Traverse	McDonalds	2468 S. Airport Rd. W, Traverse City, MI 49684
2	Kent	McDonalds	3030 Walker Ave., Walker, MI 49504
2	Kent	McDonalds	417 Michigan St., Grand Rapids, MI 49503
2	Kent	McDonalds	415 28th St., Kalamazoo, MI 49548
2	Macomb	McDonalds	25900 Crocker Blvd., Mt. Clemens, MI 48045
2	Macomb	McDonalds	15401 E. 12 Mile, Roseville, MI 48066
2	Macomb	McDonalds	41500 Garfield Rd., Clinton Twp., MI 48038
2	Ottawa	McDonalds	5371 Lake Michigan Dr., Allendale, MI 49401
2	Ottawa	McDonalds	213 N. River Rd., Holland, MI 49424
3	Berrien	McDonalds	150 Ryno Rd., Coloma, MI 49038
3	Calhoun	McDonalds	812 W. Columbia Ave., Battle Creek, MI 49015
3	Genesee	McDonalds	214 N. State St., Otisville, MI 48463
3	Genesee	McDonalds	3212 Clio Rd., Flint, MI 48504
3	Genesee	McDonalds	3391 S. Saginaw St., Burton, MI 48529
3	Lapeer	McDonalds	486 S. Main St., Lapeer, MI 48446
3	Lenawee	McDonalds	503 S. Meridian St., Hudson, MI 49247
3	Monroe	McDonalds	1001 S. Monroe St., Monroe, MI 48161
3	Muskegon	McDonalds	3586 E. Apple Ave., Muskegon, MI 49442
3	Muskegon	McDonalds	1832 W. Sherman Blvd., Muskegon MI 49441
3	Saginaw	McDonalds	6331 Dixie Hwy., Bridgeport, MI 48722
3	Saginaw	McDonalds	2745 Bay Rd., Saginaw, MI 48603
3	St. Clair	McDonalds	1201 24th St., Port Huron, MI 48060
3	St. Clair	McDonalds	4155 24th Ave., Fort Gratiot, MI 48059
4	Wayne	McDonalds	15405 Southfield Rd., Detroit, MI 48223
4	Wayne	McDonalds	1469 Fort St., Lincoln Park, MI 48146
4	Wayne	McDonalds	3975 Conner St., Detroit, MI 48215
4	Wayne	McDonalds	17800 E. 8 Mile Rd., Harper Woods, MI 48225
4	Wayne	McDonalds	39700 Five Mile Rd., Plymouth, MI 48170
4	Wayne	McDonalds	4145 S. Telegraph Rd., Dearborn Heights, MI 48125
4	Wayne	McDonalds	27255 Telegraph Rd., Flat Rock, MI 48134
4	Wayne	McDonalds	1581 Van Horn Rd., Trenton, MI 48183
4	Wayne	McDonalds	23000 Eureka Rd., Taylor, MI 48180
4	Wayne	McDonalds	38418 Ford Rd., Westland, MI 48185
4	Wayne	McDonalds	13158 Ford Rd., Dearborn, MI 48126
4	Wayne	McDonalds	10236 S. Telegraph Rd., Taylor, MI 48180

SHOPPING CENTERS

Strata	County	Name of Shopping Center	Address
1	Ingham	Eastwood Town Center	1500 W. Lake Lansing Rd., Lansing, MI 48840
1	Ingham	Target	4890 Marsh Rd., Okemos, MI 48864
1	Ingham	Meijer	5125 W. Saginaw Hwy., Lansing, MI 48917
1	Kalamazoo	Harding's Market	6330 S. Westnedge Ave., Portage, MI 49002
1	Kalamazoo	Kmart	6355 S. Westnedge Ave., Portage, MI 49002
1	Kalamazoo	Felpausch Food Center	120 W. Prairie St., Vicksburg, MI 49097
1	Kalamazoo	Harding's Market	5161 W. Main St., Kalamazoo, MI 49009
1	Kalamazoo	Kmart	4620 Stadium Dr., Kalamazoo, MI 49008
1	Kalamazoo	Meijer	5800 Gull Rd., Kalamazoo, MI 49048
1	Oakland	Great Lakes Crossing	4000 Baldwin Rd., Auburn Hills, MI 48326
1	Oakland	Ferndale Foods	600 W. 9 Mile Rd., Ferndale, MI 48220
1	Oakland	Holiday Food Center	1203 S. Main St., Royal Oak, MI 48067
1	Oakland	Kmart	29101 John R Rd, Madison Heights, MI 48071
1	Oakland	Dixie Highway Kroger	6625 Dixie Hwy., Clarkston, MI 48346
1	Oakland	Kroger	25780 Middlebelt Rd., Farmington, MI 48336
1	Oakland	Wal-Mart Supercenter	3301 N. Pontiac Trail, Walled Lake, MI 48390
1	Oakland	Wal-Mart Supercenter	30729 Lyon Center Dr. E., New Hudson, MI 48165
1	Oakland	Meijer	5150 Coolidge Hwy., Royal Oak, MI 48073
1	Oakland	Wal-Mart Supercenter	2500 S. Adams Rd., Rochester, MI 48309
1	Washtenaw	Meijer	5645 Jackson Rd., Ann Arbor, MI 48103
1	Washtenaw	Kroger	400 S. Maple Rd., Ann Arbor, MI 48103
1	Washtenaw	Briarwood Mall	100 Briarwood Circle, Ann Arbor, MI 48108
1	Washtenaw	Meijer	3825 Carpenter Rd., Ypsilanti, MI 48197
2	Allegan	Wal-Mart Supercenter	412 Oaks Crossing, Plainwell, MI 49080
2	Bay	Pinny Food Center	704 S Mable St., Pinconning 48650
2	Bay	Kroger	2910 Center Ave., Essexville, MI 48732
2	Eaton	Meijer	5225 N. Grand River Ave., Lansing, MI 48917
2	Eaton	Kroger	6430 W. Saginaw Hwy., Lansing, MI 48917
2	Eaton	Village Market	5125 W. Saginaw Hwy., Lansing, MI 48917
2	Gd.Traverse	Tom's Food Center	13940 S.W. Bay Shore Dr., Traverse City, MI 49684
2	Gd.Traverse	Grand Traverse Mall	3200 S. Airport Rd. W., Traverse City, MI 49684
2	Jackson	Frank's ShopRite	400 Michigan Ave., Grass Lake, MI 49240
2	Jackson	Meijer	2777 Airport Rd., Jackson, MI 49202
2	Kent	Rivertown Crossings Mall	3700 Rivertown Pkwy., Grandville, MI 49418
2	Kent	Century Park Treehouse	5710 Kenowa Ave. S.W., Grandville, MI 49418
2	Kent	Meijer	5500 Clyde Park Ave. S.W., Wyoming, MI 49509
2	Livingston	Rosati's Market	130 S. Grand Rd., Fowlerville, MI 48836
2	Macomb	Farmer Jack	50 N. Groesbeck Hwy., Mount Clemens, MI 48043
2	Macomb	Shoppers Market	22800 Van Dyke Ave., Warren 48089
2	Macomb	Kroger	26130 Gratiot Ave., Roseville, MI 48066
2	Macomb	Lakeside Mall	14000 Hall Rd., Sterling Heights, MI 48313
2	Macomb	Wal-Mart	44575 Mound Rd., Sterling Heights, MI 48314
2	Midland	Glen's	2026 N. Saginaw St., Midland, MI 49640
2	Midland	Wal-Mart	910 Joe Mann Blvd., Midland, MI 48642
2	Ottawa	Meijer	746 E. 16th St., Holland, MI 49423

SHOPPING CENTERS (continued)

Strata	County	Name of Shopping Center	Address
3	Berrien	Target	960 Fairplain Dr., Benton Harbor, MI 49022
3	Berrien	Wal-Mart Supercenter	1400 Mall Dr., Benton Harbor 49022
3	Calhoun	Lakeview Square Mall	5775 Beckley Rd., Battle Creek, MI 49015
3	Calhoun	Meijer	2177 W. Columbia Ave., Battle Creek, MI 49015
3	Calhoun	Wal-Mart Supercenter	6020 B Drive N., Battle Creek, 49014
3	Genesee	First Friends Discovery Center	8031 E. Court St., Bldg. 1, Davison, MI 48423
3	Genesee	Kroger	7188 N. Saginaw Rd., Mt. Morris, MI 48458
3	Genesee	Kroger	2629 W. Pierson Rd., Flint, MI 48504
3	Genesee	Toys "R" Us	3250 S. Linden Rd., Flint, MI 48507
3	Genesee	Kmart	3083 Miller Rd., Flint, MI 48507
3	Genesee	Kmart	1145 N. Belsay Rd., Burton, MI 48509
3	Genesee	Meijer	4333 W. Pierson Rd., Flint, MI 48504
3	Genesee	Meijer	2333 S. Center Rd., Burton, MI 48519
3	Lapeer	Wal-Mart	555 E. Genesee St., Lapeer, MI 48446
3	Lenawee	Borchardt Brothers	628 W. Adrian St., Blissfield 49228
3	Lenawee	Meijer	217 E. US Highway 223, Adrian, MI 49221
3	Lenawee	Busch's Valu Land	1450 W. Chicago Blvd., Tecumseh, MI 49286
3	Monroe	Wal-Mart	2155 N. Telegraph Rd., Monroe, MI 48162
3	Muskegon	Lakeshore Market Place	5241 Harvey St., Muskegon, MI 49444
3	Muskegon	Target - Sherman Blvd	1740 E. Sherman Blvd., Muskegon, MI 49444
3	Muskegon	Meijer	700 W Norton Ave., Muskegon, MI 49441
3	Saginaw	Target/ Toys "R" Us	2772 Tittabawassee Rd., Saginaw, MI 48604
3	Saginaw	Kroger	3430 State St., Saginaw, MI 48602
3	Saginaw	Meijer	8400 Gratiot Rd., Saginaw, MI 48609
3	Shiawassee	Wal-Mart	1621 E. M-21, Owosso, MI 48867
3	Van Buren	Village Market	407 N. State St., Gobles, MI 49055
3	Van Buren	Wagoner's	24064 McGillen, Mattawan, MI 49071
3	Van Buren	Wal-Mart Supercenter	201 73rd St., South Haven, MI 49090
4	Wayne	Sears Lincoln Park	2100 Southfield Rd., Lincoln Park, MI 48146
4	Wayne	Kroger	23303 Michigan Ave., Dearborn, MI 48124
4	Wayne	Kroger	200 S. Merriman Rd., Westland, MI 48186
4	Wayne	Sak n Save	1647 S. Merriman Rd., Westland, MI 48186
4	Wayne	Harbortown Foods	3472 E. Jefferson, Detroit MI 48207
4	Wayne	Farmer's Food Center	2411 Central Ave., Detroit MI 48209
4	Wayne	Wal-Mart	30007 Plymouth Rd., Livonia, MI 48150
4	Wayne	Kroger	2060 Dix Ave., Lincoln Park, MI 48146
4	Wayne	Kroger	37700 Six Mile Rd., Livonia, MI 48152
4	Wayne	Target	20100 Haggerty Rd., Livonia, MI 48152
4	Wayne	Target	29859 Plymouth Rd., Livonia, MI 48150
4	Wayne	Toys "R" Us	29150 W. Seven Mile Rd., Livonia, MI 48152
4	Wayne	Kmart	2095 Rawsonville Rd., Belleville, MI 48111
4	Wayne	Kroger	45540 Michigan Ave., Canton, MI 48188
4	Wayne	Holiday Market	520 S. Lilley Rd., Canton 48188
4	Wayne	Kroger	1905 N. Canton Center Rd., Canton, MI 48187
4	Wayne	Food Pride	500 E. Warren Ave., Detroit, MI 48201
4	Wayne	Wal-Mart	29555 Plymouth Rd., Livonia, MI 48150
4	Wayne	Wal-Mart	5851 Mercury Drive, Dearborn, MI 48126
4	Wayne	Meijer	14640 Pardee Rd., Taylor, MI 48180
4	Wayne	Wal-Mart Supercenter	7555 Telegraph Rd., Taylor, MI 48180
4	Wayne	Meijer	45001 Ford Rd., Canton, MI 48187

ROADSIDE LOCATIONS

Strata	County	Roadside Location
1	Ingham	Barnes and Eden
1	Ingham	Cavanaugh and Pennsylvania
1	Ingham	Cedar and US-127
1	Ingham	Haslett and Zimmer
1	Ingham	Holt and M-52
1	Ingham	I-496 and Dunkel
1	Ingham	Lake Lansing and Hagadorn
1	Ingham	M 36 and Dexter
1	Ingham	M 36 and M 106
1	Ingham	M 43 and M 52
1	Ingham	M-106 and M-52
1	Ingham	M-43 and Putnam
1	Ingham	M-43 and Williamston
1	Ingham	Michigan and Waverly
1	Ingham	Rossman and Onodaga
1	Ingham	Tihart and Cornell
1	Ingham	US-127 and Saginaw
1	Kalamazoo	G and Riverview
1	Kalamazoo	G avenue and 33rd
1	Kalamazoo	H-Avenue and Sprinkle
1	Kalamazoo	M 43 and 9th
1	Kalamazoo	M-43 and M-89
1	Kalamazoo	M-89 and 34th St.
1	Kalamazoo	Qth and 8th
1	Kalamazoo	Sprinkle and Center
1	Kalamazoo	Sprinkle and Zylman
1	Kalamazoo	U and 33rd
1	Kalamazoo	U and 8th
1	Oakland	14 Mile and Main
1	Oakland	Baldwin and Clarkston
1	Oakland	Dixie Hwy and Davisburg
1	Oakland	Grand River and Taft
1	Oakland	Grange Hall and Holly
1	Oakland	I-696 and Woodward
1	Oakland	I-75 and Sashabaw
1	Oakland	M-10 and 8 Mile
1	Oakland	Northwestern and Middlebelt
1	Oakland	Orchard Lake and I-696
1	Oakland	Snell and Rochester
1	Oakland	Taft and 9 Mile
1	Oakland	Walton and Lapeer
1	Washtenaw	Ann Arbor/Saline and Main
1	Washtenaw	Austin and Schneider
1	Washtenaw	Dixboro and Territorial
1	Washtenaw	Geddes and Earhart
1	Washtenaw	I-94 and Huron
1	Washtenaw	I-94 and Jackson
1	Washtenaw	I-94 and State
1	Washtenaw	Miller Ave and Maple
1	Washtenaw	Mooreville and Stoney Creek
1	Washtenaw	Rosehill and Elm Road
1	Washtenaw	Saline Milan and Mooreville
1	Washtenaw	Zeeb and Territorial

Strata	County	Roadside Location
2	Allegan	30th and 128
2	Allegan	M-89 and Main
2	Allegan	M-89 and US-131
2	Allegan	US-131 and US-135
2	Bay	I-75 and Pinconning
2	Bay	Kochville and Adams
2	Bay	M-15 and Munger
2	Bay	M-61 and Standish
2	Eaton	Battle Creek and Ainger Rd
2	Eaton	I-96 and Nash
2	Eaton	Kalamo and Battle Creek
2	Eaton	M-43 and Canal
2	Eaton	M-43 and M-50
2	Eaton	Nixon and Willow
2	Eaton	Royston and Island Hwy
2	Eaton	Wahington and Lawrence
2	Gd.Traverse	M-72 and US-31
2	Jackson	Elm Road and Rosenhill
2	Jackson	Michigan and Lake
2	Jackson	Michigan and US-127
2	Jackson	US-127 and Page
2	Jackson	Wolflake and Cady
2	Kent	10 Mile and Wabasis
2	Kent	14 Mile and Howard
2	Kent	4 mile and Walker
2	Kent	Aberdeen and Diamond
2	Kent	BallCreek and Sparta
2	Kent	Myers Lake and 17 Mile
2	Kent	Sparta and Ball Creek
2	Kent	US-131 and 10 Mile
2	Kent	US-131 and 68th
2	Kent	US-131 and 84th
2	Livingston	Grand River and Kensington
2	Livingston	Grand River and Pleasant
2	Livingston	Old US-23 and M-59
2	Livingston	US-23 and Clyde
2	Macomb	22 Mile and Heydenreich
2	Macomb	Groesbeck Hwy and I-696
2	Macomb	Jefferson and Martin
2	Macomb	Moranian and Harrington
2	Macomb	Romeo Plank and 27 Mile
2	Macomb	Van Dyke and 23 Mile
2	Macomb	Van Dyke and 34 Mile
2	Midland	Lake sanford and Curtis
2	Midland	M 20 and Homer
2	Midland	Pine River and Badour
2	Midland	Redstone and 11 Mile
2	Midland	Redstone and Coleman
2	Ottawa	Lake Michigan and US-131
2	Ottawa	Polk and 104

ROADSIDE LOCATIONS (continued)

Strata	County	Roadside Location
3	Berrien	I-94 and M-139
3	Berrien	Lakeside and Union Pier
3	Berrien	Piperstone and Nickerson
3	Calhoun	15 Mile and Michigan
3	Calhoun	Beckley and 5 Mile
3	Calhoun	Evanston and Michigan
3	Calhoun	I-94 and 5 Mile
3	Clinton	Clark and Upton
3	Clinton	Hyde and Welling
3	Clinton	M 21 and Lowell
3	Clinton	M-21 and Shepherdville
3	Clinton	Main and Westphalia
3	Genesee	Ballenger and Flushing
3	Genesee	Chavez and Court
3	Genesee	Elms Rd and Beecher
3	Genesee	Grand Blanc and Duffield
3	Genesee	Mt.Morris and I-75
3	Genesee	I-475 and Court
3	Genesee	M-57 and Vassar
3	Ionia	Bridge and State
3	Ionia	Main and Cross
3	Isabella	Blanchard and Winn
3	Lapeer	M-24 and Coulter
3	Lapeer	Otter Lake and Klam
3	Lenawee	Clinton and Tecumseh
3	Lenawee	M 50 and Pentecost Hwy
3	Lenawee	US 12 and Brooklyn
3	Monroe	Eureka and Telegraph
3	Monroe	Hull and Dunbar
3	Monroe	Plank and Ostrander
3	Monroe	Tecumseh and Ann Arbor
3	Monroe	Telegraph and 7th
3	Monroe	Telegraph and Northline
3	Monroe	US 23 and US 223
3	Monroe	US-23 and Plank Rd
3	Montcalm	Condensery and Crystal
3	Montcalm	M-91 and Sidney
3	Montcalm	Sidney and Crystal
3	Muskegon	Maple Island and Ravenna Hts
3	Muskegon	Moorland and Ravenna Hts
3	Muskegon	Ravenna Hts and Blackmer
3	Saginaw	M-57 and Bishop
3	Saginaw	M-57 and Fergus
3	Shiawassee	Grand River and M-52
3	Shiawassee	I-69 and M-52
3	Shiawassee	Juddville and Chipman
3	St. Clair	I-69 and Riley Center
3	St. Clair	M-19 and Lambs
3	St. Clair	M-29 and Palms
3	St. Clair	M-29 and Perch
3	St. Joseph	Banker and Klinger
3	St. Joseph	Millard and US-131
3	Van Buren	CR-380 and CR-681
3	Van Buren	CR-681 and CR-684
3	Van Buren	I-196 and Phoenix
3	Van Buren	M-51 and CR-352

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

APPENDIX II – COMPLETE LISTING OF INTERVIEW/INSPECTION SITES

INTERVIEW/INSPECTION SITES

Stratum 1					
County	City	Location	Type	Day	Date
Ingham	Lansing	Educational Child Care Center	Day Care	Tues	8/18/2009
Kalamazoo	Portage	Kmart	Shopping	Mon	8/24/2009
Oakland	Troy	KinderCare Learning Center	Day Care	Wed	7/29/2009
Oakland	Pontiac	KinderCare Learning Center	Day Care	Wed	8/12/2009
Oakland	Novi	Sam's Club	Shopping	Wed	7/29/2009
Oakland	Pontiac	Toys R Us	Shopping	Fri	8/14/2009
Washtenaw	Ann Arbor	KinderCare Learning Center	Day Care	Mon	8/17/2009
Stratum 2					
County	City	Location	Type	Day	Date
Allegan	Plainwell	McDonald's	McDonald's	Sat	8/22/2009
Bay	Bay City	McDonald's	McDonald's	Tues	8/11/2009
Bay	Bay City	McDonald's	McDonald's	Wed	8/12/2009
Bay	Essexville	Kroger	Shopping	Sun	8/16/2009
Eaton	Delta Twp.	McDonald's	McDonald's	Thur	8/13/2009
Kent	Cutlerville	Cutlerville Fire Department	Seat Check	Thur	8/13/2009
Kent	Grand Rapids	Woodland Shopping Center	Shopping	Sat	8/15/2009
Kent	Kentwood	Sam's Club	Shopping	Sat	8/15/2009
Macomb	Sterling Hghts.	Babies R Us	Seat Check	Sat	5/16/2009
Macomb	Roseville	Babies R Us	Seat Check	Thur	6/4/2009
Macomb	New Haven	New Haven PD	Seat Check	Sat	7/11/2009
Ottawa	Allendale	Appletree Learning Center	Day Care	Thur	8/13/2009
Ottawa	Holland	Sam's Club	Shopping	Sat	8/15/2009
Stratum 3					
County	City	Location	Type	Day	Date
Genesee	Flint	Our Lady of Guadalupe Church	Seat Check	Sat	7/18/2009
Muskegon	Muskegon	Sam's Club #6562	Shopping	Fri	8/14/2009
Saginaw	Saginaw	Buena Vista Fire Department	Seat Check	Thur	8/20/2009
St.Clair	Port Huron	Nu-Nu's Nursery and Daycare	Day Care	Mon	8/17/2009
St.Clair	Marysville	Marysville Children's Center	Day Care	Tues	8/18/2009
Stratum 4					
County	City	Location	Type	Day	Date
Wayne	Westland	Childtime Children's Center	Day Care	Wed	7/15/2009
Wayne	Taylor	Nanny's Nursery and Day Care	Day Care	Thur	7/16/2009
Wayne	Westland	KinderCare Learning Center	Day Care	Thur	7/23/2009
Wayne	Livonia	Little Tots Day Nursery	Day Care	Tues	7/28/2009
Wayne	Dearborn	KinderCare Learning Center	Day Care	Thur	7/30/2009
Wayne	Detroit	Glory Foods	Seat Check	Sat	7/18/2009
Wayne	Lincoln Park	Sears	Shopping	Thur	7/16/2009
Wayne	Westland	Kroger	Shopping	Tues	7/28/2009
Wayne	Dearborn	Value City/Wal-Mart	Shopping	Thur	7/30/2009

APPENDIX III – SAMPLE OBSERVATION AND INTERVIEW FORMS

CHILD RESTRAINT OBSERVATION FORM

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

VEHICLE			
TYPE:	USE:		
<input type="checkbox"/> Passenger Car <input type="checkbox"/> Van/Minivan <input type="checkbox"/> SUV <input type="checkbox"/> Pickup Truck	<input type="checkbox"/> Non-Commercial <input type="checkbox"/> Commercial		
DRIVER			
BELT:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Not Belted <input type="checkbox"/> Belted <input type="checkbox"/> Shoulder Belt Behind Back <input type="checkbox"/> Shoulder 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
CHILD PASSENGER			
BELT:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Rear Facing Child Seat <input type="checkbox"/> Forward Facing Child Seat <input type="checkbox"/> Booster Seat <input type="checkbox"/> Not Belted <input type="checkbox"/> Belted <input type="checkbox"/> Shoulder Belt Behind Back <input type="checkbox"/> Shoulder Belt Under Arm	<input type="checkbox"/> 0-3 <input type="checkbox"/> 4-15 <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

VEHICLE			
TYPE:	USE:		
<input type="checkbox"/> Passenger Car <input type="checkbox"/> Van/Minivan <input type="checkbox"/> SUV <input type="checkbox"/> Pickup Truck	<input type="checkbox"/> Non-Commercial <input type="checkbox"/> Commercial		
DRIVER			
BELT:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Not Belted <input type="checkbox"/> Belted <input type="checkbox"/> Shoulder Belt Behind Back <input type="checkbox"/> Shoulder 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
CHILD PASSENGER			
BELT:	AGE:	GENDER:	RACE:
<input type="checkbox"/> Rear Facing Child Seat <input type="checkbox"/> Forward Facing Child Seat <input type="checkbox"/> Booster Seat <input type="checkbox"/> Not Belted <input type="checkbox"/> Belted <input type="checkbox"/> Shoulder Belt Behind Back <input type="checkbox"/> Shoulder Belt Under Arm	<input type="checkbox"/> 0-3 <input type="checkbox"/> 4-15 <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

CHILD RESTRAINT DEVICES INTERVIEW FORM (hands-on interaction) - Form for child occupants under the age of 4

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 under the age of 4. Complete page one first. For occupants who are restrained, complete all questions on the second page.

Vehicle Type: 1 Passenger car 2 SUV 3 Van/minivan 4 Pick-up truck

Make: _____ Model: _____ Year: _____

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

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

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

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

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

Weight (fill in and then circle category): _____ 1 <20 lbs 2 20-39 lbs 3 40-80 lbs 4 81+ lbs

Last time weighed: _____

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

Comments: _____

Restraint:

- 1 Rear-Facing CRD
- 2 Forward-Facing CRD
- 3 Belt Positioning Boosters (BPB)
- 4 Shield Booster
- 5 Integrated Seat
- 6 Seat Belt
- 7 Unrestrained (If unrestrained circle and stop the observation)

Law and Best Practices:

- 1. Child restrained in accordance with State Law? 1 Yes 2 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)? 1 Yes 2 No 3 NA

CRD Selection and Child Position (All seats)

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

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

- 7. Does the vehicle have a passenger airbag? 1 Yes 2 No
- 8. If there is an airbag, is it turned off? 1 Yes 2 No 3 Don't Know
- 9. If the airbag is on, is the child at least 12" away from the airbag? 1 Yes 2 No 3 Don't Know
- 10. If the airbag is on, is the child facing forward? 1 Yes 2 No 3 Don't Know

For restrained occupants, is restraint use correct?

- 1 Yes (All CRD & Child Position questions and all Page 2 questions answered "Yes" or "N/A")
- 2 No (1 or more CRD & Child Position questions answered "No" and/or 1 or more Page 2 questions answered "No.")
- 3 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 (1 year AND 20 lbs)

1. Is the seat reclined properly (upright)? Yes No
2. Is only 1 vehicle system used to attach CRD (please circle the system used) (SB or Lower Anchors, not both)? Yes No NA
3. Is the internal harness buckle attached? Yes No
4. How tight are the shoulder harness straps (in fingers)?
 1 Finger 4 Fingers
 2 Fingers NA
 3 Fingers
5. Where are the shoulder harness straps?
 1 Just right (at shoulder level or above)
 2 Too high (above ears)
 3 Too low
 NA
6. Are the shoulder harness straps flat (not twisted)? Yes No NA
7. Is the harness retainer clip attached and threaded correctly? Yes No NA
8. Where is the harness retainer clip?
 1 Just right (at armpit level)
 2 Too high
 3 Too low
 NA
9. Is crotch strap flat (not twisted)? Yes No NA
10. Is seatbelt buckled? Yes No NA
11. Is seatbelt flat/lower strap (not twisted)? Yes No NA
12. Is the proper belt path/lower strap connector path used? Yes No NA
13. Is either the latch plate or seatbelt retractor locked, or locking clips used properly (1 inch from tongue)? Yes No NA
14. What is the space between the CRD back and vehicle seat back (in inches)?
 0 inches 3 inches
 1 inch 4 inches
 2 inches NA
15. Is the tether routed under an adjustable head restraint or over a non-adjustable head restraint? Yes No NA
16. Is tether strap flat (not twisted)? Yes No NA
17. How much slack is in the tether strap (in inches)?
 0 inches 4 inches
 1 inch 5 inches
 2 inches 5.5 inches
 3 inches NA
18. Is the CRD installation tight (1-inch rule)? Yes No NA

For Integrated Seats (usually in Minivans)

1. Is the harness or SB buckled? Yes No
2. Is the shoulder belt properly positioned over shoulder, collar bone, and chest? Yes No NA
3. Is the shoulder belt flat (not twisted)? Yes No NA
4. Is the lap belt properly positioned across the hips/upper thighs? Yes No NA
5. Is the lap belt flat (not twisted)? Yes No NA
6. How tight is the harness?
 0 inches 3 inches
 1 inch 4 inches
 2 inches NA

For Rear-Facing CRDs

1. Is the seat reclined properly (60° for >6 mos. Or 45° for <6 mos)? Yes No
2. Is only 1 vehicle system used to attach CRD (please circle the system used) (SB or Lower Anchors, not both)? Yes No NA
3. Is internal harness buckle attached? Yes No
4. How tight are the shoulder harness straps (in fingers)?
 1 Finger 4 Fingers
 2 Fingers NA
 3 Fingers
5. Where are the shoulder harness straps?
 1 Just right (at shoulder level or below)
 2 Too high
 3 Too low
 NA
6. Are the shoulder harness straps flat (not twisted)? Yes No NA
7. Is the harness retainer clip attached and threaded correctly? Yes No NA
8. Where is the harness retainer clip?
 1 Just right (at armpit level)
 2 Too high
 3 Too low
 NA
9. Is crotch strap flat (not twisted)? Yes No NA
10. Is seatbelt buckled? Yes No
11. Is seatbelt flat (not twisted)? Yes No NA
12. Is the proper belt path/lower strap connector path used? Yes No NA
13. Is either the latch plate or seatbelt retractor locked, or locking clips used properly? Yes No NA
14. What is the space between the CRD and vehicle seat base (in inches)?
 0 inches 4 inches
 1 inch 5 inches
 2 inches 6 inches
 3 inches NA
15. Is the CRD installation tight (1-inch rule)? Yes No NA

For Belt Positioning Boosters (BPB)

1. Is a lap and shoulder belt system used? Yes No
2. Is proper (3-point) belt being used? Yes No NA
3. Is the shoulder belt properly positioned over shoulder, collar bone, and chest? Yes No NA
4. Is the shoulder belt flat (not twisted)? Yes No NA
5. Is the lap belt properly positioned across the hips/upper thighs? Yes No NA
6. Is the lap belt flat (not twisted)? Yes No NA
7. Is the seat belt tight (not loose)? Yes No NA
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)? Yes No NA
9. What is the space between the BPB back and vehicle seat back (in inches)?
 0 inches 3 inches
 1 inch 4 inches
 2 inches NA