



# **FINAL REPORT**

## **2022 Direct Observation Survey of Child Restraint and Booster Seat Use and Misuse in Michigan**

**Prepared for:  
Michigan Office of Highway Safety Planning  
7150 Harris Drive  
Dimondale, MI 48821**



**Prepared by:  
Michigan State University  
Department of Civil and Environmental Engineering  
East Lansing, MI 48824**

**September 30, 2022**



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

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16. Abstract This study provides the results of the 2022 statewide direct observation survey of child restraint device (including booster seats) use and misuse in Michigan. Child restraint device (CRD) use rates were determined through a direct observation survey conducted near shopping centers, recreational areas, daycare centers, fast food restaurants, and other locations throughout Michigan. The direct observation survey, conducted at 54 locations between May and August of 2022, showed statewide child restraint use rates of 98.1 percent for 0 to 3-year-old children (consistent with prior surveys) and 60.5 percent for 4 to 7-year-olds (an increase from prior surveys). CRD misuse rates were determined through on-site inspections conducted at permanent inspection stations hosted at police or fire stations and various organized events, including those held at community or church festivals or health care facilities. The statewide inspections found that only 21.3 percent of the CRDs were correctly utilized, which is consistent with prior inspections performed in Michigan. In particular, forward-facing CRD show higher rates of misuse than rear-facing seats, while booster seats were misused the least. The most common seat-related misuse was loose seat installation (i.e., greater than 1-inch of lateral sway), which was observed in more than one-half of rear- and forward-facing seats, and was observed more frequently compared to the 2018 inspections. Another common misuse was the improper positioning of the harness retainer clip, which was typically too low on the child. It was also determined that nearly 41 percent of 1-year old children were prematurely seated in a forward-facing CRD, which represented a substantial increase from 2018. Similarly, approximately 15 percent of 2- and 3-year old children were prematurely seated in a booster seat. Improper harness routing below the shoulders was a common problem for forward-facing seats, which is likely a carry-over from prior rear-facing utilization of the particular seat. Excessive harness slack (greater than 1-inch) continues to persist as a common issue, especially for forward facing seats. The average risk priority numbers, which are based on both the frequency and severity of observed misuses, indicate that a majority of rear-facing and forward-facing CRDs inspected have protective capabilities that may be compromised if involved in an automobile crash. Finally, although more than 98 percent of vehicles inspected were equipped with lower anchors and tethers (LATCH), which greatly simplify attachment of the CRD to the vehicle, only 42.5 percent of CRDs were secured with LATCH.			
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## TABLE OF CONTENTS

	PAGE
1.0 INTRODUCTION .....	1
2.0 STUDY OBJECTIVES .....	2
3.0 METHODOLOGY .....	2
3.1 Site Selection .....	3
3.2 Observer Training.....	5
3.3 Data Collection Procedures for Direct Observation Survey .....	6
3.4 Data Collection Procedures for Misuse Inspections .....	7
3.5 Data Analysis.....	7
4.0 DATA SUMMARY .....	10
4.1 Child Restraint Device Use.....	10
4.2 Child Restraint Device Misuse Inspections .....	13
5.0 RESULTS.....	15
5.1 Statewide and Stratum-Level Child Restraint Device Use Rates .....	15
5.2 Child Restraint Device Use Rates by Location, Vehicle, and Driver Characteristics.....	16
5.3 Misuse Rates.....	18
5.4 Risk Priority Values for CRD Misuses.....	22
5.5 LATCH Utilization.....	25
6.0 CONCLUSIONS AND RECOMMENDATIONS .....	26
6.1 Conclusions .....	26
6.2 Recommendations.....	30
7.0 REFERENCES .....	32
APPENDIX I – LIST OF OBSERVATION LOCATIONS .....	33
APPENDIX II – LIST OF INSPECTION LOCATIONS.....	35
APPENDIX III – INSPECTION FORM.....	36

## LIST OF TABLES AND FIGURES

	PAGE
Table 1. 2020 Michigan Population Estimates of Children Ages 0 to 3 and 4 to 7 by County .....	4
Table 2. Counties Utilized for Direct Observation Survey, by Stratum .....	4
Figure 1. Sample Data Collection Form .....	6
Table 3. Summary of Observations by Stratum and Site Type.....	10
Table 4. Summary of Observations by Vehicle Characteristics .....	11
Table 5. Summary of Observations by Driver Characteristics .....	12
Table 6. Summary of Misuse Inspections by Strata, Day of Week, and Type of Site.....	13
Table 7. Summary of Misuse Inspections by Vehicle Type, CRD Type, Position in Vehicle, and Child Age .....	14
Table 8. Statewide Rate of Appropriate Child Restraint Device Use, by Age Group .....	15
Table 9. Restraint Use Proportions, by Child Age Group and Seat Type.....	15
Table 10. Child Restraint Device Use, by Stratum.....	16
Table 11. Child Restraint Device Use, by Site Type .....	16
Table 12. Child Restraint Device Use, by Vehicle Characteristics.....	17
Table 13. Child Restraint Device Use, by Driver Characteristics.....	18
Table 14. Child Restraint Device Correct Use and Misuse Rates.....	19
Table 15. Child Restraint Device Selection and Seat Orientation Characteristics.....	20
Table 16. Child Restraint Device Selection, by Age of Child .....	20
Table 17. Booster Seat Installation and Restraint Characteristics .....	21
Table 18. Rear-Facing and Forward-Facing CRD Installation and Restraint Characteristics .....	21
Table 19. Rear-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority .....	23
Table 20. Forward-Facing CRD Severity Scores, Percent Occurrence, and Risk Priority .....	24
Table 21. LATCH Availability and Utilization .....	26
Table 22. Statewide Rates of Appropriate Child Restraint Device Use, by Year.....	27
Table 23. Statewide Rates of Child Restraint Device Misuse, by Year.....	28

## 1.0 INTRODUCTION

Motor vehicle crashes are one of the leading causes of death and injury for children under 8 years of age. From 2017 to 2021, a total of 72,908 child passengers under the age of 8 were involved in 52,694 traffic crashes in Michigan [1]. Among those child-aged vehicle occupants for whom restraint use information was recorded, only 51,773 (71 percent) were restrained in some type of child-specific restraint, either a child restraint device or a belt-positioning booster seat. Amongst these children restrained in some type of child safety seat, 175 (0.3 percent) suffered fatal (K) or incapacitating (A) injuries [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 ages 4 to 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].

Over the prior two decades, Michigan has experienced increases in the use of CRDs among children under 4 years of age from 74.5 percent in 1997 to 98.2 percent in 2018 [4-9]. In spite of these gains, 61 percent of the children under the age of 4 who were killed in traffic crashes in Michigan from 2017 to 2021 were not restrained in a rear- or forward-facing CRD [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) and the Michigan State University Department of Civil and Environmental Engineering have shown roughly 70 to 80 percent of CRDs in Michigan are improperly used to some degree [4-9]. The most recent CRD study performed by MSU in 2018 found that the most common CRD misuses were (1) improper positioning of the harness retainer clip (typically too low), (2) improper harness routing height, (3) loose harness straps, and (4) excessive space between the CRD and vehicle seat (forward-facing only) [9]. This is concerning as loose harness straps, routing the harness straps too high (rear-facing only), and excessive space between the CRD and vehicle seat (forward-facing only) have been identified in previous research as some of the most severe forms of misuse [10,11]. Other severe CRD misuses include: internal harness not buckled, not buckling the seatbelt or attaching to the LATCH anchor, improper seat recline, and improper routing of the seatbelt when restraining the CRD to the vehicle seat [10,11]. Fortunately, the other severe misuses were found to occur relatively infrequently during the most recent CRD inspections performed for OHSP.

While child restraint use has remained very high among children under the age of 4, restraint use among 4 to 7-year-olds has been shown to be substantially lower [12]. There are several potential explanations for the low CRD/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 [13-19]. Following the enactment of statewide legislation in July 2008, booster seat use was found to increase substantially in Michigan [20,21]. However, while the most recent survey (2018) found that CRD/booster seat use had increased for 4 to 7-year olds compared to prior years, the overall CRD/booster use rate for this age group remained at just 54.5 percent [9].

## **2.0 STUDY OBJECTIVES**

The purpose of this study was to determine the rates of child restraint device use and misuse among children passengers under the age of 8 in 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, 2011, 2013 and 2015 studies conducted by the WSU-TRG [5,6,7,8,20,21] and the 2018 study conducted by MSU [9], 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 8 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 inspections. 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 is similar to prior surveys, utilizing a destination-based sampling strategy for both the surveys and inspections. This sampling scheme is based upon the methodology utilized during the 2009, 2010, 2011, 2013, 2015, and 2018 surveys and involves collecting data from a random sample of target age children at daycare centers, fast food restaurants, recreational sites, and shopping centers, as well as the street adjacent to each selected location.

### 3.1 Site Selection

In order to accurately determine rates of CRD and booster seat use and misuse, a representative sample of target-aged groups of children were required as a part of this study: (a) children from ages 0 to 3 and (b) children from ages 4 to 7. 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 24 counties representing greater than 78 percent of the target population (children ages 0 to 7). The counties were similar to those included in the 2009, 2010, 2011, 2013, 2015, and 2018 surveys [5,6,7,8,9,20,21]. The 2020 county census estimates for children ages 0 to 3, and children ages 4 to 7 are provided in Table 1 [22]

The candidate counties were previously partitioned into four strata based upon historical safety belt use rates and vehicle miles traveled (VMT) as per the direct observation surveys of safety belt use. This stratification was based upon the fact that CRD and booster seat use have been shown to be related to the driver's safety belt use by previous studies [5,6,7,8,9,20,21]. 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 (e.g., zoos, museums, parks, etc.), 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 in Appendix I.

Site selection for the misuse inspections was largely based upon the methodology of the 2011, 2013, 2015, and 2018 studies [6,7,8,9]. In both studies, inspections were performed at daycare centers, fire stations, 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, 2013, 2015, and 2018 studies were again contacted to determine their willingness to participate in the 2022 study. The county strata assignments for the inspections were identical to those used in the CRD direct observation surveys, although the target sample size for the inspection of the restraint use characteristics of passengers under the age of 8 was much smaller due to the time and human resources necessary to perform the inspections. A list of all CRD inspection locations is provided in Appendix II.



**Table 1. 2020 Michigan Population Estimates of Children Ages 0-3 and 4-7, by County**

County	Ages 0 to 3		Ages 4 to 7	
	Population	Percent of Statewide Population	Population	Percent of Statewide Population
Berrien	6741	1.5%	7265	1.6%
Branch	2177	0.5%	2115	0.5%
Calhoun	6184	1.4%	6863	1.5%
Cass	1909	0.4%	2208	0.5%
Cheboygan	784	0.2%	818	0.2%
Clinton	3431	0.8%	3747	0.8%
Eaton	4587	1.0%	5005	1.1%
Genesee	18,580	4.2%	19,588	4.2%
Ingham	12,414	2.8%	13,025	2.8%
Ionia	2847	0.6%	3095	0.7%
Isabella	2486	0.6%	2656	0.6%
Jackson	6912	1.6%	7381	1.6%
Kalamazoo	12,253	2.8%	12,852	2.8%
Kent	33,793	7.6%	35,123	7.5%
Livingston	7448	1.7%	8412	1.8%
Macomb	37,567	8.5%	38,972	8.3%
Marquette	2365	0.5%	2565	0.5%
Midland	3561	0.8%	3791	0.8%
Oakland	52,522	11.9%	55,563	11.9%
Ottawa	13,556	3.1%	15,437	3.3%
Saginaw	8654	2.0%	8869	1.9%
St. Joseph	3055	0.7%	3228	0.7%
Washtenaw	14,008	3.2%	14,449	3.1%
Wayne	90,498	20.4%	91,580	19.6%
<b>Sample</b>	<b>348,332</b>	<b>78.7%</b>	<b>364,607</b>	<b>78.1%</b>
<b>Statewide</b>	<b>442,869</b>	<b>100.0%</b>	<b>467,010</b>	<b>100.0%</b>

**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	Calhoun	Berrien	Macomb
Kalamazoo	Eaton	Branch	Wayne
Oakland	Jackson	Cass	
Washtenaw	Kent	Cheboygan	
	Livingston	Clinton	
	Midland	Genesee	
	Ottawa	Ionia	
		Isabella	
		Marquette	
		Saginaw	
		St. Joseph	

### **3.2 Observer Training**

Two targeted training programs specific to this project were conducted during the spring of 2022: (1) training for inspection of CRD/booster seat misuse; and (2) training for direct observation of CRD/booster seat use. All training occurred during May of 2022. Classroom training for the inspections was conducted on May 18, 2022 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.

Classroom training for the direct observation survey of child restraint use was conducted on May 16, 2022. 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. The classroom training session was followed by practice field data collection at a local recreational location. The purpose of the field data collection was to provide observers with an opportunity to gain field experience in assessing child passenger age and determining the type of child restraint use. Observers worked as a group at the start of the field training, quickly followed by a mock session where they were instructed to record the information needed to the best of their ability. Following the field training, 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 type of restraint used 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 shopping center locations in route to a daycare center scheduled to be visited later the same day. Each daycare center was researched to determine start and release 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 was performed at all types of locations, excluding daycare centers.

During the direct observation use surveys, several factors were assessed as a part of data collection. For all vehicles identified to have a 0 to 7-year-old child passenger, the driver and all target-age child passengers were observed for restraint use and non-use. A sample field observation form is shown in Figure 1.

Vehicles were observed at the entrance or exit of the observation site. At the primary observation sites where traffic volumes were relatively low, data were also collected from vehicles on the adjacent street. The vehicles were categorized into four groups: passenger vehicles, sport utility vehicles, vans/minivans, or pickup trucks. Driver restraint use, gender, age group, and ethnicity were assessed and recorded. Driver restraint use was categorized as belted, not belted, or unknown. An age assessment was required for each child passenger under age 8, in addition to the type of restraint and seating position within the vehicle. The seven restraint categories for each child were: belted, not belted, unknown, rear-facing child safety seat, front-facing child safety seat, high-back booster, or backless booster.

<input type="checkbox"/> SAME VEHICLE AS PREVIOUS <input type="checkbox"/> OBSERVED ON ADJACENT STREET															
<b>VEHICLE TYPE:</b>															
<input type="checkbox"/> Passenger Car		<input type="checkbox"/> SUV		<input type="checkbox"/> Van/Minivan		<input type="checkbox"/> Pickup Truck									
<b>DRIVER</b>															
<b>RESTRAINT USE:</b>		<b>AGE:</b>		<b>GENDER:</b>		<b>RACE:</b>									
<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"/> Unkown									
<b>CHILD PASSENGER</b>															
<b>RESTRAINT USE:</b>			<b>AGE:</b>		<b>SEATING POSITION:</b>										
<input type="checkbox"/> Belted			<input type="checkbox"/> Rear-Facing CSS		<input type="checkbox"/> Under 2										
<input type="checkbox"/> Not Belted			<input type="checkbox"/> Front-Facing CSS		<input type="checkbox"/> 2 to 3										
<input type="checkbox"/> Unknown			<input type="checkbox"/> High-Back Booster		<input type="checkbox"/> 4 to 7										
			<input type="checkbox"/> Backless Booster												
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Figure 1. Sample Data Collection Form

### 3.4 Data Collection Procedures for Misuse Inspections

A separate data collection effort included visual and hands-on inspection of the child restraint devices for children under the age of 8 at targeted locations. The same vehicle and driver data were collected as for the use rate survey. Data collected with respect to the child passengers were similar, but also included age, height, and weight information, either measured or reported by the adult driver or passenger. The vehicle year, make, and model were also noted. An initial assessment of the restraint type, location in the vehicle, direction of placement, attachment to the vehicle, and placement of the child in the device was made. LATCH availability and utilization were also noted.

Each child seated 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, including loose internal harness, 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, 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. The complete inspection checklist is included in the inspection form, which is displayed in Appendix III.

### 3.5 Data Analysis

Rates of appropriate child restraint use were determined at the statewide- and stratum-level, as well as with respect to each of the characteristics previously described. For the purposes of the direct observation survey, “appropriate” child restraint use was defined based on current Michigan law. Thus, children under the age of 4 that were seated in a rear-facing or forward-facing child safety seat were considered to be using the appropriate restraint. Premature graduation to a booster seat or safety belt was classified as inappropriate restraint use for this age group. Appropriate restraint use for children ages 4 through 7 included rear-facing restraint, forward-facing restraint, or booster seat (high back or backless). Premature graduation to safety belts (without a booster) was classified as inappropriate. The procedures used to calculate the appropriate use rates and their associated variances are outlined below.

#### 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 [4-9,20,21]. This procedure is illustrated here with respect to the appropriate use rate calculation. First, the child restraint device use rate at each study location was calculated as shown here:

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

where:

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

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

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

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

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

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

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

where:

$r_{TOTAL}$  = statewide child restraint device use rate

$p_j$  = population of target age children in stratum j

The ‘p’ values in the preceding equation are weighting factors that are necessary because strata with higher populations of target age children will have a greater impact on the statewide use rate. Separate estimates were obtained for the 0 to 3, and 4 to 7-year-old age groups.

### 3.5.2 Statewide Child Restraint Device Use Variance Calculation

Upon obtaining estimates of the child restraint device use and misuse rates for each of the four strata, the variance for each stratum was determined using the following equation [22]:

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

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 seat misuse rates for each stratum and statewide were determined based on the data obtained from the inspections. Separate misuse rates were also computed for rear-facing CRDs, forward-facing CRDs, and booster seats. 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 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. The overall statewide misuse rate was calculated by weighting the misuse rates for each of the three seat-type categories (rear-facing, forward-facing, and booster seat) based on seat use proportions obtained from the direct observation survey. The misuse rates were also compared with those obtained during prior inspections.

A severity score was also 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 [10], which were developed by CRD safety experts [11]. 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 [10]. The severity scores for each type of misuse were multiplied by the number of occurrences, resulting in a risk priority number for each type of misuse, which gives an indication of the most severe types of misuses. The risk priority numbers were then summed and averaged over the total number of observations for the particular seat type to determine the average risk priority number for both the forward-facing CRD and rear-facing CRD. LATCH availability and utilization was also computed and compared to prior surveys.

## 4.0 DATA SUMMARY

### 4.1 Child Restraint Device Use

The observational surveys of child restraint device use were performed near daycare centers, fast food restaurants, shopping centers, and recreation centers, as well as the streets adjacent to these locations between May 17, 2022 and August 17, 2022. The surveys were performed at 54 locations in 24 counties statewide. A total of 3,961 observations of 0 to 7-year-old child passengers were obtained. Summary statistics detailing the results of the child restraint use survey by stratum and site type are provided in Table 3.

**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	852	35.5%	490	31.4%
Stratum 2	558	23.3%	335	21.5%
Stratum 3	488	20.3%	305	19.5%
Stratum 4	502	20.9%	431	27.6%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</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	11	0.5%	2	0.1%
Recreation	1300	54.2%	780	50.0%
Shopping Center	229	9.5%	174	11.1%
Fast Food	130	5.4%	96	6.1%
Adjacent Street	730	30.4%	509	32.6%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>

Table 4 provides details of the number of children observed by type of vehicle and seating position. Approximately half of the target-age children in each age category were in sport utility vehicles, with lower percentages in passenger cars, vans/minivans, and pickup trucks. Approximately 6.8 percent of 4 to 7-year-old children were observed in the first row of seating. This is an increase from 2018 and is problematic since these seating positions put children at a higher risk of injury due to issues such as airbag deployment. Unfortunately, 2 children from 0 to 3 were restrained in the front seat. This is an increase from the 2018 study of 0. 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	422	17.6%	337	21.6%
Sport Utility Vehicle	1400	58.3%	761	48.8%
Van/Minivan	395	16.5%	290	18.6%
Pickup Truck	183	7.6%	173	11.1%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>
<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 - Left	0	0.0%	0	0.0%
First Row - Center	0	0.0%	2	0.1%
First Row - Right	2	0.1%	104	6.7%
Second Row - Left	1116	46.5%	590	37.8%
Second Row - Center	166	6.9%	116	7.4%
Second Row - Right	1104	46.0%	653	41.8%
Third Row - Left	7	0.3%	45	2.9%
Third Row - Center	2	0.1%	18	1.2%
Third Row - Right	3	0.1%	33	2.1%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>

Table 5 presents data on the number of children observed by various driver characteristics, including gender, age, race, and belt use. Overall, approximately 63.9 percent of children aged 0 to 3 years-old and 60.3 percent of children aged 4 to 7 years-old were riding with a female driver. Slightly more than half of the children (59.1 percent) were traveling with a driver in the 30 to 59-year-old age group and approximately 88.2 percent of the children observed were traveling with a Caucasian driver. Among 4 to 7-year-old children, 98.4 percent were traveling with a driver who was appropriately belted while 99 percent of 0 to 3-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	861	35.9%	617	39.5%
Female	1534	63.9%	942	60.3%
Unknown	5	0.2%	2	0.1%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>
<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	906	37.8%	277	17.7%
30-59	1251	52.1%	1091	69.9%
60+	235	9.8%	193	12.4%
Unknown	8	0.3%	0	0.0%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>
<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	2147	89.5%	1348	86.4%
Black	112	4.7%	104	6.7%
Other	134	5.6%	102	6.5%
Unknown	7	0.3%	7	0.4%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>
<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	2377	99.0%	1536	98.4%
Not Belted	11	0.5%	12	0.8%
Unknown	12	0.5%	13	0.8%
<b>Total</b>	<b>2400</b>	<b>100.0%</b>	<b>1561</b>	<b>100.0%</b>

#### 4.2 Child Restraint Device Misuse Inspections

The misuse inspections were performed at 17 locations statewide between May 20 and August 24, 2022. Note, of these 17 locations, only 15 yielded inspections, which is reflected in Table 6. A total of 91 complete inspections of the CRD/boosters used by child passengers under the age of 8 were performed, including 41 under age 2, 26 in the 2 to 3-year-old range, and 24 in the 4 to 7-year-old age range. 14 inspections were performed at three sites in Stratum 1, 8 inspections at two sites in Stratum 2, 57 inspections at eight sites in Stratum 3, and 12 inspections at two 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. Summary of Misuse Inspections by Strata, Day of Week, and Type of Site**

<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	3	20.0%	14	15.4%
Stratum 2	2	13.3%	8	8.8%
Stratum 3	8	53.4%	57	62.6%
Stratum 4	2	13.3%	12	13.2%
<b>Total</b>	<b>15</b>	<b>100.0%</b>	<b>91</b>	<b>100.0%</b>
<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	1	6.7%	11	12.1%
Monday	3	20.0%	9	9.9%
Tuesday	1	6.7%	5	5.5%
Wednesday	2	13.3%	9	9.9%
Thursday	3	20.0%	34	37.4%
Friday	3	20.0%	18	19.8%
Saturday	2	13.3%	5	5.5%
<b>Total</b>	<b>15</b>	<b>100.0%</b>	<b>91</b>	<b>100.0%</b>
<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>
Health Care Center or Hospital	3	20.0%	9	9.9%
Community, Church, or Corporate Event	4	26.7%	34	37.4%
Fire or Police Station	8	53.3%	48	52.7%
<b>Total</b>	<b>15</b>	<b>100.0%</b>	<b>91</b>	<b>100.0%</b>

**Table 7. Summary of Misuse Inspections by Vehicle Type, CRD Type, Position in Vehicle, and Child Age**

<b>Vehicle Type</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Passenger Car	19	20.9%
Sport Utility Vehicle	51	56.0%
Van/Minivan	15	16.5%
Pick-up Truck	6	6.6%
<b>Total</b>	<b>91</b>	<b>100.0%</b>
<b>Type of Restraint</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Rear-Facing CRD	36	39.6%
Forward-Facing CRD	37	40.7%
Belt Positioning Booster	18	19.8%
<b>Total</b>	<b>91</b>	<b>100.0%</b>
<b>Position of the Child</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Front Passenger	0	0.0%
Second Row Left	31	34.1%
Second Row Middle	13	14.3%
Second Row Right	40	44.0%
Third Row Left	1	1.1%
Third Row Middle	0	0.0%
Third Row Right	6	6.6%
<b>Total</b>	<b>91</b>	<b>100.0%</b>
<b>Age of Child</b>	<b>No. of Inspections</b>	<b>Pct. of Inspections</b>
Less than 1 Year	19	20.9%
1 Year – Less than 2 Years	22	24.2%
2 Years – Less than 3 Years	12	13.2%
3 Years – Less than 4 Years	14	15.4%
4 Years – Less than 5 Years	12	13.2%
5 Years – Less than 6 Years	5	5.5%
6 Years – Less than 7 Years	3	3.3%
7 Years	4	4.4%
<b>Total</b>	<b>91</b>	<b>100.0%</b>

## 5.0 RESULTS

### 5.1 Statewide and Stratum-Level Child Restraint Device Use Rates

The statewide child restraint device use rates were calculated based upon the procedure described in the previous section for the 3,961 children for which restraint use could be determined. The CRD use rates displayed in Table 8 represent the weighted statewide percentages of 0 to 3-year old children seated in rear-facing or forward-facing seats and of 4 to 7-year-old children seated in rear-facing, forward facing, or booster seats. The weighted statewide child restraint use rates were 98.1 percent for 0 to 3-year-old children and 60.5 percent for 4 to 7-year-old children. The 0 to 3-year-old use rate represents a 0.1 percent decrease over the 98.2 percent use rate observed during the 2018 survey [9]. Further, the 60.5 percent use rate for 4 to 7-year-olds represents a 6.0 percent increase over the 54.5 percent use rate observed during the 2018 survey [9].

**Table 8. Weighted Statewide Rate of Appropriate Child Restraint Device Use, by Age Group**

Age Group	CRD Use Rate*	Standard Error
0-to-3 years old	98.1% ± 0.75%	0.38%
4-to-7 years old	60.5% ± 4.89%	2.49%

\*Use rate based on 0 to 3-year-old children seated in rear-facing or forward-facing seats and 4 to 7-year old children seated in rear-facing, forward facing, or booster seats.

Table 9 displays the proportional breakdown of observations by seat type. When examining each of the specific restraint types, 37.1 percent of 0 to 3-year-old children were restrained in rear-facing child safety seats and 60.8 percent were in forward-facing safety seats. Among 4 to 7-year-olds, approximately 23.1 percent of children were restrained in front-facing child safety seats, 21.3 percent were observed in high-back boosters, and 16.1 percent were in backless boosters, as shown in Table 9. The percentage of children ages 0 to 3 traveling completely unrestrained was 0.3 percent, while the percentage of unrestrained children among 4 to 7-year-olds was 3.7 percent. Most concerning was the 35.7 percent of 4 to 7-year-olds that were restrained using only the safety belt.

**Table 9. Restraint Use Proportions, by Child Age Group and Seat Type**

Age Group	Rear-Facing CRD	Forward-Facing CRD	High Back Booster	Backless Booster	Safety Belt Only	Not Restrained
Ages 0-to-3	37.1%	60.8%	0.9%	0.7%	0.2%	0.3%
Ages 4-to-7	0.2%	23.1%	21.3%	16.1%	35.7%	3.7%
<b>OVERALL Ages 0-to-7</b>	<b>22.5%</b>	<b>45.9%</b>	<b>9.0%</b>	<b>6.8%</b>	<b>14.2%</b>	<b>1.6%</b>

When examining child restraint device use by stratum, the use rates among 0 to 3-year-olds ranged from 97.0 percent in Stratum 2 to 99.0 percent in Stratum 4. Among 4 to 7-year-olds, the use rates were highest in Stratum 3 (62.8 percent) and lowest in Stratum 4 (59.4 percent). These results are reflected in Table 10.

**Table 10. Child Restraint Device Use, by Stratum**

Stratum	Age 0-3		Age 4-7	
	CRD Use Rate	Std. Error	CRD Use Rate	Std. Error
Stratum 1	98.1% ± 2.16%	1.10%	60.0% ± 11.04%	5.63%
Stratum 2	97.0% ± 1.42%	0.73%	61.2% ± 11.94%	6.09%
Stratum 3	97.7% ± 1.93%	0.98%	62.8% ± 7.94%	4.05%
Stratum 4	99.0% ± 0.70%	0.36%	59.4% ± 7.26%	3.71%

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

This section provides details of the (unweighted) child restraint device use rates based upon vehicle and driver characteristics among the 3,691 children for which restraint use could be determined. Again, the CRD use rates represent the percentages of 0 to 3-year-old children seated in rear-facing or forward-facing seats and of 4 to 7-year old children seated in rear-facing, forward facing, or booster seats. 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. CRD use rates were the highest at daycare centers and shopping centers for children aged 0 to 3 and at day care centers and recreational locations for children aged 4 to 7. The lowest CRD use rates were observed at fast food restaurants for children aged 0 to 3 as well as for children aged 4 to 7.

**Table 11. Child Restraint Device Use, by Site Type**

Location Type	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
Daycare Center	11	11	100.0%	2	2	100.0%
Recreation	1274	1300	98.0%	520	780	66.7%
Shopping Center	227	229	99.1%	92	174	52.9%
Fast Food	125	130	96.2%	48	96	50.0%
Adjacent Street	713	730	97.7%	285	509	56.0%
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.9%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>

Table 12 displays very little variability between the CRD use rates across vehicle types for 0 to 3-year-olds, although passenger cars were slightly lower. However, among 4 to 7-year-olds, CRD use was clearly highest for drivers of minivans and lowest for passenger cars. CRD use was also particularly low for children restrained in the first row of seats.

**Table 12. Child Restraint Device Use, by Vehicle Characteristics**

Vehicle Type	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
Passenger Car	407	422	96.4%	120	337	35.6%
Sport Utility Vehicle	1,378	1,400	98.4%	507	761	66.6%
Van/Minivan	385	395	97.5%	224	290	77.2%
Pickup Truck	180	183	98.4%	96	173	55.5%
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.9%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>
Child Passenger Seating Position	Age 0-3 in CRD	Age 0-3 Total	Age 0-3 CRD Use Rate	Age 4-7 in CRD	Age 4-7 Total	Age 4-7 CRD Use Rate
First Row - Left	0	0	-	0	0	-
First Row - Center	0	0	-	0	2	0.0%
First Row - Right	2	2	100.0%	5	104	4.8%
Second Row - Left	1,097	1,116	98.3%	373	590	63.2%
Second Row - Center	163	166	98.2%	47	116	40.5%
Second Row - Right	1,077	1,104	97.6%	452	653	69.2%
Third Row - Left	6	7	85.7%	33	45	73.3%
Third Row - Center	2	2	100.0%	13	18	72.2%
Third Row - Right	3	3	100.0%	24	33	72.7%
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.9%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>

Table 13 displays the rate of child restraint device use by various driver characteristics. The CRD use rates for 4-7 year olds were lower among male drivers as compared to female drivers, although no substantive differences were observed between male and female drivers for 0-3 year olds. Analysis by driver age group showed little distinction in CRD use rates for 0 to 3-year-old passengers, while drivers between 16 and 29 were less likely to appropriately restrain 4 to 7-year-olds (44.4 percent). White drivers showed higher rates of appropriate child restraint use, while black drivers displayed the lowest use rates, particularly for 4 to 7-year-olds (38.5 percent). Finally, unlike prior CRD surveys in Michigan, child restraint device use was similarly lower for 0 to 3-year-old children traveling with drivers who were belted vs. unbelted. However, this result is likely due to the very small sample of unbelted drivers.

**Table 13. Child Restraint Device Use, by Driver Characteristics**

<b>Driver Gender</b>	<b>Age 0-3 in CRD</b>	<b>Age 0-3 Total</b>	<b>Age 0-3 CRD Use Rate</b>	<b>Age 4-7 in CRD</b>	<b>Age 4-7 Total</b>	<b>Age 4-7 CRD Use Rate</b>
Male	844	861	98.0%	350	617	56.7%
Female	1,501	1,534	97.8%	595	942	63.2%
Unknown	5	5	100.0%	2	2	100.0%
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.9%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>
<b>Driver Age</b>	<b>Age 0-3 in CRD</b>	<b>Age 0-3 Total</b>	<b>Age 0-3 CRD Use Rate</b>	<b>Age 4-7 in CRD</b>	<b>Age 4-7 Total</b>	<b>Age 4-7 CRD Use Rate</b>
16-29	890	906	98.2%	123	277	44.4%
30-59	1,223	1,251	97.8%	706	1,091	64.7%
60+	229	235	97.4%	118	193	61.1%
Unknown	8	8	100.0%	0	0	-
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.9%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>
<b>Driver Race</b>	<b>Age 0-3 in CRD</b>	<b>Age 0-3 Total</b>	<b>Age 0-3 CRD Use Rate</b>	<b>Age 4-7 in CRD</b>	<b>Age 4-7 Total</b>	<b>Age 4-7 CRD Use Rate</b>
White	2,104	2,147	98.00%	847	1,348	62.8%
Black	108	112	96.43%	40	104	38.5%
Other	131	134	97.76%	54	102	52.9%
Unknown	7	7	100.00%	6	7	85.7%
<b>Total</b>	<b>2,350</b>	<b>2,400</b>	<b>97.92%</b>	<b>947</b>	<b>1,561</b>	<b>60.7%</b>
<b>Driver Restraint</b>	<b>Age 0-3 in CRD</b>	<b>Age 0-3 Total</b>	<b>Age 0-3 CRD Use Rate</b>	<b>Age 4-7 in CRD</b>	<b>Age 4-7 Total</b>	<b>Age 4-7 CRD Use Rate</b>
Belted	2,327	2,377	97.9%	935	1,536	60.9%
Not Belted	11	11	100.0%	4	12	33.3%

**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. As the inspections were concerned with utilization of the seat itself, cases where no CRD or booster seat was utilized (e.g., using the vehicle restraint system only or unrestrained) were not considered. Table 14 shows the statewide misuse rate in addition to the misuse rate broken down by CRD type (rear-facing, forward-facing, and booster seats only), age group, and stratum.

**Table 14. Child Restraint Device Correct Use and Misuse Rates**

Type of CRD	No. of Inspections	Correct Use Rate	Misuse Rate
Rear-Facing	36	25.0%	75.0%
Forward Facing	37	13.5%	86.5%
Belt Positioning Booster Seat	18	38.9%	61.1%
Age Group	No. of Inspections	Correct Use Rate	Misuse Rate
0 - 3	67	17.9%	82.1%
4 - 7	24	37.5%	62.5%
Stratum	No. of Inspections	Correct Use Rate	Misuse Rate
Stratum 1	14	0%	100%
Stratum 2	8	37.5%	62.5%
Stratum 3	57	22.8%	77.2%
Stratum 4	12	41.7%	58.3%
<b>Statewide (Weighted)*</b>	<b>91</b>	<b>21.3%</b>	<b>78.7%</b>

\*Weighted based on seat use proportions from direct observation survey of 26.7%, 54.5%, and 18.8% for rear-facing, forward-facing, and booster seats, respectively.

Statewide, only 21.3 percent of the inspections of the restraint characteristics of children under age 8 showed utilization of the appropriate CRD, correct CRD installation, and correct restraint of the child within the CRD. The remaining 78.7 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses), which represents the weighted overall statewide misuse rate for children under the age of 8. The overall misuse rate of 78.7 percent is slightly lower than the 79.5 percent rate observed during the 2018 inspections, but higher than the 74.0 percent observed during the 2015 inspections. The overall misuse rate for children under 4 was 82.1 percent, which decreased to 62.5 percent for children ages 4 to 7, who were typically seated in booster seats. Both of these age-group specific misuse rates were similar to those observed during inspections performed in prior years. It was not possible to perform any meaningful stratum-level comparisons due to small sample sizes in all but Stratum 3.

Rear-facing CRDs had an overall misuse rate of 75.0 percent, which was similar to the 74.6 percent rate observed during 2018 and considerably lower than the 81.1 percent observed during 2015. Forward facing CRDs showed a slight decrease in misuse, down from 87.4 percent in 2018 to 86.5 percent in the current study. As expected, the lowest observed misuse rates were for children seated in booster seats, with a misuse rate of 61.1 percent, which was slightly higher than the 59.0 percent observed in the 2018 inspections. Booster seats have historically had lower rates of misuse compared to rear and forward facing CRDs, which is likely due to the reduced complexity of booster seat installation and utilization compared to the other 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 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. Child Restraint Device Selection and Seat Orientation Characteristics**

CRD Characteristic	Percent Correct	Percent Incorrect
Restraint appropriate for child’s age*	85.7%	14.3%
Restraint appropriate for child’s height	86.8%	13.2%
Restraint appropriate for child’s weight**	97.3%	2.7%
CRD facing proper direction for child’s age/weight*,**	83.5%	16.5%
Seat intended to be used in direction installed**	98.6%	1.4%
CRD installed on a forward-facing vehicle seat	100%	0.0%

\*Forward-facing seat utilization is considered misuse for children under the age of 2. Booster seat utilization is considered misuse for children under the age of 4.

\*\*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. These values show somewhat lower percent correct compared to those observed in the 2018 inspections. The most common CRD selection/orientation misuses were inappropriate seat selection based on age and height, due in large part to the premature transition of children between the ages of 1 and 2 into forward facing CRDs. This issue is further delineated in Table 16, which displays the types of seats utilized by each age group.

**Table 16. Child Restraint Device Selection, by Age of Child**

Age	Rear-Facing CRD		Forward-Facing CRD		Booster Seat	
	No.	Pct. of Age Group	No.	Pct. of Age Group	No.	Pct. of Age Group
0	19	100%	0	0%	0	0%
1	13	59%	<b>8</b>	<b>36%</b>	<b>1</b>	<b>5%</b>
2	3	25%	7	58%	<b>2</b>	<b>17%</b>
3	1	7%	11	79%	<b>2</b>	<b>14%</b>
4	0	0%	8	67%	4	33%
5	0	0%	2	40%	3	60%
6	0	0%	1	33%	2	67%
7	0	0%	0	0%	4	100%

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 41 percent of 1-year old children were prematurely transitioned into a forward-facing CRD or booster seat prior to the age of 2, which is the minimum age to ride in a forward facing CRD in the guidance established by the American Association of Pediatrics (AAP) in August 2018 [24]<sup>1</sup>. This represents a considerable increase over the 22 percent observed for the 1-year old age group during the 2018 inspections. Similarly, 17 percent and 14 percent of the 2- and 3-year old age groups, respectively, had been prematurely transitioned into a booster seat, which should not occur until the child has reached at least 4 years of age [24]. These rates were also higher than the 9 percent observed for each of these age groups in 2018. 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, which are summarized in Table 18.

<sup>1</sup> Note: Michigan law only states that a “child less than 4 years of age” must be properly secured in a “child restraint system” that meets federal requirements and “in a rear seat” if one is available [MCL 257.710d(1,2)].

**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>	<b>55.6%</b>	<b>44.4%</b>
<b>Backless Booster: Vehicle seat back high enough to restrain child’s head</b>	<b>61.6%</b>	<b>38.4%</b>
<b>Seat belt tight</b>	<b>66.7%</b>	<b>33.3%</b>
Lap belt properly positioned across hips and upper thighs	77.8%	22.2%
Shoulder belt flat	77.8%	22.2%
Lap belt flat	77.8%	22.2%
3-point lap-shoulder belt used	94.5%	5.5%
Proper space between booster back and vehicle seat back	94.5%	5.5%

Note: boldface indicates a common misuse (i.e., greater than 25 percent misuse). Data represents 18 booster seat inspections. Characteristics are sorted by misuse rate (highest to lowest).

**Table 18. Rear-Facing and Forward-Facing CRD Installation and Restraint Characteristics**

<b>CRD Characteristic</b>	<b>Rear-Facing CRDs (n=36)</b>		<b>Forward-Facing CRDs (n=37)</b>	
	<b>Percent Correct</b>	<b>Percent Incorrect</b>	<b>Percent Correct</b>	<b>Percent Incorrect</b>
<b>CRD installation tight (1 in or less lateral sway)</b>	47.2%	<b>52.8%</b>	43.2%	<b>56.8%</b>
<b>Harness retainer clip in proper location</b>	66.7%	<b>33.3%</b>	51.4%	<b>48.6%</b>
<b>Shoulder harness straps route into CRD at proper height</b>	66.7%	<b>33.3%</b>	51.4%	<b>48.6%</b>
Harness straps tight (1 in or less slack)	77.8%	22.2%	67.6%	<b>32.4%</b>
Seatbelt/LATCH properly buckled and tight	80.6%	19.4%	73.0%	<b>27.0%</b>
Proper belt path/LATCH connector path used	88.9%	11.1%	83.8%	16.2%
Harness retainer clip fastened and properly oriented	91.7%	8.3%	86.5%	13.5%
Harness straps flat	91.7%	8.3%	75.7%	24.3%
Internal harness buckled	94.4%	5.6%	100.0%	0.0%
Crotch strap flat	94.4%	5.6%	86.5%	13.5%
CRD at the proper angle	94.4%	5.6%	94.6%	5.4%
Only one vehicle system used to attach CRD	100.0%	0.0%	91.8%	8.2%
Top tether routed correctly over/under headrest	N/A	N/A	84.7%	15.3%
No excess space between CRD and vehicle seat	N/A	N/A	97.3%	2.7%

Note: boldface indicates a common misuse (i.e., greater than 25 percent misuse). Characteristics are sorted by misuse rate for rear-facing seats (highest to lowest).

A discussion of the itemized CRD and booster seat misuses displayed in Tables 17 and 18 is as follows:

- The most common misuse for both rear- and forward-facing CRDs was loose seat installation (i.e., greater than 1-inch of lateral sway). Not surprisingly, this often stems from the seat belt or LATCH straps not sufficiently tight or not buckled to the vehicle seat.

- Improper positioning of the harness retainer clip (typically too low) was observed in 33.3 percent of the rear-facing seats and 48.6 percent of the forward-facing seats. Although low harness retainer clips have historically been a problem in prior CRD misuse inspections, and continue to be so, the problem seems to have decreased considerably for rear-facing seats since the 2018 inspections.
- Improper shoulder harness routing was observed in approximately 33.3 percent of the rear facing and 48.6 percent of the forward-facing seats, which are both higher than observed in the 2018 survey. In many cases, this misuse for forward-facing seats results from the harnesses being routed below the shoulders, which is likely a carry-over from rear-facing utilization of the particular seat.
- Excessive harness slack was observed in 22.2 percent and 32.4 percent of the rear- and forward-facing seats, respectively, both increases from the 2018 inspections.
- Twisted harness straps were present in 24.3 percent of the forward-facing seats, although this was not a common misuse for rear-facing seats.
- Alarming, the internal harness was not buckled in 5.6 percent of the rear-facing seats, although this was not observed for forward-facing seats.
- Excess space between the CRD and the vehicle seat-back was not observed to be a problem for either forward-facing CRDs or booster seats (not applicable to rear-facing seats), both improvements from the 2018 inspections.
- The top tether was routed incorrectly over/under the headrest in 15.3 percent of the forward-facing seats for which a tether was utilized, a considerable improvement over the 2018 inspections.
- One misuse that continues to be improved from prior inspections is the seat recline angle for rear facing seats, which is no longer considered a primary misuse. This may be due to improvements in the seat recline guidance provided on modern CRDs.
- The most common misuses for booster seats were improper positioning of the shoulder belt over the shoulder and chest (44.4 percent), vehicle seat back not high enough to restrain the child's head for backless boosters (38.4), and seat belt too loose (33.3 percent).

#### **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 7.7. The forward-facing CRDs average risk priority number of 6.8 was lower than that 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 both rear-facing and forward-facing CRDs indicate that 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 [10,11]</b>	<b>Number of Occurrences</b>	<b>Risk Priority Number</b>
Shoulder harness straps routed too high	6.3	12	75.6
Seatbelt routed incorrectly	9	4	36
Seatbelt/LATCH was not buckled	7	4	28
Harness too loose ( $\geq 4$ fingers)	6.7	4	26.8
Harness too loose (2 fingers)	1.7	13	22.1
Harness retainer clip was too low	2	11	22
Internal harness was not buckled	10	2	20
Harness too loose (3 fingers)	4.3	4	17.2
Shoulder harness straps were twisted	2.7	3	8.1
Crotch strap was twisted	3.5	2	7
Harness retainer clip was not attached	2.3	3	6.9
CRD was reclined at improper angle	3	2	6
Harness retainer clip was too high	2.5	1	2.5
<b>Average Risk Priority Number per Rear-Facing CRD (n=36)</b>			<b>7.7</b>

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

<b>Forward-Facing CRD Misuse</b>	<b>Severity Score [10,11]</b>	<b>Number of Occurrences</b>	<b>Risk Priority Number</b>
Harness too loose ( $\geq 4$ fingers)	6.3	7	44.1
Seatbelt/LATCH was not buckled	6	6	36
Shoulder harness straps routed too low	2.3	10	23
Harness retainer clip was too low	1.5	13	19.5
Harness too loose (3 fingers)	3.7	5	18.5
Tether routed incorrectly	9	2	18
Crotch strap was twisted	3.5	5	17.5
Shoulder harness straps were too high	1.7	8	13.6
Shoulder harness straps were twisted	1.3	9	11.7
Harness retainer clip was not attached	2	5	10
CRD was reclined at improper angle	4.6	2	9.2
Harness too loose (2 fingers)	1.3	7	9.1
Space between CRD and vehicle seat 2"	4	2	8
Space between CRD and vehicle seat 4"	6	1	6
Harness retainer clip was too high	2.5	2	5
Space between CRD and vehicle seat 1"	2	1	2
Internal harness was not buckled	10	0	0
Space between CRD and vehicle seat 3"	5	0	0
<b>Average Risk Priority Number per Forward-Facing CRD (n=37)</b>			<b>6.8</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 misuses that should be emphasized for correction based on the risk priority number. The highest priority misuses for rear- and forward-facing seats are as follows, based on those misuses with the highest risk priority numbers:

- Rear-Facing CRDs
  - Shoulder harness straps routed too high. Similar to inspections performed in prior years, this misuse represents the highest priority risk for rear-facing seats. Shoulder harness straps in rear-facing seats should be routed at or below the child's shoulders to help prevent ejection from the seat.

- Excessive harness slack. The second highest priority risk for rear-facing CRD misuse was excessive harness slack, particularly 3 fingers (approximately 2 inches) or greater of slack. The severity of this misuse obviously becomes greater as the harness loosens. An improperly tightened harness may potentially allow for the child to eject from the CRD in the event of a crash.
- Seatbelt routed incorrectly. Incorrect routing of the seat belt through the seat is a very high severity misuse as it compromises the crashworthiness of the seat. Fortunately, the rate of occurrence was low.
- Seatbelt/LATCH not buckled. Failure to buckle the seatbelt/LATCH leaves the seat free to move about within the vehicle during a collision and is considered a very severe misuse. Fortunately, the rate of occurrence was relatively low.
- Harness retainer clip too low. Although the severity score is relatively low, this was one of the most frequent misuse for rear-facing CRDs (30.6 percent), leading to a relatively high-risk priority number. The harness retainer clip should be at armpit level.
- Internal harness was not buckled. The internal harnesses were not buckled in approximately 1 in 20 rear-facing CRDs. Not buckling of the internal harness creates a high likelihood of ejection in the event of a crash.
- Forward-Facing CRDs
  - Excessive harness slack. The highest priority risk for forward-facing CRD misuse was excessive harness slack, particularly 3 fingers (approximately 2 inches) or greater of slack. The severity of this misuse obviously becomes greater as the harness loosens. An improperly tightened harness may potentially allow for the child to eject from the CRD in the event of a crash.
  - Seatbelt/LATCH not buckled. Failure to buckle the seatbelt/LATCH leaves the seat free to move about within the vehicle during a collision and is considered a very severe misuse. This was observed in 16.2 percent of the inspections.
  - Shoulder harness straps routed too low. Shoulder harness straps should be at or above the shoulders for forward-facing CRDs. Although this was a relatively low severity misuse, it was observed in greater than one in four cases. This is often a result of rear/forward convertible seats typically being initially used in the rear-facing position, for which the shoulder straps should be routed at or below the shoulders.
  - Harness retainer clip too low. Although the severity score is relatively low, this was the most frequent misuse for forward-facing CRDs (35.1 percent), leading to a relatively high-risk priority number. The harness retainer clip should be at armpit level.
  - Improper routing of top tether. This is a severe misuse for forward-facing seats, which fortunately was not frequently observed during inspections. The top tether should be routed over a fixed headrest and under a movable headrest.

## 5.5 LATCH Utilization

During the inspections, the observers also noted whether or not the LATCH system was available within the vehicle and, if so, whether or not the vehicle's 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**

<b>CRD Type</b>	<b>Pct. of Vehicles Equipped with LATCH</b>	<b>Pct. of Equipped Vehicles Using LATCH</b>	<b>Pct. of All Vehicles Using LATCH</b>
Rear-Facing	97.2%	51.4%	52.7%
Forward-Facing	100%	32.4%	32.4%
<b>Total</b>	<b>98.6%</b>	<b>41.6%</b>	<b>42.5%</b>

The LATCH system was utilized to secure the CRD in 42.5 percent of the inspected vehicles, even though 98.6 percent of all inspected vehicles were LATCH equipped. Not surprisingly, the percent of vehicles equipped with LATCH has increased since prior inspection studies, increasing from 90.7 percent of vehicles in 2018 to 98.6 percent in 2022. Unfortunately, LATCH was utilized at approximately the same level as that observed during the 2018 inspections. This is in spite of the increase in the proportion of vehicles being equipped with LATCH and the fact that LATCH greatly simplifies the attachment of the CRD to the vehicle seat.

## **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 0 through 7. The child restraint use rates were determined through a direct observation survey conducted at or near shopping centers, recreational areas, daycare centers, fast food restaurants, and general roadside locations throughout the state of Michigan. Misuse rates were determined through in-vehicle inspections conducted at permanent inspection stations hosted at police or fire stations and various organized events, including those held at community or church festivals or health care facilities.

### **6.1 Conclusions**

#### *6.1.1 CRD/Booster Seat Utilization*

The statewide child restraint device roadside direct observation survey was performed between May 17 and August 17, 2022. During this observation period, a total of 3,961 observations of 0 to 7-year-old child passengers were conducted at daycare centers, fast food restaurants, shopping centers, and recreation centers, as well as on streets adjacent to these locations throughout the 24-county sample.

The direct observation survey showed children ages 0 to 3 were seated in a rear or forward facing CRD in 98.1 percent of the statewide observations, and children ages 4 to 7 were restrained in a rear or forward facing CRD or booster seat in 60.5 percent of the statewide observations. These usage rates have increased from prior surveys conducted in 2009, 2011, 2013, 2015, and 2018, especially for 4 to 7-year-olds, which is reflected in Table 22. It should be noted that Michigan's current child restraint and booster seat law was enacted in 2008.

**Table 22. Statewide Rates of Appropriate Child Restraint Device Use, by Year**

Age Group	CRD Use Rate by Year*					
	2009/2010	2011	2013	2015	2018	2022
0-to-3 years old	94.9%	95.0%	93.6%	95.7%	98.2%	98.1%
4-to-7 years old	44.5%	43.9%	42.4%	49.7%	54.5%	60.5%

\*Use rate based on 0 to 3-year-old children seated in rear-facing or forward-facing seats and 4 to 7-year-old children seated in rear-facing, forward facing, or booster seats.

Several additional conclusions regarding CRD and booster seat utilization are summarized as follows:

- CRD use rates were relatively consistent between the various location types for children aged 0 to 3. For children aged 4 to 7, the highest CRD use rates were observed near recreation areas (e.g., zoos, museums).
- CRD use rates were relatively consistent between the various vehicle types for children aged 0 to 3. Among 4 to 7-year-olds, CRD use was highest for vans/minivans and was considerably lower for passenger cars compared to all other vehicle types. Specifically, for 4 to 7-year olds, the rate of CRD use in passenger cars was less than one-half of the use rate in vans/minivans.
- Little difference in CRD use was observed between male and female drivers for 0 to 3-year-olds. However, for 4 to 7-year-olds, CRD use rates were higher when the driver was female.
- Little difference in CRD use was observed across the various driver age groups for 0 to 3-year-olds. However, drivers between ages 16 and 29 were less likely to use an appropriate restraint for 4 to 7-year-olds.
- White drivers showed the highest CRD use rates for both 0 to 3 and 4 to 7-year-olds, while black drivers showed the lowest rates, particularly for 4 to 7-year-olds. Specifically, the rate of CRD use for 4 to 7-year olds with a black driver was 40 percent lower than when the driver was white. These findings are consistent with prior CRD observation surveys.
- The sample of unbelted drivers was too small to draw meaningful conclusions relating driver belt use to CRD use. However, prior CRD surveys in Michigan have found driver belt use to be a significant determinant of CRD or booster seat use for child passengers within the same vehicle. Furthermore, other research has shown that unrestrained children are generally found with riskier drivers, including those who are less likely to be properly restrained and more likely to be crash-involved [25].
- No significant differences were found between usage rates across the various strata.

#### *6.1.2 CRD/Booster Misuse*

The misuse inspections were performed at 17 locations statewide between May 20 and August 24, 2022. A total of 91 inspections of the restraint devices used by child passengers under the age of 8 were performed, including 41 under age 2, 26 in the 2 to 3-year old range, and 24 in the 4 to 7-year old age range. It is important to note that the number of inspection events available during 2022 and was down considerably from prior years. Furthermore, public attendance at the events was also considerably lower than prior years, reducing the average number of inspections performed at each event from 9.0 in 2018 to 5.4 in 2022. These declines resulted in a significant reduction in the



number of inspections performed as a part of this project and were almost certainly due to the lingering effects of the COVID-19 pandemic in Michigan, which contributed to the following issues:

- 2022 was the first attempt at scheduling large seat-check events since 2019, which presented marketing and advertising challenges for the event coordinators, some of which are new and/or inexperienced;
- The surge in COVID cases during summer 2022 brought a reluctance for parents to attend seat check events, particularly with young children; and
- Some prior event locations were not receptive to hosting seat-check events due to the ongoing pandemic.

Statewide, only 21.3 percent of the inspections of the restraint characteristics of children under age 8 showed utilization of the appropriate CRD, correct CRD installation within the vehicle, and correct restraint of the child within the CRD. The remaining 78.7 percent of the inspections showed one or more improper restraint characteristics (i.e., misuses), which represents the overall weighted statewide misuse rate for children under the age of 8. As can be observed in Table 23, the overall misuse rate is similar to the most recent inspections performed in 2018, and somewhat higher than that observed during the 2011, 2013, and 2015 inspections. This is largely due to a substantial increase in the misuse of forward-facing CRDs, which have increased substantially since prior surveys, which is reflected in Table 23. Rear-facing seats have experienced the opposite trend, as an overall decline in misuse for rear-facing seats has been observed since 2011. Because forward-facing seats represent greater than one-half of all CRDs observed during the surveys, they carry substantial weight in the overall misuse rate calculation. Booster seat misuse rates have remained consistent during that time.

**Table 23. Statewide Rates of Child Restraint Device Misuse, by Year**

Age Group	Misuse Use Rate by Year				
	2011	2013	2015	2018	2022
Rear-Facing CRD	86.1%	87.8%	81.1%	74.6%	75.0%
Forward-Facing CRD	75.8%	77.2%	80.0%	87.4%	86.5%
Booster Seat	60.2%	58.7%	60.0%	59.0%	61.1%
<b>OVERALL</b>	73.9%*	74.9%*	74.0%**	79.5%**	78.7%**

\*Unweighted

\*\* Weighted based on seat use proportions from direct observation survey

Several conclusions were also drawn regarding common CRD/booster misuses, which are summarized as follows:

- 41 percent of 1-year old children were (prematurely) seated in a forward-facing CRD, which the AAP now recommends should not occur until the weight or height of the seat has been exceeded for the rear facing position, which almost never occurs for children under age 2 [24]. This rate is up substantially from the 22 percent observed in the 2018 misuse inspections.
- Similarly, 17 percent and 14 percent of the 2- and 3-year old age groups, respectively, had been prematurely transitioned into a booster seat, which should not occur until the child has reached at least 4 years of age [24]. These rates were also higher than the 9 percent observed for each of these age groups in 2018.

- The most common seat-related misuse for both rear- and forward-facing CRDs was loose seat installation (i.e., greater than 1-inch of lateral sway), which was observed in more than one-half of rear- and forward-facing seats, and was observed more frequently compared to the 2018 survey.
- Another common misuse was improper positioning of the harness retainer clip (typically too low). Although the misuse rates had decreased from 2018, it was still observed for approximately one-third of rear-facing seats and one-half of forward-facing seats. This issue undoubtedly persists due to the clip being carried downward by gravity, which is exacerbated by the increased vertical incline of forward-facing seats.
- Improper routing of the shoulder harness straps continues to be a common problem, especially for forward-facing seats, which is likely a carry-over from rear-facing utilization of the particular seat.
- Excessive harness slack (greater than 1-inch) continues to persist, especially for forward facing seats. A common reason given by parents for not tightening the harness properly was they did not want the harness to cause discomfort to the child.
- One misuse that continues to be improved from prior inspections is the seat recline angle for rear facing seats, which is no longer considered a primary misuse. This may be due to improvements in the seat recline guidance provided on modern CRDs.
- Other misuses that are no longer significant issues include excess space between the CRD and the vehicle seat-back and routing of the top tether over or under the vehicle headrest.
- Twisted harness straps (twisted seat belts for booster seats) were present in approximately 1 in 4 forward-facing CRDs and booster seats, although this was not a common misuse for rear-facing seats.
- The most common misuses for booster seats were improper positioning of the shoulder belt over the shoulder and chest, vehicle seat back not high enough to restrain the child's head (backless boosters only), and seat belt too loose.
- The percent of vehicles equipped with the LATCH system has increased since prior inspection studies, increasing from 90.7 percent of vehicles in 2018 to 98.6 percent in 2022. However, LATCH utilization (42.5 percent of all vehicles) has remained relatively constant since 2018.

In terms of risk-priority number [10,11], the following conclusions were drawn from the misuse inspections:

- The average risk priority numbers for rear-facing and forward-facing CRDs indicate that a majority of the CRDs inspected have protective capabilities that may be compromised if involved in an automobile crash.
- Rear-facing seats showed a slightly higher average risk priority number per seat than forward-facing seats.
- From a risk priority standpoint, the most problematic rear-facing seat misuses are as follows:
  - Shoulder harness straps routed too high
  - Excessive harness slack
  - Seatbelt routed incorrectly
  - Seatbelt/LATCH not buckled
  - Harness retainer clip too low
  - Internal harness was not buckled
- From a risk priority standpoint, the most problematic forward-facing seat misuses are as follows:
  - Excessive harness slack
  - Seatbelt/LATCH not buckled

- Shoulder harness straps routed too low
- Harness retainer clip too low
- Improper routing of top tether

## 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 3-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 6 and 12 months of age (switch from infant carrier to larger rear-facing CRD and increase in the incline from 45 to 60 degrees from horizontal when the child is able to lift his/her head)
- Switch from rear-facing CRD to forward-facing CRD, which requires increasing the seat incline and re-routing of the harness straps and seat belt/LATCH path, among other changes.
- Age 4 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 CRD transitioning guidelines published by the American Association of Pediatrics, which advise keeping children in each restraint type, including rear-facing, forward-facing and booster seats, for as long as possible (e.g., until reaching the height or weight limit of the seat) before graduating to the next type of restraint [24]. Particular emphasis should be placed on educating parents as to the appropriate timing for: 1) transitioning from a 45 to 60-degree incline for a rear-facing seat, 2) transitioning from rear-facing to forward-facing, and 3) transitioning from forward-facing CRD to booster seat. The rear-facing position reduces stresses to the neck and spine to infants and reduces the likelihood of severe injury during a crash. Consequently, parents and caregivers should be encouraged to seat children rear-facing until the weight or height limit of the seat is exceeded for the rear facing position, and should also be trained on the proper repositioning of the harness and other straps when converting a seat from rear to forward facing. Similarly, forward-facing seat utilization should be emphasized until the child outgrows the seat (or the seat expires), due to the inherent safety benefits compared to booster seats.

Although the sample of unbelted drivers was too small to draw meaningful conclusions, prior CRD surveys in Michigan have found that the most significant driver-related determinant of CRD or booster seat use among child passengers was driver belt use. CRD/booster seat use has historically been significantly lower when the driver was not belted appropriately. Unbelted 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.

While the COVID-19 pandemic had reduced the number of available seat-check events, 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 technicians 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 technicians 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 technicians 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 technician anytime a new CRD/booster seat 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. While the use of LATCH has shown great improvement from prior surveys, is still only utilized by approximately one-half of all equipped vehicles.

## 7.0 REFERENCES

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**APPENDIX I – LIST OF OBSERVATION LOCATIONS**

<b>Strata</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
1	Ingham	Potter Park Zoo	1301 S Pennsylvania Ave, Lansing, MI 48912
2	Eaton	Culver’s	8488 W Saginaw Hwy, Lansing, MI 48917
2	Calhoun	Binder Park Zoo	7400 Division Dr, Battle Creek, MI 49014
2	Kent	John Ball Zoo	1300 Fulton St W, Grand Rapids, MI 49504
3	Saginaw	Children's Zoo at Celebration Square	1730 S Washington Ave, Saginaw, MI, 48601
3	Saginaw	Tim Hortons	2039 N Michigan Ave, Saginaw, MI 48602
3	Clinton	McDonald's	16827 Marsh Rd, Haslett, MI 48840
1	Ingham	Target	4890 Marsh Rd, Okemos, MI 48864
3	Isabella	Soaring Eagle Waterpark	5665 E Pickard St, Mount Pleasant, MI, 48858
3	Isabella	Culver's	1021 W Pickard St, Mt Pleasant, MI 48858
1	Oakland	Detroit Zoo	8450 W 10 Mile Rd, Royal Oak, MI 48067
3	Berrien	Silver Beach	101 Broad St, St Joseph, MI 49085
3	St. Joseph	Walmart	101 S Tolbert Dr, Three Rivers, MI, 49093
3	St. Joseph	Starbucks	410 S US Hwy 131, Three Rivers, MI 49093
3	Cass	McDonald's	68889 M-62 Edwardsburg, MI 49112
3	Branch	Dr. Robert W. Browne Aquatic Center	250 Western Ave, Coldwater, MI 49036
2	Calhoun	Target	5700 Beckley Rd, Battle Creek, MI, 49015
2	Calhoun	Arbor Academy and Child Development Center	55 Arbor St, Battle Creek, MI 49015
2	Jackson	Walmart	1700 W Michigan Ave Jackson MI 49202
1	Ingham	D&W Fresh Market	151 W Grand River Ave, Williamston, MI 48895
2	Jackson	McDonald's	2601 Airport Rd, Jackson, MI, 49202
4	Macomb	Lakeside Mall	14425 Lakeside Cir, Sterling Heights, MI, 48313
1	Oakland	Somerset Collection	2800 W Big Beaver Rd N120, Troy, MI, 48084
1	Oakland	McDonald's	4819 Rochester Rd, Troy, MI 48098
2	Livingston	Tanger Outlets	1475 N Burkhart Rd, Howell, MI 48843
3	Cheboygan	StarLine Ferry	801 S. Huron Ave. Mackinaw City, MI 49701
3	Marquette	McDonald's	1105 W. Washington St. Marquette, MI 49855

<b>Strata</b>	<b>County</b>	<b>Location Name</b>	<b>Address</b>
2	Eaton	Panera	5212 W Saginaw Hwy, Lansing, MI 48917
4	Wayne	Texas Roadhouse	14660 Pardee Rd Taylor MI 48180
4	Wayne	Meijer	14640 Pardee Rd, Taylor, MI 48180
3	Ionia	McDonald's	2784 S State Rd, Ionia, MI 48846
1	Washtenaw	Ann Arbor Hands On Museum	220 E Ann St Ann Arbor MI 48104
1	Washtenaw	Briarwood Mall	100 Briarwood Cir, Ann Arbor, MI 48108
1	Kalamazoo	Air Zoo	6151 Portage Rd. Portage, MI 49002
4	Wayne	Greenfield Village/Henry Ford Museum	20900 Oakwood Blvd, Dearborn, MI 48124
2	Midland	Dow Gardens	1809 Eastman Ave Midland MI 48640
2	Midland	Midland Mall	6800 Eastman Ave, Midland, MI 48642
1	Oakland	Twelve Oaks Mall	27500 Novi Rd, Novi, MI 48377
4	Wayne	IKEA	41640 Ford Rd, Canton, MI 48187
4	Wayne	McDonald's	220 Ann Arbor Rd Plymouth MI 48170
4	Wayne	Camp Mirage Junior Camp	45201 N Territorial Rd Plymouth MI 48170
4	Wayne	Plymouth Township Park	46640 W Ann Arbor Trail, Plymouth, MI 48170
4	Wayne	Fairlane Shopping	3468 Fairlane Dr. Allen Park, MI 48101
4	Wayne	McDonald's	40241 Michigan Ave, Canton, MI 48188
4	Wayne	Huron Metropark	40151 E Huron River Dr Belleville MI 48111
4	Wayne	Starbucks	10777 Belleville Rd, Belleville, MI 48111
4	Macomb	Lake St Clair Metropark	31300 Metro Pkwy Harrison Twp MI 48045
4	Macomb	George Memorial Park	40500 Moravian Dr, Clinton Township, MI 48036
4	Macomb	Partridge Creek Mall	17420 Hall Rd, Clinton Township, MI 48038
4	Wayne	McDonald's	14860 Michigan Ave Dearborn MI 48126
2	Ottawa	McDonald's	160 Chicago Dr, Jenison, MI 49428
2	Ottawa	Burger King	4842 Lake Michigan Dr, Allendale Charter Twp, MI 49401
3	Genesee	Starbucks	Pro Clean Center, 3822 E Court St, Flint MI 48506
3	Genesee	McDonalds	3216 Owen Rd, Fenton MI 48430

**APPENDIX II – LIST OF INSPECTION LOCATIONS**

<b>Strata</b>	<b>County</b>	<b>Date</b>	<b>Location</b>	<b>Address</b>
4	Macomb	5/20/2022	Dodge Park	40620 Utica Road, Sterling Heights, MI 48313
3	Marquette	6/23/2022	Marquette Township Fire Department	1000 Commerce Drive Marquette, MI 49855
1	Oakland	7/12/2022	Rochester Fire Department	277 E 2nd St, Rochester, MI 48307
3	Genesee	7/16/2022	Lenoore County Family Life Center	1401 E Court St Flint MI 48503
3	Genesee	7/22/2022	Genesee Health Plan	2171 Kinden Road, Flint, MI 48532
2	Grand Traverse	7/22/2022	Grand Traverse Metro Fire Department Station 11	3000 Albany Street, Traverse City MI 49685
4	Wayne	7/23/2022	Detroit Public Safety Headquarters	1301 3 <sup>rd</sup> Avenue, Detroit, MI 48226
3	Muskegon	7/25/2022	Mercy Health	1124 E. Hackley, Muskegon MI 49444
1	Washtenaw	7/27/2022	Ann Arbor Fire Station 6	1881 Briarwood Circle, Ann Arbor, MI 48109
3	Genesee	7/31/2022	Flint Children's Museum	1602 University Ave, Flint, MI 48504
1	Oakland	8/2/2022	United Wholesale Mortgage	585 South Blvd E, Pontiac, MI 48341
3	Muskegon	8/8/2022	Norton Shores Fire Dept.	1100 E Pontaluna Rd, Norton Shores, MI 49444
2	Jackson	8/11/2022	Jackson Fire Department	520 N Jackson St, Jackson, MI 49201
3	Mason	8/11/2022	Sterns Park	420 N Lakeshore Dr, Ludington MI 49431
1	Washtenaw	8/16/2022	Ypsilanti Fire Department	525 W Michigan Ave, Ypsilanti MI 48197
3	Muskegon	8/22/2022	Mercy Health	1124 Hackley Ave Muskegon, MI 49444
1	Washtenaw	8/24/2022	Ann Arbor Fire Station 6	1881 Briarwood Circle, Ann Arbor, MI 48109



**APPENDIX III – 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	Cargo Area
Front of Vehicle	3	6	9	
	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	Cargo Area
Front of Vehicle	3	6	9	
	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  30 - 59  60+  
 Driver Gender:  Male  Female

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

Restraint:  Rear-Facing CRD

Forward-Facing CRD

Belt Positioning Boosters (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)?  
 Yes  No
2. Is the CRD installation tight (1-inch rule when checked at base of seat)?  
 Yes  No  
0 inches  1 inch  
2 inches  3 inches  4 inches
3. What is the maximum space between the CRD and the vehicle seat back?  
 Yes  No

#### Harness

4. Is internal CRD harness completely buckled at the waist?  
**IF BUCKLED:**  
(a) How tight are the shoulder harness straps (pinch and fingers)?  
 No slack when pinched  
 1 finger  2 fingers  
 3 fingers  4 fingers  
(b) Is the harness retainer clip fastened and orientated correctly?  
 Yes  No  No Clip  
(c) Where is the harness retainer clip positioned when buckled?  
 Proper (at armpit level)  
 Too high  
 Too low  
(d) Where do the shoulder harness straps rout into the CRD?  
 Proper (at or above shoulders)  
 Too high (above ears)  
 Too low (below shoulders)  
(e) Are the shoulder harness straps flat (not twisted)?  
 Yes  No  
(f) Is crotch strap flat (check if buckle button is facing outward)?  
 Yes  No

#### Locking/Attachment

5. Which vehicle system is used to attach CRD to the vehicle?  
 SB  Lower LATCH Anchors  
 Both  None  
**IF ATTACHED:**  
(a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?  
 Yes  No  
(b) If the vehicle seatbelt is used, is the seatbelt locked? (pull on lap belt)  
 Yes  No  
(c) Is the vehicle seatbelt or LATCH strap flat (not twisted)?  
 Yes  No  
(d) Is the proper seatbelt path or LATCH strap connector path used (path nearest the vehicle's seat)?  
 Yes  No  Not Used  
(e) If a metal locking clip is used, is it positioned near the buckle?  
 Yes  No  Not Used

#### Tether (Only If Used)

6. Is the tether routed under an adjustable head restraint or over a non-adjustable head restraint?  
 Yes  No
7. Is tether strap flat (not more than one twist)?  
 Yes  No
8. When pinched, how much slack is in the tether strap (in inches)?  
0 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)?  
 ~45°  ~60°  <35°  >70°
2. Is the CRD installation tight (1-inch rule when checked at base of seat)?  
 Yes  No

#### Harness

3. Is internal CRD harness completely buckled at the waist?  
**IF BUCKLED:**  
(a) How tight are the shoulder harness straps (pinch and fingers)?  
 Yes  No  
 No slack when pinched  
 1 finger  2 fingers  
 3 fingers  4 fingers  
(b) Is the harness retainer clip attached and orientated correctly?  
 Yes  No  
(c) Where is the harness retainer clip positioned when buckled?  
 Proper (at armpit level)  
 Too high  Too low  
(d) Where do the shoulder harness straps rout into the CRD?  
 Proper (at or below shoulders)  
 Too high (above shoulders)  
(e) Are the shoulder harness straps flat (not twisted)?  
 Yes  No  
(f) Is crotch strap flat (check if buckle button is facing outward)?  
 Yes  No

#### Locking/Attachment

4. Which vehicle system is used to attach CRD to the vehicle?  
 SB  Lower LATCH Anchors  
 Both  Neither  
**IF ATTACHED:**  
(a) Is vehicle seatbelt securing CRD buckled or LATCH straps clipped to anchors?  
 Yes  No  
(b) If the vehicle seatbelt is used, is the seatbelt locked (pull on lap belt)?  
 Yes  No  
(c) Is vehicle seatbelt or LATCH strap flat (not twisted)?  
 Yes  No  
(d) Is the proper vehicle seatbelt path/lower strap connector path used (path nearest the vehicle's seat)?  
 Yes  No  
(e) If a metal locking clip is used, is it positioned near the buckle?  
 Yes  No  Not Used

### FOR BOOSTER SEATS (BPB)

#### Vehicle Seatbelt

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

#### 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)?  
 Yes  No  
 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