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THE INCIDENCE AND FACTORS ASSOCIATED  
WITH CHILD SAFETY SEAT MISUSE

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16. Abstract <p>This report presents the findings for a study on the misuse of child safety seats. Data were collected in 10 cities across the country at Hardee's Restaurants. Data collection involved observation of seat use and determination of factors associated with specific types of misuse.</p> <p>Misuse of safety seats was 64.6 percent for the 1,006 safety seats observed. Data was collected on toddler, infant and booster seats. For the 734 toddler seats observed, 40 percent of the children were not harnessed, 33 percent did not have the seat properly secured with the vehicle belt, and 85 percent of the tether-type seats were not tethered.</p> <p>Of the children not harnessed, almost all of those responsible (95 percent) were aware of this fact. The most common reason given was that the child slips out or takes off the harness. Nearly 80 percent of those not using the tether strap (when required) stated that they knew that the tether was required and indicated a strong resistance to the installation of a tether anchor. Approximately 75 percent of those incorrectly belting the seat to the vehicle did not realize the belt routing was incorrect. While a small number of safety seats were not belted, (7 percent), 75 percent of those with this misuse were aware of it. In addition, 71 percent of those facing infant seats forward, knew the seat was supposed to face the rear of the vehicle.</p> <p>The findings indicate that safety seats which are more comfortable for the child, easier to use, and have fewer opportunities of misuse, are more often used correctly. Several countermeasures are proposed to reduce misuse of safety seats.</p>			
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## I. EXECUTIVE SUMMARY

### Introduction

A number of efforts have been undertaken throughout the country to assess the correct/incorrect use of child safety seats. These efforts have consisted largely of recording information on harness use only through observations of cars in the traffic stream. In a few instances, data on the use of tethers and car seat belts to anchor child safety seats has been obtained by peering into unoccupied vehicles in parking lots. The quasi surreptitious nature of these data collection efforts do not afford observers the opportunity to examine closely the specific characteristics of improper use or determine the underlying causal factors. Furthermore, since data on harness use and seat anchorage are being collected in separate observational settings, it is not possible to document the overall problem of misuse. More specific information on the extent of and contributing factors to improper use is needed as a basis for developing improved seat design as well as educational approaches for parents and guardians of small children. The purposes of this study are, therefore, to provide comprehensive misuse information on safety seats, to gain insights on why child safety seats are misused and to identify characteristics associated with their misuse.

### Methodology

The data collection methodology involved observing children in safety seats at fast-food restaurant parking lots that characteristically attract children. Data collection also involved talking to parents to try to correct any observed misuse and to gain information related to seat misuse.

The study was conducted at Hardee's Restaurants in 10 cities throughout the country. Hardee's Food Systems Inc. provided free food coupons to their customers participating in the study. Two observers were trained to identify seat usage characteristics and to conduct the observations. The observers worked for one week in each city, working independently at different restaurants within the city. Data collection sites were selected which had a high portion of family oriented sales and a high likelihood of infant and toddler customers. Data were collected for 5 days in each city (primarily Tuesday through Saturday) during the restaurant's busiest hours of 11:00 a.m. to 2:00 p.m. and 3:30 p.m. to 6:30 p.m..

### Results

A total of 1,006 occupied safety seats were observed in this study of which 734 were toddler seats, 150 were infant seats and 122 were booster seats. Misuse information was collected relative to the use of harness/shield, belting of the seat to the vehicle, top anchor strap (tether) usage, and the facing direction of infant seats. Observed misuse for all occupied safety seats was 64.6 percent, while toddler, infant and booster seats were misused at a rate of 66.3, 59.3 and 61.5 percent, respectively as shown in Figure 1.



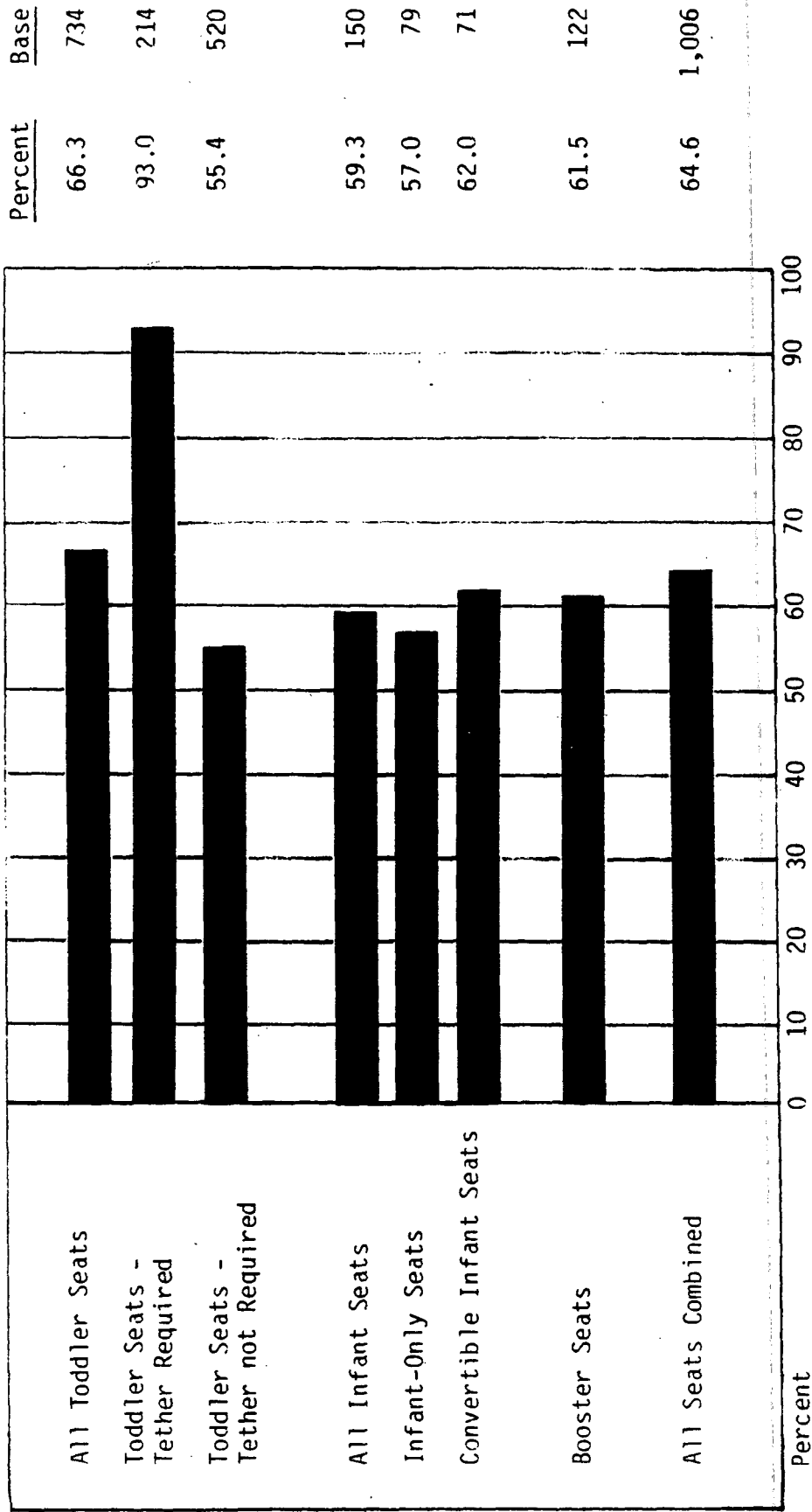


Figure 1. Misuse of Child Safety Seats

With regard to toddler seats, harness/shield misuse consisted of 21.9 percent nonuse and 18.4 percent incorrect use. The incidence of harness/shield misuse was 14.0 percent for seats with a full shield, 25.3 percent for seats with an attached partial shield, and 42.0 percent for seats designed with harness straps only. The newer seat designs with attached partial shields and full shields are used correctly more often than seats with older harnessing systems because the newer systems are so much more convenient to use.

Belt misuse included not belting the safety seat to the vehicle (4.8 percent) and incorrectly routing the vehicle belt (28.1 percent). The major type of incorrect belt use was routing the belt too low (65.0 percent of incorrect belt use). Belt misuse was highest for seats where the belt is routed through an open frame (40.9 percent) and lower for seats where the belt is routed through a slot or hole in the frame (23.3 percent) or where the belt is routed around the seat and child (12.4 percent). It appears that seats are more likely to be correctly belted when the location of belt routing is more obvious.

The use of a tether was required on 29.2 percent of the toddler seats observed. Nonuse of the tether strap was observed in 85.1 percent of the seats requiring a tether strap. Overall seat misuse was 93.0 percent for seats requiring a tether compared to 55.4 percent misuse for non-tether seats.

Of the 150 infant seats observed, 52.7 percent were seats designed exclusively for infants, and 47.3 percent were convertible seats which can be used in the infant or toddler mode. Misuse was 57.0 percent for the infant-only seats and 62.0 percent for the convertible seats.

Harness misuse for infant seats was 32.9 percent, which includes 4.0 percent incorrect harness use and 28.9 percent nonuse. Belt misuse for infant seats was 23.9 percent, comprised of not using the vehicle belt in 9.4 percent and incorrect routing in 14.1 percent of the observations. There was a higher percentage of individuals incorrectly belting seats when the intended belt routing was through the frame, but there was a higher percentage of not using the belt when the belt was intended to be placed over the child's lap.

Infant seats, which are designed to face rearward, were observed facing forward or incorrect in one-third of the observations. Convertible seats with infants were more frequently facing incorrectly than infant-only seats.

Misuse of booster seats included 61.5 percent not using a harness (upper torso restraint) and approximately 13.9 percent not using the lap belt. Of the 47 children using a harness, 76.6 percent used the shoulder harness with the 3-point vehicle belt system and 23.4 percent were restrained by a harness system and tether strap.

The following paragraphs highlight information pertaining to factors associated with the misuse of child safety seats.

- Overall, seat position had little effect on the misuse of safety seats, with the exception of the front-outboard position for booster seats where misuse was much lower. This position permits the use of the vehicle shoulder harness for upper torso restraint.
- Misuse of safety seats was more common when the driver was not belted. This relationship was more pronounced for booster seats.
- Misuse did not vary between whether the mother or father secured the children. While the numbers were small, misuse was higher for non-parents than parents.
- A majority of those first installing seats in vehicles were the parent (71.4 percent). Misuse did not vary greatly based on who first installed the seat.
- An overwhelming majority (85.3 percent) indicated that the child's safety was the primary concern for using the seat. Misuse was higher for those who gave non-safety reasons for seat use.
- In general, the age of the child does not appear to be related to toddler seat misuse.
- Overall, 86.5 percent of the seats were obtained new, and their misuse was lower than for those seats obtained used.
- Parents purchased 70.7 percent of the seats while 23.4 percent were received as gifts. A few seats were obtained from rental programs or were borrowed.
- Approximately 21 percent of the toddler seats and 17 percent of infant seats were older than four years. Misuse increased with the age of toddler and infant seats.
- Nearly 94 percent of the respondents indicated that they received instructions with their seat and this was primarily in the form of written instructions.
- When asked how the seat was first installed, 67.5 percent stated they followed manufacturer's instructions, 4.3 percent had installation demonstrated while 28.2 percent installed the seat without using instructions. Misuse was higher for those installing the seats without the aid of instructions. For those using manufacturer's instructions, misuse for all seats combined was 58.6 percent, however, 95.0 percent stated that the instructions were easy to follow.
- 54.6 percent of the respondents stated that their seat was used in more than one vehicle. In addition, 46.7 percent of toddler seats requiring a tether strap were used in more than one vehicle. Misuse, however, did not vary for seats used in more than one vehicle compared to seats which always remained in one vehicle.

When seat misuse was observed, the parents were asked if they knew that the seat was being misused. Approximately 95 percent of those not harnessing the child or incorrectly using the harness realized they were in error. The primary reasons for toddler seat misuse included; the child took the harness off (23.4 percent), the child did not like the harness/shield or was uncomfortable (13.5 percent), and the harness did not fit properly (10.7 percent). In addition, 12.1 percent felt that the harness was not necessary. Responses for infant seats included; the harness did not fit (18.7 percent), the harness was a hassle to use (14.5 percent) and the harness was not considered necessary (12.5 percent). Nearly 20 percent of those not using upper torso restraint in booster seats stated that it was not necessary, while a majority of the others gave responses relating to not wanting to use a harness/tether combination or install a tether anchor.

Nearly 80 percent of those not using a tether strap (when required) for toddler seats knew that it was required. A majority of reasons given for not using the tether strap dealt with individuals reluctance to install or drill a hole in the car for the tether anchor, or that the seat was moved from car to car.

Nearly 75 percent of those incorrectly belting the seat to the vehicle did not realize the belt was routed incorrectly. While a majority were not aware of correct belt routing, 12.5 percent of those incorrectly belting toddler seats stated that it made no difference where the belt was routed. Other responses included the belief that the incorrect routing was safer, the belt was re-routed to compensate for harness misuse, or the belt would not fit.

While only a small number of seats were observed not belted to the vehicle, approximately 75 percent of those respondents knew that the seat was not belted. A majority of those intentionally not belting the seat gave reasons including; the belt was broken/removed from the vehicle, the driver was in a hurry, the child took it off, and the belt is only used on long trips.

Pertaining to forward facing infant seats, 71.4 percent knew the seat was supposed to face rearward. Over 25 percent of those questioned knew the seat was supposed to face rearward but did not know why, and an additional 18.4 percent thought the child was old enough to use the seat facing forward.

### Countermeasures

Several countermeasures are proposed to combat safety seat misuse. These countermeasures pertain to improved seat designs which are more comfortable for the child, easier to use, reduce opportunities for misuse, modifications to vehicles to better accommodate safety seats, and the implementation of educational programs to respond to specific types of misuse. The countermeasures are listed below:

- Countermeasures for harness/shield misuse.
  1. Prohibit seats with detachable shields (toddler seats).
  2. Encourage the design of seats with full shields (toddler seats).
  3. Require seats with partial shields to have a one-piece harness/shield system to allow simpler use (toddler seats).
  4. Design seats with a harness pad instead of a shield (toddler seats).
  5. Design the harness system to be more difficult for the child to undo (toddler seats).
  6. Eliminate the optional partial shield (toddler seats).
  7. Design the belt routing to go through the frame, not around the child (infant seats).
  8. Design infant harness systems to be easier to use (infant seats).
  9. Require new cars to have 3-point safety belt systems in the back seat (booster seats).
  10. Require new cars to have tether anchorages on the rear deck lid (booster seats).
  11. Require booster harness and tether straps to be sold with the seat (booster seats).
  12. Educate the public on the hazards of harness/shield misuse (all safety seats).
- Countermeasures for incorrect belt routing.
  1. Eliminate the open frame in toddler seats. Enclose the side of the frame leaving only the hole or slot for the belt to be routed through.
  2. Install a warning sticker on the seat directing the user to route the belt at that location.
  3. Educate the public on correct belt routing and the hazards of incorrect belt use.
  4. Encourage manufacturers to provide displays of the seats in proper use at retail stores.

- Countermeasures for not belting the seat.
  1. Educate parents to check for belt use and the importance of belting the seat.
- Countermeasures for tether misuse (toddler seats).
  1. Redesign the seat to eliminate the need for a tether.
  2. Require new cars to have tether anchorages in the rear deck lid.
  3. Educate the public on the need and use of tethers.
  4. Install a warning sticker on the top of toddler seats requiring a tether.
- Countermeasures for the incorrect facing of infants seats.
  1. Educate parents on the correct use of infant seats and why seats should be rearward facing.
  2. Place a warning sticker on infant-only seats with an arrow to indicate which the direction child is to face.

Other general countermeasures include the use of gift certificates for the purchase of safety seats instead of buying the seats as gifts, discouraging the use and purchase of older safety seats and promoting more education of seat use in cooperation with hospitals and pediatricians. Furthermore, since many older safety seats are currently in use, it is important to utilize educational campaigns to reduce misuse of existing safety seats.

## II. INTRODUCTION

The use of child safety seats has been proven to be an effective means to preventing or reducing injury to small children in the event of a vehicular collision or rapid deceleration. The effectiveness of these devices are, however, dependent upon their proper use. If not used in accordance with the manufacturers instructions the devices may not only fail to protect the child but may actually increase injury severity. The increased severity is due to the extra, or unbalanced force exerted on the child, and possibly other occupants, from the weight of the seat itself.

By the end of 1984, all but one state in the country will have a law requiring infants and toddlers under a certain age to be transported in an approved child safety seat. The use of child safety seats has been increasing over the past few years, possibly due to the implementation of mandatory child restraint laws and increased awareness of child passenger safety. Studies of child passenger transport in 19 cities across the country has shown an increase in the use of child safety seats (1). In the study of restraint use in 19 cities during 1983, about 35 percent of children (aged 1-4) were observed in child safety seats (1). The same study, however, revealed that many children are not restrained by the harness in the safety seat. Other studies of belting and tether use for unoccupied safety seats in parked vehicles (in 1983) indicate that approximately 43 percent of toddler seats are incorrectly or not belted to the vehicle seats and that tether straps were not used in 75 percent of safety seats where tethers were required (1). Another study of unoccupied toddler seats (requiring a tether) in parked vehicles found that 75 percent had errors in belt routing, tether use or both (2). These findings indicate that requiring the use of child seats is not sufficient to ensure their proper use. Further study of child restraint devices is necessary to determine why these devices are being misused and to determine the best means of increasing proper usage. Only when child restraint devices are used and used properly will their full benefit be achieved.

### Purpose

The purpose of this study is to provide a more comprehensive evaluation of the use and misuse of child safety seats and to gain insights on why these seats are misused. This study is also intended to identify the major characteristics of the seats, adult users, and conditions related to misuse.

The results of this study may be useful for the development of means to increase the proper use of child safety seats. The means to eliminate misuse may include improved seat design, better instructions on seat use, vehicle modifications to make seat use easier, and educational materials on the proper use of child safety seats. The results of the study may also be useful in rule making actions by NHTSA related to child safety seat standards. In addition, the methodologies used in this study may be useful for future evaluation of programs aimed at increasing the proper use of child safety seats.

## Background

Two studies pertaining to child safety seats are currently being conducted for NHTSA in 19 cities across the country. One study involves observing passenger restraint use at shopping centers to determine the percentage of infants, toddlers and subteens using child safety seats (1). These passenger restraint observations are made at shopping center exits. In many instances the observer has neither the time nor the vantage point to record all information pertaining to proper use. Misuse data collected for safety seats is limited to harness use on toddler seats since proper belt use is too difficult to observe during this study, particularly where the car belt is secured to the frame of the seat. Tether use is also difficult to observe since a positive identification of seat model is needed to determine if a tether is required. In addition, since the various makes and designs of toddler seats have varying harness/ shield requirements, it is also difficult to determine incorrect harness/ shield use (if partially in use). Finally, the 19-city study does not include the collection of information on the type of seat or the reasons for misuse. When collecting data on infant safety seats and booster safety seats for the 19-city study, both harness and belt use is recorded. However, due to the brevity of the observation, an accurate determination of proper harness or belt use cannot always be made.

The second study is conducted at shopping center parking lots in the 19 cities to collect detailed information on belt and tether use for unoccupied child safety seats in parked vehicles (1). This study allows the observer to take a careful look at the seat to identify the make and model. Based on photographs and drawings from a Field Reference Guide (3), the observers can determine if the seat is properly belted and tethered to the vehicle. These observations are, however, made on unoccupied seats, which prevents determination of proper harnessing of children in the seats. Since booster seats and many infant seats are not belted unless occupied, data cannot be collected for these seats. In addition, some toddler seats require the vehicle safety belt to be routed around the child (i.e., Century Child Love Seat) or around a shield in front of the child (i.e., Bobby Mac Champion) and then must be removed to exit the seat. Belting data cannot be collected on these seats when unoccupied.

A review of literature failed to uncover any other studies related to determining the specific reasons for the misuse of child safety seats. A few studies have been conducted to determine consumer acceptance of various models of child safety seats in terms of comfort and convenience. These studies have postulated that if the seats are convenient and easy to use there is a greater chance that they will be used and used correctly (4). The information derived from these studies does not address the specific types of misuse, and the correct use of the seats was always explained to the parents before the seat was used.



### III. DATA COLLECTION PLAN

The data collection plan for this study involved collecting data at small parking lots with high volumes of infant and toddler passengers. This approach allowed the observer to identify candidate subjects as they entered the parking lot and meet them at their vehicle as they parked. In this manner, the observer was able to obtain a complete and accurate observation on the use of the child safety seat. At the same time, a brief interview was conducted in which the observer asked questions related to specific types of misuses observed for the child safety seat.

#### Data Collection Methodology

To maximize the number of children observed and to take advantage of the efficiency of sites with small parking areas and large vehicle turn-overs, it was decided to enlist the cooperation of a nationwide fast-food chain. NHTSA made contact with Hardee's Food Systems, Inc. and they showed a strong interest in the study and agreed to participate. In addition, Hardee's Food Systems, Inc. provided free food coupons to encourage candidate respondents to participate in the study.

The study design called for data collection based on approximately 100 children in safety seats in each of 10 cities (1,000 observations total). The cities were selected to represent various geographic regions of the country to the extent practical, provided they had at least five Hardee's restaurants to facilitate data collection.

Collecting misuse data for child safety seats is difficult due to the complex nature of various types of safety seats and the diversity of child safety seats available. Trained observers are required in order to simultaneously identify the seat model and verify correct or incorrect usage. In addition, the observers are required to be personable when engaging in informal discussions with the driver. These informal discussions were important in determining the reasons for misuse and, in some cases, demonstrating the proper use of the seats.

Due to sample size limitations and the restrictions on city and site selections, the results of this study do not provide a cross-sectional representation of the country. However, the results are believed to represent valid information relative to the use and misuse of child safety seats.

#### Data Collection Sites

Ten cities were selected for data collection. The selected cities represented market areas where Hardee's had at least five restaurants which were company owned (non-franchise). These site selection criteria were used to provide an adequate sample of sites and to assure full cooperation of the local restaurant personnel. The criteria, however, precluded the selection of west coast cities. The locations, selected jointly by the contractor and NHTSA, for project purposes are shown below and depicted graphically in Figure 2.

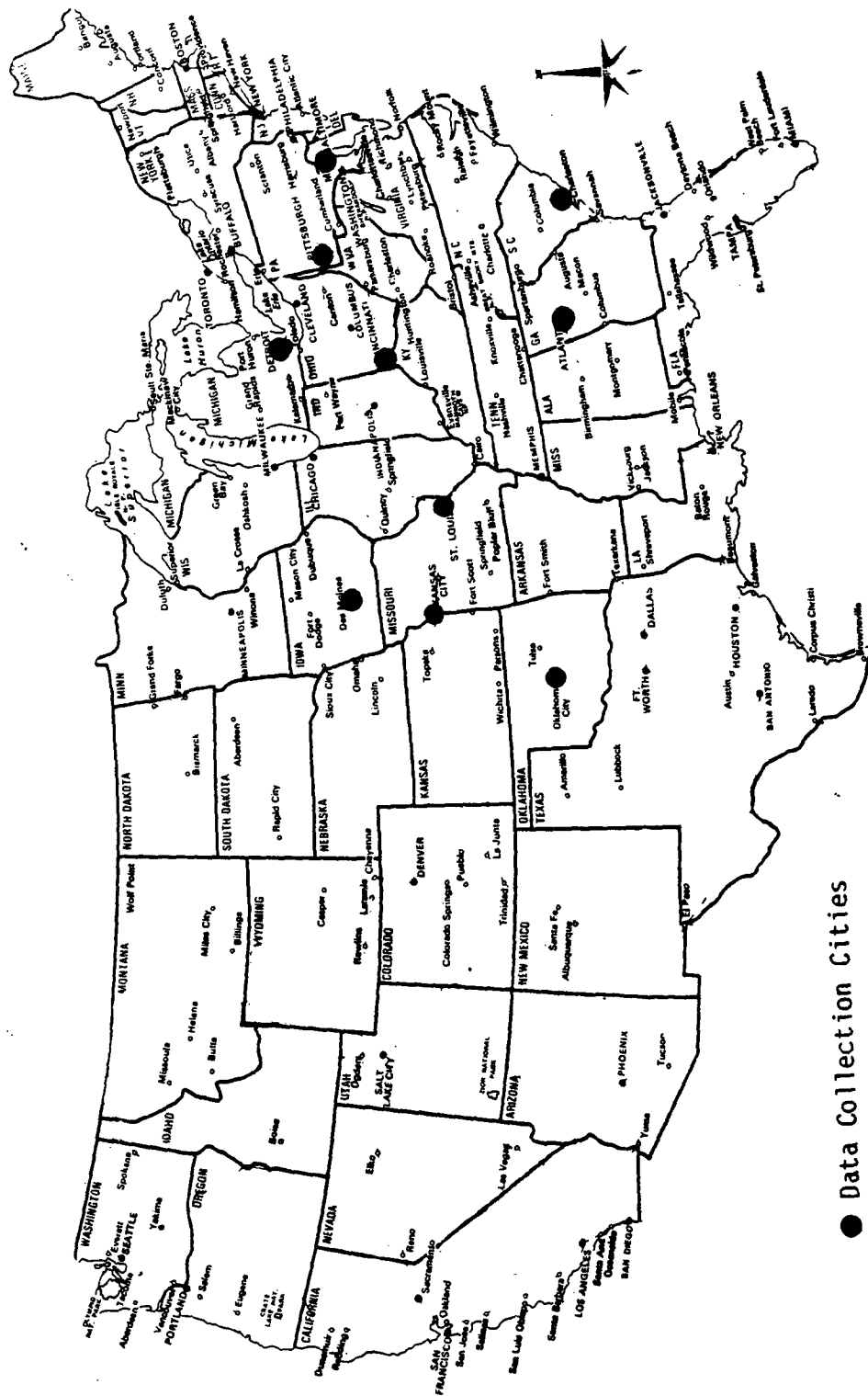


Figure 2. Location of data collection cities.

- Baltimore, MD
- Pittsburgh, PA
- Detroit, MI
- Cincinnati, OH
- Charleston, SC
- Atlanta, GA
- Kansas City, MO and KS
- Oklahoma City, OK
- Des Moines, IA
- St. Louis, MO

The individual sites within each city area were selected with the assistance of a Hardee's representative. The representative tentatively selected sites based on sales of children's items and the percentage of family oriented sales. This resulted in the majority of sites being located in suburban areas. A list of 4 to 7 restaurants were generated in each city area. While each site was visited at least once during the data collection period, the observers conducted additional data collection activities at those sites experiencing the highest volumes of children in child safety seats.

#### Data Collection Instruments

The study used a data collection instrument consisting of two observation forms. The first observation form was used to record the usage characteristics of child safety seats. General information as well as driver/occupant and child safety seat data were recorded on the form. Data was collected for both occupied and unoccupied seats, however, only a limited amount of data could be collected for unoccupied seats. Special emphasis was placed on describing improper uses observed for harness/shield, belting, and tethering. This observation form is shown in Appendix A.

The second observation form was developed to record additional misuse related data. This form was initially developed by NHTSA and is also shown in Appendix A. The purpose of this form was to record data pertaining to installation and use of child safety seats, the characteristics of the seats in use, and reasons for misusing the seats. This information was noted during an unstructured and informal discussion conducted immediately after the observation of the seat in use and was recorded onto the observation form a short time later.

#### Data Collection Procedure

The data collection activities were accomplished by two observers, each trained for 2 weeks in the identification and correct use of child safety seats and in field work necessary for identifying seats and usage characteristics. Training also included observations at test sites in the Detroit area which resulted in a streamlining of the data collection procedure based upon the experience gained. A formal pilot test was conducted in early June, 1984 in the Detroit area. Formal data collection was begun at the Detroit sites after the pilot testing and completion of procedural modifications. Data collection activities were coordinated with special promotions of children's records and books by Hardee's Food Systems, Inc. in the summer of 1984.

Prior to data collection, the Director of Operation for Hardee's in each city was notified of the anticipated data collection date. It was the responsibility of each director to notify participating restaurants in his area. Coupons were forwarded from Hardee's corporate headquarters to all participating restaurants.

The observers travelled together to each city, working independently at different restaurants within the city. Upon arriving at each restaurant, the observer would park in an out-of-the-way space so as not to obstruct restaurant clientele. The restaurant manager would then be notified of the observer's presence and intentions.

The observers positioned themselves on a curb or sidewalk to allow identification of vehicles equipped with safety seats. Upon identification of a target vehicle, information pertaining to time, number of auto occupants, number of children in safety seats, and use of driver restraint was recorded on the observation form. The observer would then meet the target vehicle at its parking position or in line for the drive-thru window, inform the driver that he/she is conducting a study of child safety seats, and request permission to observe the child safety seat. A food coupon was offered to the driver as an incentive to participate. If permission and cooperation was not received, the observer then offered a NHTSA brochure on safety seats, thanked the individual, and aborted the observation. If permission was received, the observer would then observe and record the harnessing of the child and the installation of the seat. An informal interview would then follow, comprised of questions from the second data collection form. During the interview, the observers allowed the respondent to freely answer without prompting with sample responses. Categories of responses were subsequently expanded to accommodate the additional answers received. While it was originally expected that all the observations would be conducted as people were parking at the restaurants, a majority of observations were conducted while the motorists were waiting in the drive-thru lines at some locations.

The observers followed the data collection procedure, recording as many observations as time permitted. Data was collected for approximately 5 days in each city primarily on Tuesday through Saturday from 11:00 a.m. to 2:00 p.m. and 3:30 p.m. to 6:30 p.m. These hours were selected to maximize the probability of children observations. The data collection procedure and associated guidelines for observers used in this study are provided in Appendix B.

#### IV. RESULTS

A total of 1,006 occupied child safety seats were observed in this study, of which 734 (73.0 percent) were toddler safety seats, 150 (14.9 percent) were infant safety seats, and 122 (12.1 percent) were booster safety seats. The number of safety seats observed in each city is shown in Table 1.

Data was collected for 403 unoccupied seats to obtain additional information on the reasons and methods of incorrect belt use and improper tether use (when applicable). Harnessing information (and belting information for select seat models) could not be obtained when the seats were unoccupied. Information was only collected from unoccupied safety seats when they were in position for use by a child. Data was not collected for unoccupied seats that were simply thrown into the vehicle.

Misuse information for child safety seats pertained to the belt use, harness/shield use, tether use, and the correct facing of infants. The observers did not collect misuse information on the seat being reclined or upright or if the belt or harness was properly snug. Only when the harnessing or the belting was not used, incorrectly used, or excessively loose was it classified as misused. Based on direct observations, 64.6 percent of the occupied child safety seats were misused. Table 2 illustrates the types of misuse for occupied child safety seats observed in this study. Of the 734 toddler safety seats observed, 66.3 percent were misused. Infant and booster safety seats were misused in 59.3 percent and 61.5 percent of the observations respectively. The following sections describe the detailed characteristics of misuse for toddler, infant and booster seats.

##### Misuse of Toddler Safety Seats

There are various types of toddler safety seats, each with specific requirements for correct use. All toddler seats require a means to restrain the child to the seat. This is accomplished either by use of harness straps, a combination of a partial shield (or harness pad) and harness straps, or a full shield (where no harness straps are required). All toddler seats require the seat to be secured to the vehicle by means of the vehicle safety belt. In addition, some seats require the use of a top anchor strap (tether) to prevent the seat from rotating or pivoting forward in the event of a collision. The observers used in this study were trained to recognize the attributes and correct usage requirements for the most common types of seats in use. In addition to an extensive training program, the observers were equipped with a reference manual of safety seats (3) to verify their observations.

##### Harness/Shield Usage for Toddler Seats

Table 2 shows that 40.3 percent of the toddlers observed in toddler safety seats were either not using the harness/shield or were improperly using the harness/shield. Table 3 shows the types of improper harness/

Table 1. The number of child safety seats observed by city and type of seat.

City	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Occupied	Unoccupied	Occupied	Unoccupied	Occupied	Unoccupied	Occupied	Unoccupied
Baltimore, MD	79	36	18	8	13	0	110	44
Cincinnati, OH	104	39	24	5	12	2	140	46
Pittsburgh, PA	96	47	14	8	17	8	127	63
Charleston, SC	71	40	12	5	9	0	92	45
Atlanta, GA	53	21	12	4	19	0	84	25
Des Moines, IA	42	29	8	5	4	2	54	36
St. Louis, MO	72	22	17	5	15	0	104	27
Oklahoma City, OK	77	37	9	3	16	4	102	44
Kansas City, MO	47	18	13	0	7	1	67	19
Kansas City, KS	27	9	14	0	6	0	47	9
Detroit, MI	<u>66</u>	<u>37</u>	<u>9</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>79</u>	<u>45</u>
Total	734	335	150	46	122	22	1,006	403

Table 2. Percentage of child safety seats misused by type of seat.

<u>Misuse Category</u>	<u>Seat Type</u>		
	<u>Toddler Seats</u>	<u>Infant Seats*</u>	<u>Booster Seats</u>
Harness and/or shield not used	21.9	28.9	61.5
Harness and/or shield incorrectly used	18.4	4.0	0.0
Vehicle seat belt not used	4.8	9.4	13.9
Vehicle seat belt incorrectly used	28.1	14.1	0.8
Tether not used (tether seats only)	85.1	--	--
Tether incorrectly used (tether seats only)	0.9	--	--
Seat facing wrong direction	--	33.3	--
Overall seat misuse (Number of occupied seats observed)	66.3 (734)	59.3 (150)	61.5 (122)

\* Includes infant-only seats and convertible seats used in the infant mode.

Table 3. Type of incorrect harness/shield use for toddler seats.

<u>Incorrect Use</u>	<u>Base</u>	<u>Percent of Incorrect Harness/Shield Use</u>
Harness not over shoulders	54	40.0
Shield and harness both required, shield not used	53	39.3
Shield and harness both required, harness not used	20	14.8
Harness very loose	5	3.7
Shield not attached properly	2	1.5
Other incorrect use	1	0.7
Total	135	100.0

shield use observed in the study. The most common misuse was observed in those seats requiring the use of both the shield and harness. Of the 135 observations, 73 indicated that either the harness or the shield was being used, but not both. Another common misuse involved not correctly harnessing the child to the seat. This misuse usually consisted of not securing the harness straps over the toddler's shoulders.

A separate analysis was conducted to determine the harness/shield use of various seats based on manufacturer requirements. Four classes of seats were identified as follows:

1. Full shield - Seats with a shield which eliminates the need for harness straps.
2. Partial shield (attached) - Seats which have a partial shield (or harness pad) and harness straps which are permanently attached to the seat and snap or lock into place.
3. Partial shield (detachable) - Seats which require a partial shield or harness pad and harnessing. The partial shield is easily detachable from the seat.
4. Harness strap only - Seats which do not require the use of a shield or harness pad.

As shown in Table 4, 57 (7.9 percent) of the seats observed were equipped with a full shield, of which 14.0 percent had shield misuse. Seats requiring partial shields occurred for 346 toddler seat observations (48.3 percent). Seats with a detachable partial shield experienced a 95.2 percent rate of misuse while seats with attached partial shields were misused at a lower rate of 25.3 percent. Toddler seats requiring harness straps only were observed 314 (43.8 percent) times. Some of the seats observed which do not require the use of a shield are equipped with a partial shield as an option, but are not required for full occupant protection. A total of 42.0 percent of the harness only seats were misused with respect to the harness requirements. It appears that seats with newer harness/shield designs and those with full and attached partial shields substantially increase the likelihood of correct restraint use. Seats with detachable shields and older harnessing systems which are difficult were not frequently used.

Table 4. Incorrect harness/shield use for different harness/shield requirements for toddler seats.

<u>Harness/Shield Requirement</u>	<u>Base</u>	<u>Percent Harness/Shield Not Used</u>	<u>Percent Harness/Shield Incorrectly Used</u>	<u>Total Percent Misused</u>
Full Shield (No harness straps)	57	7.0	7.0	14.0
Partial Shield (Attached)	262	8.9	16.4	25.3
Partial Shield (Detachable)	84	60.7	34.5	95.2
Harness Straps Only	314	23.9	18.1	42.0



### Belt Usage for Toddler Seats

Incorrect securing of the toddler seats using the vehicle seat belt represents another common misuse. As shown in Table 2, the vehicle belt was not used to secure the safety seat in 4.8 percent of the observations and the vehicle belt was incorrectly routed in 28.1 percent of the occupied seats, resulting in a 32.9 percent rate of misuse. Table 5 shows the breakdown of incorrect toddler seat belting. Of the 206 incorrectly belted seats, 134 (65.0 percent) were belted too low and 40 of these were belted around and in front of the base of the frame instead of through the frame.

Table 5. Observed incorrect belt use for toddler seats.

<u>Incorrect Use</u>	<u>Base</u>	<u>Percent of Incorrect Belt Routing</u>
Belt too low (through frame)	94	45.6
Belt too low (around base and in front of frame)	40	19.4
Belt around seat and child (instead of through frame)	19	9.2
Belt not in belt clip	15	7.3
Other incorrect routing	<u>38</u>	<u>18.5</u>
Total	206	100.0

Toddler seat belt misuse was further analyzed based on provisions for the location and routing of the vehicle belt. Four categories were defined as follows:

1. Belt routed around child and shield.
2. Belt routed around child (no shield).
3. Belt routed through open frame.
4. Belt routed through hole in frame.

A small number of seat types require belt routing through a clip in the frame. Since few of these seats were observed, a separate analysis on this belt routing category was not conducted. The results of the analysis are shown in Table 6.

Table 6. Incorrect belt use for different methods of belt routing.

<u>Belt Routing</u>	<u>Base</u>	<u>Percent Belt Not Used</u>	<u>Percent Belt Incorrectly Routed</u>	<u>Total Percent Misused</u>
Around child and shield	139	5.0	9.4	14.4
Around child (no shield)	39	2.6	2.6	5.2
Through open frame	484	3.9	37.0	40.9
Through hole in frame	43	9.3	14.0	23.3

A majority of the toddler seats observed (68.7 percent) required the vehicle belt to be routed through the open frame of the seat. The belt was incorrectly routed in 37.0 percent and not used in 3.9 percent of the observations. The primary incorrect belt use involved routing the belt too low and the secondary incorrect belt use involved routing around the base and in front of the frame.

A total of 43 (6.1 percent) toddler seats were observed with a hole or slot in the plastic frame for the routing of the vehicle belt. Incorrect belt routing was observed in only 14.0 percent of these seats. These types of seats, however, had the highest percentage of vehicle belt misuse. The belting system showing the lowest rate of misuse was that which requires belting around the seat and child with no shield required on the seat. Only 1 in 39 of these seats were belted incorrect and 1 was not belted. It appears that seats with more obvious belt routings are more likely to be used correctly.

#### Tether Usage for Toddler Seats

The use of a tether strap was required on 214 (29.2 percent) of the observed toddler seats. When a tether was required, it was not used 85.1 percent of the time and was incorrectly used in 2 observations. Incidents of incorrect tether use included a tether strap routed around the seat instead of over the seat and a tether not anchored correctly.

### Multiple Misuses of Toddler Seats

Based on the individual harness/shield, belting, and tethering requirements of each seat, it is possible to have different combinations of incorrect use. For example, seats requiring a tether can have as many as three incorrect uses while seats such as the Ford Tot Guard can only be used incorrectly in one way. While 66.3 percent of the toddler seats were observed to be misused, 40.3 percent of the seats had one misuse, 20.1 percent had two misuses and 5.9 percent had three misuses. Toddler seats requiring a tether were misused more often than nontether toddler seats (93.0 percent misuse and 55.4 percent misuse, respectively). Figure 3 illustrates the multiple misuses observed in tether and non-tether toddler seats. Multiple misuse is illustrated by two or more overlapping bars in the diagram. For example, in the top diagram, tether misuse was observed in 86.0 percent of the seats and harness misuse was observed in 45.3 percent of tether required seats. However, both tether and harness misuse was observed in 41.2 percent of the seats, represented by the corresponding overlap. In addition, while belt misuse occurred in 35.5 percent of the seats, tether, harness and belt misuse occurred in 20 percent of the observations. Figure 4 illustrates a breakdown of tether, harness/shield, and belt use for the 214 toddler seats observed which required a tether strap. Following the top branch on the diagram indicates that only 7.0 percent of the seats were used correctly. Figure 5 illustrates a breakdown of harness/shield, and belt use of the 520 toddler seats which did not require the use of a tether strap. The top branch of this diagram indicates that 44.6 percent of the seats observed were correctly used.

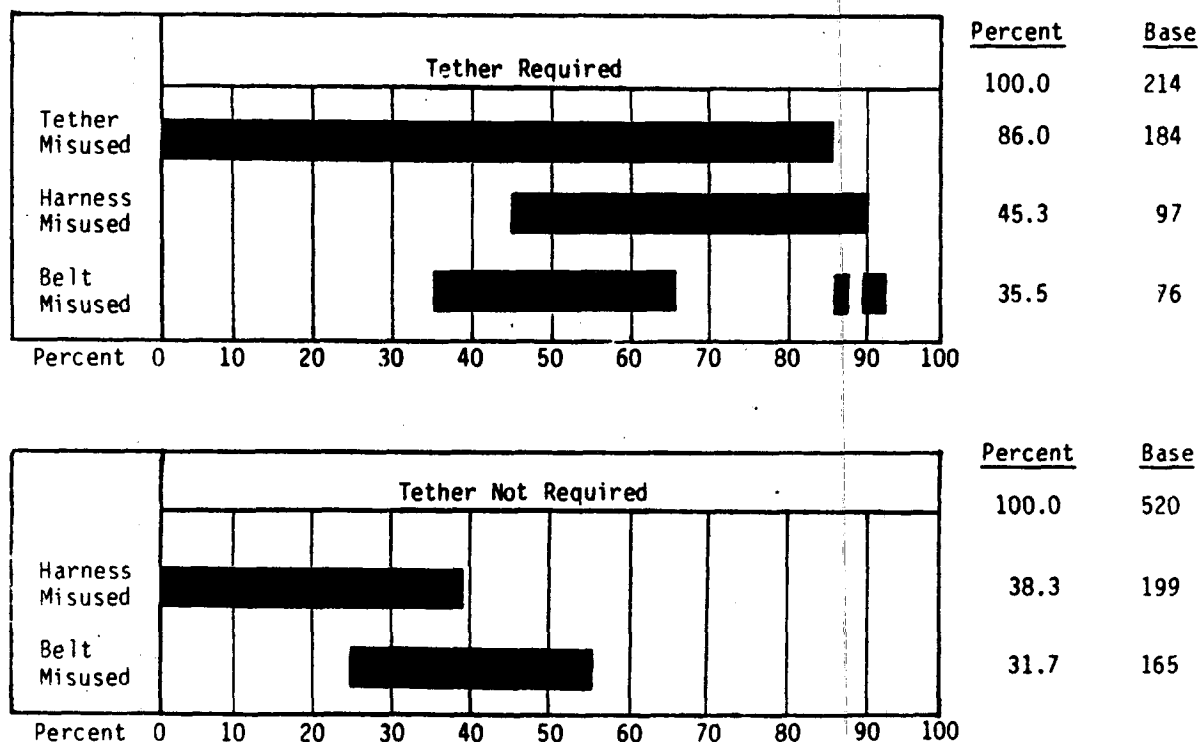


Figure 3. Illustration of the multiple misuses of toddler seats.

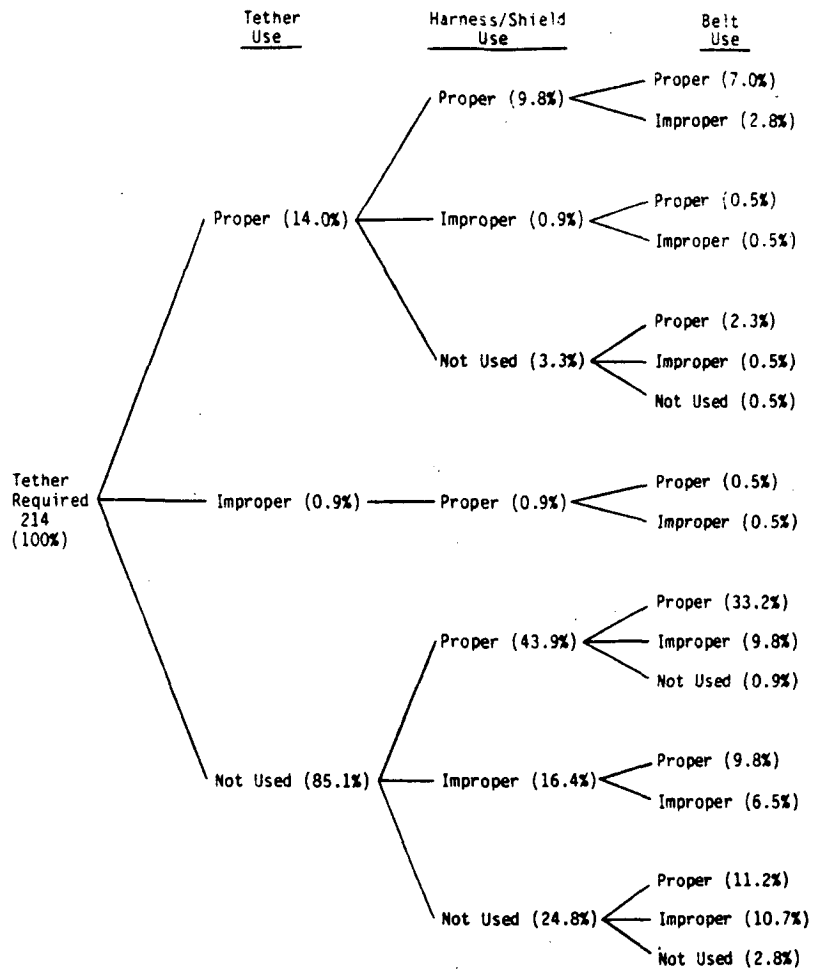


Figure 4. Breakdown of the misuse of toddler seats which require a tether strap.

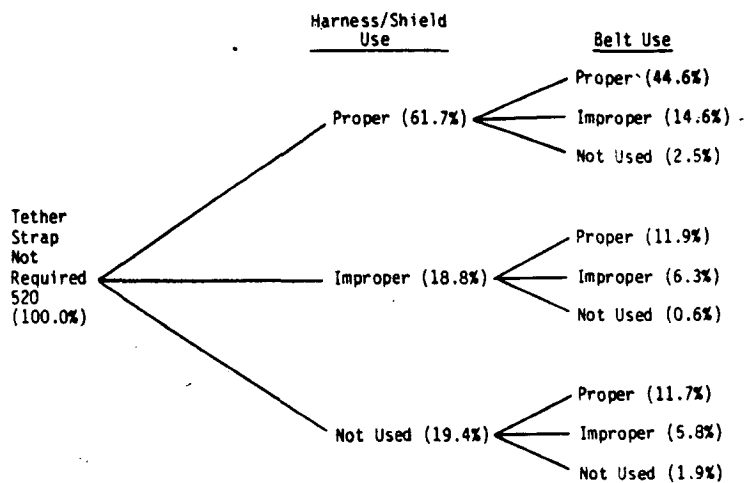


Figure 5. Breakdown of the misuse of toddler seats which do not require a tether strap.

Misuse of Toddler Seats by Model and Manufacturer

Table 7 shows the misuse of child safety seats by seat model and manufacturer. The most common seat was the Strolee Wee Care Models 597 and 599 which represented 22.2 percent of all toddler seat observations. This seat was, however, misused in 93.9 percent of the observations. The second most commonly observed seat was the Kantwet One Step (133 observations, 18.1 percent) which was misused 49.6 percent of the time. Another commonly observed seat, the Bobby Mac Champion (64 observations) was misused in 93.7 percent of the observations while 90.0 percent of all Bobby Mac seats combined were misused. On the other hand, the Collier-Keyworth Co-Pilot seat was observed to be misused in only 10.8 percent of 37 observations, and overall, Collier-Keyworth seats were misused in 15.2 percent of the 46 observations. A more comprehensive illustration of seat misuse for the models with 20 or more observations is shown in Appendix C.

Table 7. Misuse of toddler seats by seat model and manufacturer.

<u>Seat Model</u>	<u>Base</u>	<u>Percent Misused (Model)</u>	<u>Percent Misused (Manufacturer)</u>
Strolee 500 Series	163	93.9	92.6
Strolee 600 Series	12	75.0	
Bobby Mac Deluxe II	6	16.7	90.0
Bobby Mac Champion	64	93.7	
Bobby Mac Baby Chair	20	100.0	
Century 100	30	50.0	62.4
Century 200	44	40.9	
Century 300	33	78.8	
Child Love Seat	34	85.3	
Cosco-Peterson Safe-N-Easy	7	14.3	61.8
Cosco-Peterson Safe-T-Shield	10	40.0	
Cosco-Peterson Safe-T-Seat	36	75.0	
Cosco-Peterson Safe-N-Snug	9	44.4	
Peterson Safety Shell	5	100.0	
Cosco-Peterson Safe-T-Mate	1	100.0	
Kantwet Care Seat	7	71.4	52.6
Kantwet One Step	133	49.6	
Kantwet Safe Guard	5	40.0	
Kantwet Other	7	100.0	
Welsh Travel Tot	4	50.0	50.0
Kolcraft Hi-Rider	22	54.5	41.7
Kolcraft Redi-Rider	6	16.7	
Kolcraft Quick Step	8	25.0	
Teddy-Tot Astroseat	12	25.0	25.0
Collier-Keyworth Co-Pilot	37	10.8	15.2
Collier-Keyworth Safe & Sound	9	33.3	
Ford Tot Guard	2	0.0	0.0
Other	8	87.5	-
Totals	734	66.3	

### Misuse of Infant Safety Seats

There are two types of infant seats; seats designed exclusively for infants, and convertible seats which can be used in the infant or toddler mode. Infant seats (or convertible seats used in the infant mode) must be used rearward facing in a semi-reclined position. This will allow the baby's back to absorb the force in a collision rather than the chest or abdomen. In addition, all infant seats must have provisions to belt the seat to the vehicle (using the vehicle belt) and harness the child to the seat. In this study, 150 infant seats were observed, of which 52.7 percent were infant-only seats and 47.3 percent were convertible seats used in the infant mode. While 59.3 percent of all infant seats were misused, 57.0 percent of infant-only seats and 62.0 percent of convertible seats were misused.

### Harness Usage for Infant Seats

Proper use of infant safety seats requires that the harness be used to secure the child to the seat. Incorrect harness uses primarily consisted of not routing the straps over the shoulders of the infant. Table 2 indicates that the harness was not used in 28.9 percent of the observations and was incorrectly used in 4.0 percent of the observations (32.9 percent combined harness misuse).

Some infant seats require the vehicle belt to be routed through the frame and other infant seats require the vehicle belt to be routed over the child's lap through clips provided for the belt. Table 8 summarizes the observed harness misuse based on the routing of the vehicle belt. For infant seats where the vehicle belt secures the seat above the child's lap, 40.8 percent did not use the harness straps. For seats which require belting to the vehicle through the frame, 5.8 percent did not use the harness and 9.6 percent incorrectly used the harness.

Table 8. Harness misuse for infant seats with different belt routings.

<u>Belt Routing</u>	<u>Base</u>	<u>Percent Harness Not Used</u>	<u>Percent Harness Used Incorrect</u>	<u>Total Percent Misuse</u>
Over child's lap	98	40.8	1.0	41.8
Through frame	52	5.8	9.6	15.4

### Belt usage for Infant Seats

All infant seats require the use of the vehicle belt to secure the seat to the vehicle. Table 2 shows that the vehicle belt was not used in 9.4 percent and was incorrectly routed in 14.1 percent of the observations (23.5 percent combined misuse of belting).

The two major infant-only seats (Infant Love and Dyn-0-Mite) and some of the convertible seats require the use of the vehicle belt to secure the seat and the child every time the seat is used. The belt then must be removed for the child to exit the seat. Several of the convertible seats require the belt to be routed through the seat frame which allows the seat to be permanently belted. This arrangement results in the infant being secured by only the harness straps when in the seat. An analysis of the two types of belt routing is shown in Table 9. There was a higher percentage of incorrectly belted seats when the belt routing was through the frame, but there was a higher percentage of not using the belt when the belt was designed to be routed over the child's lap (10.2 percent compared to 7.7 percent belt misuse).

Table 9. Belt misuse for infant seats with different belt routings.

<u>Belt Routing</u>	<u>Base</u>	<u>Percent Belt Not Used</u>	<u>Percent Belt Used Incorrect</u>	<u>Total Percent Misuse</u>
Over child's lap	98	10.2	11.2	21.4
Through seat frame	52	7.7	19.2	26.9

### Incorrect Facing of Infant Seats

Infant seats are designed to face rearward. However, 33.3 percent of the infant seats were observed forward facing. Convertible seats used in the infant position were forward facing (misused) in 42.3 percent of 71 observations. Seats designed for infant use only were forward facing in 25.3 percent of 79 observations.

### Multiple Misuses of Infant Seats

Since all infant seats must be belted to the vehicle, rearward facing, and the infant harnessed in the seat, it is possible to have three incorrect uses for each seat. Although 59.3 percent of the infant seats were recorded as misused, 33.3 percent had one misuse, 22.0 percent had two misuses, and 4.0 percent had three misuses. Figure 6 illustrates the multiple misuses of infant safety seats. Figure 7 shows the breakdown in the usage characteristics for infant seats and the observed percentages in each category. Figure 7 shows, for example, that 6.7 percent of the infant seats observed were not belted and not harnessed while 40.7 percent were used correctly.

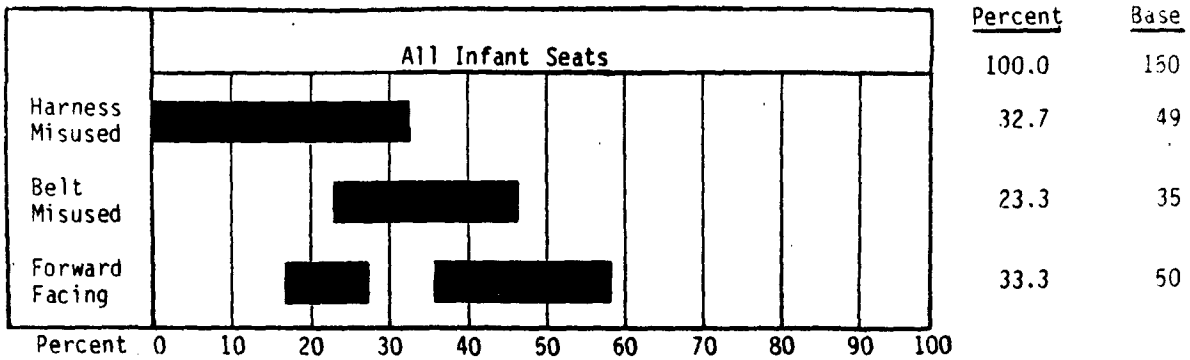


Figure 6. Illustration of the multiple misuses of infant seats.

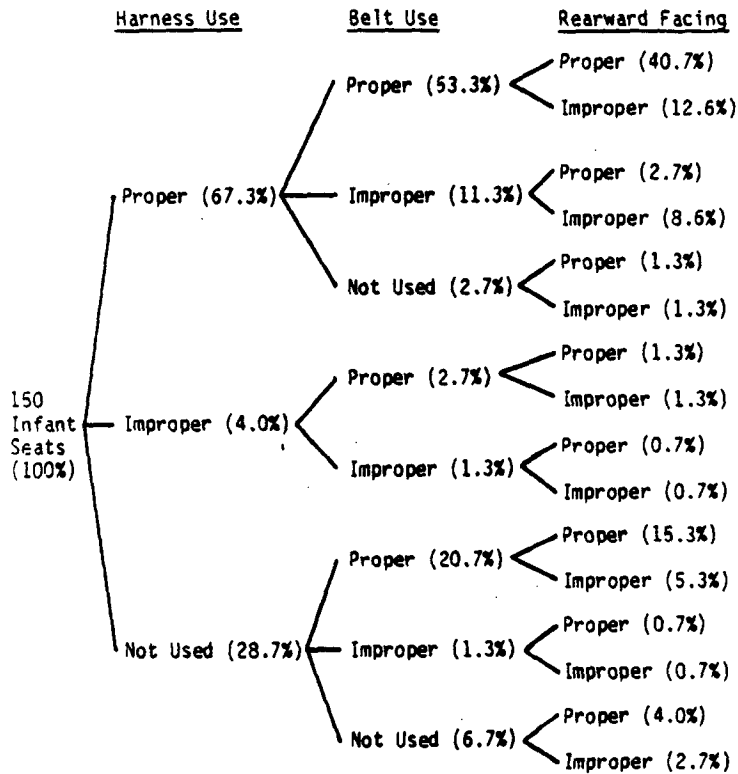


Figure 7. Breakdown of the misuse of infant seats.



### Misuse of Infant Seats by Manufacturer

Misuse of infant seats by model or manufacturer is shown in Table 10. The Dyn-0-Mite infant carrier was the most commonly observed seat used for infants (30.0 percent of the observations) and had a lower rate of misuse than most other infant seats. The second most popular seat used for transporting infants was the Infant Love Seat (21.3 percent of the observations) which was misused in 75.0 percent of the observations. Bobby Mac seats (Questor) were the most common convertible seats observed used for infants (13.3 percent of the observations).

Table 10. Misuse of infant seats by seat model/manufacturer.

<u>Seat Model/Manufacturer</u>	<u>Base</u>	<u>Percent Misused</u>
Infant only seats		
Dyn-0-Mite (Questor)	45	46.7
Infant Love (Century)	32	75.0
First Ride (Cosco)	2	0.0
Convertible Seats		
Bobby Mac (Questor)	20	70.0
Kantwet (Questor)	12	50.0
Strolee	10	70.0
Century	9	55.6
Collier-Keyworth	9	55.6
Cosco-Peterson	8	75.0
Kolcraft	1	0.0
Teddy-Tot	2	50.0
All Seats Combined	150	59.3

### Misuse of Booster Safety Seats

Booster safety seats designed for children 3 to 6 years in age are similar in that they require a means to secure the seat to the vehicle (using the vehicle belt) and they require upper torso restraint. The upper torso restraint can be provided by the shoulder harness of a 3-point vehicle belt system or with a harness system secured by a tether strap. Some booster seat models also come equipped in a high-back design or a harness pad to be used with a tether strap. However, all booster seats are basically the same in design and usage characteristics.

Misuse of booster seats consisted of not using the harness or tether strap (upper torso support) or not using the vehicle belt at all. Of the 122 booster safety seats observed, 61.5 percent were misused.

#### Harness Usage for Booster Seats

Booster seats in the front outboard position of a vehicle may use the shoulder harness of the 3-point vehicle belt to secure the child. Since very few vehicles are equipped with 3-point belt systems in the back seats, a tether strap must be used. Table 2 shows that booster seats were not harnessed 61.5 percent of the time. Of the 47 children using a harness, 76.6 percent used the shoulder harness from the 3-point vehicle belt system and 23.4 percent were restrained by a harness system and tether strap.

#### Belt Usage for Booster Seats

Over 85 percent of the children in booster seats were belted. In 17 observations (13.9 percent) the vehicle lap belt was not used and in 1 observation (0.8 percent) the vehicle lap belt was incorrectly routed.

#### Multiple Misuses of Booster Seats

For booster safety seats, there are two possibilities for incorrect use. While 61.5 percent of booster seats observed were misused, 46.7 percent had one incorrect use and 14.7 had two incorrect uses. Figure 8 shows the distribution of booster seat misuse characteristics. Figure 9 shows a breakdown of the misuse of booster seats. There were no observations of a child harnessed in a booster seat but not belted.

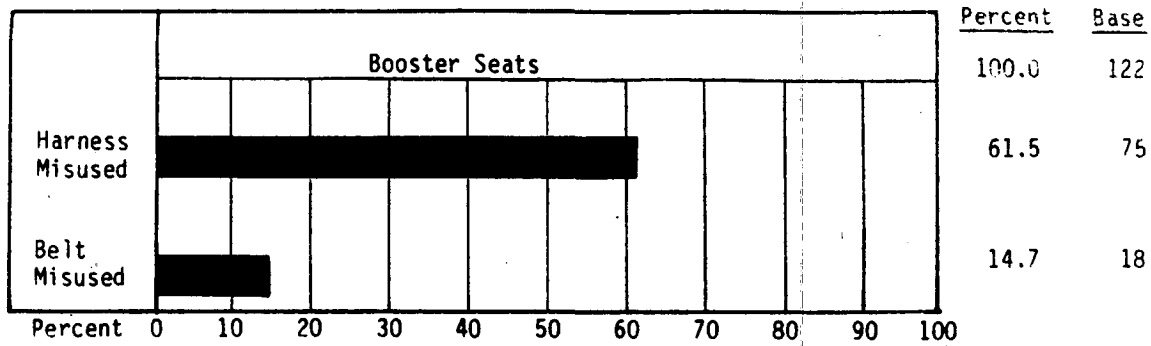


Figure 8. Illustration of the multiple misuses of booster seats.

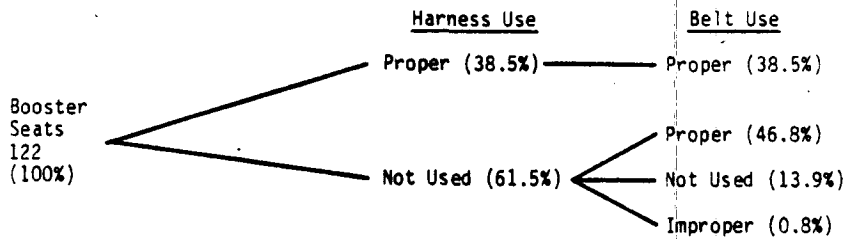


Figure 9. Breakdown of the misuses of booster seats.

Misuse of Booster Seats by Model and Manufacturer

The number of booster seats observed by seat manufacturer is shown in Table 11. The booster seat observed most was the Kolcraft Tot Rider (53.5 percent) followed by the Century Safe-T-Rider (25.4 percent of the observations). The percent misused by each manufacturer is also shown in Table 11.

Table 11. Misuse of booster seats by manufacturer.

<u>Manufacturer</u>	<u>Base</u>	<u>Percent Misused</u>
Kolcraft Tot Rider	65	66.2
Century Safe-T-Rider	31	54.8
Strolee Wee Care	16	56.2
Cosco-Peterson Travel Hi-Lo	7	71.4
Teddy Tot Astrorider	1	0.0
Seat not identified	2	50.0
Total	122	61.6

## Summaries of the Misuse of Child Safety Seats

The following summaries show the misuse of child safety seats based on various observed conditions (such as driver restraint use or safety seat location) and responses to the survey questions. In each summary seat misuse is shown independently by type of seat and all seats combined.

### Misuse of Child Safety Seats by Seat Position

Usage characteristics for safety seats by seat position in the vehicle are shown in Table 12. Toddler seats were more commonly observed in the back outboard position, back driver position, and back center position. Misuse of toddler seats ranged from 79.5 percent in the front center position to 59.7 percent in the back center position.

The most common position observed for infant seats was the front outboard and over 53 percent of infant seats were observed in the front seat, compared to less than 20 percent of toddler seats. Misuse of infant seats was more common in the back seat than in the front seat.

Booster seats were most frequently observed in the front outboard position (32.4 percent). Booster seats in the front outboard position were misused in 28.9 percent of the observations while 77.9 percent of the booster seats in other positions were misused. Overall, seat position has little relation between misuse of safety seats, with the exception of booster seats in the front outboard position.

**Table 12. Misuse of child safety seats by seat position.**

<u>Seat Position</u>	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>Booster Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>
Front Center	39	79.5	26	53.8	7	100.0	72	72.2
Front Outboard	94	68.1	49	51.0	38	28.9	181	55.2
Front Total	133	71.4	75	52.0	45	40.0	253	60.1
Back Driver	191	69.1	21	66.7	30	73.3	242	69.4
Back Center	134	59.7	15	80.0	10	80.0	159	62.9
Back Outboard	234	64.5	30	63.3	31	71.0	295	65.1
Back Total	559	64.9	66	68.2	71	73.2	696	66.1
Rear of Station Wagon	0	-	0	-	1	100.0	1	100.0
Total	692	66.2	141	59.6	117	60.7	950	64.5

### Misuse of Child Safety Seats by Driver Restraint Use

Driver restraint usage was recorded in 800 observations of child safety seats. As shown in Table 13, there is a higher likelihood of misusing safety seats when the driver is not belted. For all seats combined, 47.1 percent of the seats were misused when the driver was belted compared to a 71.0 percent misuse when the driver was not belted. This relationship was more pronounced with respect to booster seats which requires the use of the shoulder harness from a 3-point belt system (or a tether strap/lap belt combination) for correct usage.

Table 13. Misuse of child safety seats by driver restraint use.

Driver Belted	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Yes	169	50.9	32	43.7	41	34.1	242	47.1
No	<u>406</u>	<u>72.4</u>	<u>96</u>	<u>62.5</u>	<u>56</u>	<u>75.0</u>	<u>558</u>	<u>71.0</u>
Total	575	66.1	128	57.8	97	57.7	800	56.8

### Misuse of Child Safety Seats by Relationship to Child

In a majority of the observations, only one adult was observed per vehicle. In the cases where two or more adults were in the vehicle, the person surveyed was the individual responsible for securing the child and safety seat. A vast majority of those surveyed were either the mother (76.0 percent) or the father (19.9 percent) of the child. The percentage of misuse between mothers and fathers did not differ greatly, as shown in Table 14. Where the child's parent was responsible for securing the safety seat, 63.9 percent of the seats were misused. In the 42 instances where non-parents were responsible for securing the child safety seat, misuse was approximately 81 percent.

Table 14. Misuse of child safety seats by relationship to child.

Relationship to Child	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Mother	556	66.7	118	61.0	104	58.7	778	64.8
Father	146	61.0	25	52.0	12	66.7	183	60.1
Relative	21	85.7	4	50.0	4	100.0	29	82.8
Babysitter	9	77.8	3	67.0	1	100.0	13	76.9

Misuse of Child Safety Seats by Who First Installed the Seat

A majority of respondents indicated that either they or their spouse were responsible for first installing the safety seat in their vehicle. The results indicated that 71.4 percent of those surveyed were responsible for initially installing the seat in the vehicle and misuse was not related to who first installed the seat. Table 15 shows the misuse of child safety seats based on who first installed the seat.

**Table 15. Misuse of child safety seats by who first installed the seat.**

Who First Installed the Seat	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Self	512	66.6	116	57.8	91	70.3	719	65.5
Spouse	208	64.6	32	62.5	27	40.7	267	61.8
Other	14	85.7	2	100.0	4	0.0	20	70.0

Misuse of Child Safety Seats by Reason for Using the Seat

One of the questions asked during the survey related to why the child was being transported in a safety seat. An overwhelming majority (85.3 percent) of the respondents indicated that the child's safety was their primary concern as shown in Table 16. In addition, 7.5 percent indicated that the safety seat was used to keep the child still while in the car, and 5.5 percent used the seat because it was required by law. Misuse of safety seats was 62.7 percent for those who indicated that safety was the primary reason while misuse was 76.3 percent for those who gave non-safety related reasons for using the safety seat.

**Table 16. Misuse of child safety seats by reason for using the seat.**

Reason	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Safety	631	65.0	131	55.0	95	57.9	857	62.7
Keep child still	53	79.2	4	100.0	18	77.8	75	80.0
Required by law	39	69.2	10	90.0	6	66.6	55	72.7
Other	<u>10</u>	<u>70.0</u>	<u>5</u>	<u>80.0</u>	<u>3</u>	<u>66.7</u>	<u>18</u>	<u>72.2</u>
Total	733	66.3	150	59.3	122	61.5	1,005	64.7

### Misuse of Child Safety Seats by the Age of the Child

Misuse of child safety seats, in general, does not appear to be related to the age of the child. Summaries of seat misuse are shown in Tables 17, 18, and 19 for toddler seats, infant seats, and booster seats respectively.

Approximately 4 percent of the children observed in toddler seats were 4 years or older while 12.4 percent were younger than 12 months. Misuse of toddler seats ranged from 52.7 percent for children less than 12 months to 75.3 percent for those 36-41 months old. However, there appears to be no direct relationship between the age of the toddler and the misuse of toddler seats.

Table 17. Misuse of toddler seats by age of child.

<u>Age of Child</u>	<u>Base</u>	<u>Percent Misused</u>
Less than 12 Months	91	52.7
12 - 17 Months	162	66.7
18 - 23 Months	129	69.0
24 - 29 Months	162	69.1
30 - 35 Months	69	62.3
36 - 41 Months	77	75.3
42 - 47 Months	14	64.3
4 Years or Older	<u>30</u>	<u>66.7</u>
Total	734	66.3

The distribution of children by age observed using infant safety seats is shown in Table 18. Approximately 9 percent of the children using infant seats were 10 months or older, two 18-month old children, and one 3-year old child were observed in infant-only carriers. On the other hand, 14.7 percent of those observed in an infant seat were one month or less in age. Misuse of infant seats was lowest for children 3 months or younger. This age group experienced a 43.8 percent rate of misuse. This can be compared to 72.1 percent rate of misuse for those older than 3 months.

Table 18. Misuse of infant seats by age of child.

<u>Age of Child</u>	<u>Base</u>	<u>Percent Misused</u>
1 Month	22	31.8
2 Months	21	52.4
3 Months	21	47.6
4 Months	18	77.8
5 Months	15	80.0
6 Months	19	52.6
7 - 9 Months	20	65.0
10 - 12 Months	9	100.0
Over 1 Year	<u>5</u>	<u>80.0</u>
Total	150	59.3

A majority of children observed using booster seats were aged 3 to 4 years while 13.1 percent were 2 years or younger and 22.1 percent were 5 years in age or older (Table 19). While the numbers are very small, there is a tendency for the misuse of booster seats to decrease with increasing ages of children. Misuse of booster seats ranged from 81.2 percent for those 2 years old or younger to 44.4 percent for those 5 years or older.

Table 19. Misuse of booster seats by age of child.

<u>Age of Child</u>	<u>Base</u>	<u>Percent Misused</u>
Up to 2 Years	16	81.2
3 Years	32	68.7
4 Years	47	59.6
5 Years or Older	<u>27</u>	<u>44.4</u>
Total	122	61.5



### Misuse of Child Safety Seats by Method of Seat Acquisition

As shown in Table 20, 65.8 percent of the respondents indicated that their safety seats were purchased new, while 20.7 percent were received new as a gift. Overall, 86.5 percent were obtained new while 13.5 percent were obtained used. The lowest rate of misuse was for seats bought new while the highest misuse was for used seats received as gifts and for used seats bought or previously used. In addition, 23.4 percent of the seats were obtained as a gift which indicates that nearly one quarter of the parents were not involved in the seat selection process. Seats obtained as a gift were misused in 73.3 percent of the observations.

For toddler seats, 86.9 percent were obtained new, and these seats had the lowest frequency of misuse. Seats obtained used as a gift were misused in 21 of 23 observations.

The respondents using infant seats indicated that 43.2 percent bought the seat new and 32.2 percent received the seat new as a gift. Those who received the seat new as a gift, had the highest rate of misuse. There were smaller differences in the proportion of infant seat misuse between seats obtained new and seats obtained used compared to toddler seats. Infant seats obtained new were misused at a higher rate than those obtained used. A higher proportion of infant safety seats were borrowed or rented (17.1 percent) than toddler seats (4.6 percent) or booster seats (0.8 percent). This may be due to the fact that infant seats are only used for 9 to 12 months (for a particular child) whereas toddler and booster seats may be used for 3 or 4 years.

Most of the booster seats observed were bought new (93.4 percent), and only 3 of those observed were obtained used.

Table 20. Misuse of child safety seats by method of seat acquisition.

Method of Acquisition	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Bought New	477	60.4	63	52.4	113	60.2	653	59.6
Gift New	153	72.5	47	70.2	5	60.0	205	71.7
Bought Used	39	84.6	7	57.1	2	100.0	48	81.2
Gift Used	23	91.3	4	50.0	0	-	27	85.2
Borrowed/Loaner	33	78.8	25	56.0	1	100.0	59	69.5
Obtained New (Total)	630	63.3	110	60.0	118	60.2	858	62.5
Obtained Used (Total)	95	84.2	36	55.5	3	100.0	134	76.9

### Misuse of Child Safety Seats by the Age of the Seat

During the survey, respondents were asked how long they owned the safety seat. Since about 87 percent of those owning toddler seats obtained them new, a majority of the responses accurately indicated the actual age of the seat. For the 13 percent who obtained their toddler seat used, the seats were actually older, but respondents were unable to accurately give the actual age of the seat. Approximately 38 percent of the respondents with toddler seats owned the seats for less than 18 months. While 21 percent owned the seats for 4 years or more, 3 percent owned the seats for 7 years or more and 3 individuals indicated they had the toddler seat for 11 years. As shown in Table 21, misuse of toddler seats increased with the age of the seat. Misuse ranged from 43.5 percent for seats owned less than 12 months to 90.9 percent for seats over 7 years old.

Table 21. Misuse of toddler seats by how long the seat was owned.

<u>Age of Seat</u>	<u>Base</u>	<u>Percent Misused</u>
Less than 12 Months	154	43.5
12 - 17 Months	125	56.0
18 - 23 Months	92	66.3
24 - 29 Months	101	74.3
30 - 35 Months	34	70.6
36 - 47 Months	74	81.1
48 - 59 Months	61	75.4
5 Years	44	90.9
6 Years	27	88.9
7 Years or Older	<u>22</u>	<u>90.9</u>
Total	734	66.3

Misuse of infant seats based on how long the seat was owned is shown in Table 22. Of those surveyed, 97 (64.7 percent) owned their seat less than one year and over 10 percent owned the seat for 5 years or more. Misuse of infant seats tended to increase with increasing age of the seat. For seats owned less than 12 months, observed misuse was recorded as 51.5 percent, while 73.5 percent of those seats older than 12 months were misused.

Table 22. Misuse of infant seats by how long the seat was owned.

<u>Age of Seat</u>	<u>Base</u>	<u>Percent Misused</u>
Less than 6 Months	72	50.0
6 - 11 Months	25	56.0
12 - 23 Months	10	70.0
24 - 35 Months	7	57.1
36 - 59 Months	20	75.0
5 Years or Older	<u>16</u>	<u>81.3</u>
Total	150	59.3

Table 23 indicates that 28 (23.0 percent) of the booster seats observed in the study were owned 6 months or less while 63 (51.6 percent) were owned for one year or less. Only 18 respondents (14.8 percent) indicated that they had owned their seat for more than 2 years. This result may be expected since booster seats are a relatively new type of safety seat which are just starting to gain a more widespread acceptance and use by consumers. Misuse of booster seats by age of the seat is also shown in Table 23.

Table 23. Misuse of booster seats by how long the seat was owned.

<u>Age of Seat</u>	<u>Base</u>	<u>Percent Misused</u>
Up to 6 Months	28	53.6
7 - 12 Months	35	80.0
13 - 24 Months	41	51.1
More Than 2 Years	<u>18</u>	<u>61.1</u>
Total	122	61.5

### Misuse of Child Safety Seats Based on Instructions Received

Respondents were asked if they had received instructions on the use of their safety seats and what types of instructions they received. Of those responding, 93.8 percent said they had received instructions. Of those receiving instructions, 94.0 percent received written instructions, 4.0 percent received verbal instructions, and 2.0 percent received both written and verbal instructions. Misuse of safety seats was highest for those not receiving instructions and for those receiving verbal instructions only as shown in Table 24.

Table 24. Misuse of child safety seats based on instructions received.

What type of Instructions Did You Receive	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused	Base	Percent Misused
Written	630	64.0	120	58.3	117	60.7	867	62.7
Verbal	28	85.2	8	50.0	2	100.0	37	78.4
Written & Verbal	8	62.5	9	33.3	1	0.0	18	44.4
None	50	86.0	10	90.0	1	100.0	61	86.9

### Misuse of Child Safety Seats Based on How the Seat was First Installed

Respondents were also asked how they first installed and used the safety seat in order to determine how many people actually used the instructions or had installation/use of the seat demonstrated. Of those responding to this question, 67.5 percent followed the manufacturer's instructions, 4.3 percent had the initial installation demonstrated and 28.2 percent stated they had no help. Several of those who said that they had no help stated that they had previous experience with other child safety seats or that the seat was fairly straight forward to use (as in the case of some infant and booster seats). Misuse of safety seats was, however, highest for those who stated they had no help, as shown in Table 25.

Approximately 80 percent of those stating that the installation of the seat was demonstrated received the demonstration from their spouse. A few individuals cited demonstrations from salespersons, nurses, friends and relatives. Misuse for those that had the seat installation demonstrated was 70.7 percent. One individual, who was a demonstrator of safety seats for a major retail store, improperly routed the vehicle belt to secure her toddler seat and stated she was unknowingly giving wrong information on safety seat use during her demonstrations.

Misuse of safety seats was lowest among individuals who stated they followed the manufacturer's instructions. Of those who followed the manufacturer's instructions, 95.0 percent stated that the instructions were easy to follow. Select comments from individuals having difficulty with the manufacturer's instructions (by seat model) are shown in Appendix D.

Table 25. Misuse of child safety seats based on how the seat was first installed.

<u>How First Installed</u>	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>Booster Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>
Followed Instructions	472	60.4	94	51.1	84	57.1	650	58.6
Installation Demonstrated	25	80.0	15	60.0	1	0.0	41	70.7
No Help	202	75.7	36	80.6	34	76.5	272	76.1

Misuse of Child Safety Seats by Use in More Than One Vehicle

Table 26 indicates that 52.1 percent of safety seats remain in one vehicle at all times. While 54.6 percent of the toddler seats remain in one vehicle at all times, a lower percentage of infant seats (36.7 percent) always remain in one vehicle. The seats designed exclusively for infants are smaller than toddler seats, are very portable and can be used while in the house. Misuse of seats which always remained in one vehicle was somewhat lower for toddler seats but was higher for infant and booster seats. This question has more relevance for seats which can be permanently secured to the vehicle, particularly those seats requiring a tether. Of the 214 toddler seats requiring a tether, 46.7 percent were used in more than one vehicle. Therefore, a tether anchorage had to be available in more than one vehicle to allow those toddler seats to be used correctly.

Table 26. Misuse of child safety seats by use in more than one vehicle.

<u>Does Seat Always Remain in One Vehicle</u>	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>Booster Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>
Yes	401	65.1	55	67.3	68	64.7	524	61.8
No	333	67.9	95	54.7	54	57.4	482	64.1

Misuse of Child Safety Seats by Existence of a Mandatory Child Restraint Law

An analysis was conducted to determine if misuse of safety seats varied based on the existence of a mandatory child safety seat law in the state. This summary is shown in Table 27. By the time data collection began on this project most states had passed a mandatory child restraint law. However, in one state a law was passed but not yet into effect (Iowa) and in another state the law had gone into effect during the same month that data collection was conducted in that state (Georgia). The lowest misuse was recorded in a city without a child restraint law in effect while the highest misuse was recorded where the law had most recently gone into effect. These results tend to support the conclusion that those using the safety seat for safety purposes were less likely to misuse the seat. Sample sizes were, however, small in the two states and it is difficult to draw any conclusions.

Table 27. Misuse of child safety seats by existence of mandatory child restraint law.

<u>Effective Date of Law</u>	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>Booster Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>	<u>Base</u>	<u>Percent Misused</u>
Prior to 1984	345	67.2	68	58.8	47	57.4	460	65.0
During 1984, Prior to Data Collection	294	63.2	62	58.1	52	71.2	408	63.7
July, 1984	53	77.4	12	66.7	19	52.6	84	70.2
Law Not Yet in Effect	42	64.3	8	25.0	4	50.0	54	57.4

Intentional Versus Unintentional Misuse of Child Safety Seats

When observers noted that the safety seat was misused, they asked the parent if they realized that the seat was used incorrectly. In addition, the parent was asked why the seat was misused. The results are presented independently for harnessing, tether usage, incorrect belt routing, non-use of the belt and using infant seats facing forward.

Misuse of Harness/Shield

Approximately 95 percent of 411 respondents stated that they realized that the child was not (or was improperly) harnessed. The results were consistent for all three types of safety seats as shown in Table 28. For cases of observed misuse, the respondents were asked why the safety harness was not used or improperly used. The responses for toddler seats are shown in Table 29. The main response (23.4 percent) was that the child

took it off during the trip. In another 3.9 percent of the responses, parents responded that the child always takes it off and they don't bother anymore. Other responses related to the discomfort of the child using the harness/shield (13.5 percent) or the harness/shield not fitting properly (10.7 percent). Thirty-six respondents indicated that they felt the harness and/or shield was not necessary or offered no protection. Approximately 9 percent indicated that the harness was too much trouble to use on short trips, an additional 5 percent indicated that the harness was a hassle to use on any trip, and 2.8 percent stated they were in a hurry. Only 2.5 percent stated they forgot to put the harness/shield on.

An infrequent response was that the harness/shield was too difficult to use with bulky clothes and blankets. This was an expected result since the survey was taken during the summer, and may change during cold weather conditions. On the other hand, several individuals complained that the harness/shield was too hot to use in the summer.

The reasons for not using the harness on infant seats are shown in Table 30. Nine of the respondents (18.7 percent) indicated that the harness did not fit while one stated that the child was uncomfortable. Seven individuals (14.5 percent) indicated that the harness was a hassle to use, 12.5 percent stated that it was not necessary and 8.3 percent stated that they were in a hurry.

Responses for those using a booster seat are shown in Table 31. Fourteen individuals stated they felt the shoulder harness (or tether strap) was not necessary and the lap belt alone was sufficient, while 11 percent stated that the harness was a hassle to use. Several responses related to the difficulty in the use of the tether harness or an unwillingness to drill a hole for a tether anchor. The child's comfort or improper fit of the harness was mentioned in 12.3 percent of the responses.

Table 28. Intentional versus unintentional misuse of the safety harness/shield.

Safety Harness/ Shield Misuse	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent	Base	Percent	Base	Percent	Base	Percent
Intentional	271	94.1	48	100.0	74	98.7	393	95.6
Unintentional	17	5.9	0	0.0	1	1.3	18	4.4

Table 29. Reasons for not wearing the safety harness or improperly wearing the safety harness/shield for toddler seats.

<u>Base</u>	<u>Percent</u>	<u>Response</u>
66	23.4	Child took it off after I put it on
38	13.5	Child did not like it/child uncomfortable
34	12.1	Don't use it because it is <u>not necessary</u>
30	10.7	Harness and/or shield does not fit
25	8.9	Harness not used for short trip
14	5.0	Don't use it because it is a hassle to use
13	4.6	Harness/fastener is broken/removed
11	3.9	Child always takes it off, doesn't bother anymore
8	2.8	In a hurry
7	2.5	Forgot to put it on
6	2.1	Too hot to use shield/harness
6	2.1	Child was sleeping, didn't want to wake to put on harness
5	1.8	Bought used, did not come with shield
4	1.4	Parent doesn't like it
3	1.1	Don't know how to use it or use it correctly
3	1.0	Shield lost/no longer has shield or harness
3	1.0	Other
2	0.7	Didn't know harness was needed
1	0.4	Lent seat out, came back without harness
1	0.4	Belt doesn't fit with shield on
1	0.4	Too bulky with winter coat
1	0.4	Harness off/unfastened so parent can care for child needs
282	100.0	Total

Table 30. Reasons for not using the safety harness or improperly wearing the safety harness for infant seats.

<u>Base</u>	<u>Percent</u>	<u>Response</u>
9	18.7	Harness does not fit
7	14.5	Don't use it because it is a hassle to use
6	12.5	Don't use it because it is <u>not necessary</u>
4	8.3	In a hurry
4	8.3	Too hot to use it
3	6.2	Parent doesn't like it
3	6.2	Harness not used for short trip
2	4.2	Forgot to put it on
2	4.2	Harness/fastener is broken/removed
2	4.2	Don't know how to use it or use it correctly
1	2.1	Child took it off after I put it on
1	2.1	Bought used, did not come with harness
1	2.1	Child uncomfortable
1	2.1	Just took it off, haven't put it back on
1	2.1	So parent can care for child's needs
1	2.1	Other
48	100.0	Total



Table 31. Reasons for not wearing the harness or tether strap for booster seats.

<u>Base</u>	<u>Percent</u>	<u>Response</u>
14	19.2	Don't use it because it is <u>not necessary</u>
9	12.3	Don't want to drill hole (Booster tether)
8	11.0	Don't use it because it is a hassle to use
7	9.6	Child did not like it/child uncomfortable
5	6.8	Other
5	6.8	Not my car (Booster tether)
4	5.5	Seat moved often (Booster tether)
4	5.5	Harness not used for short trip
3	4.1	Child took it off after I put it on
3	4.1	Bought new, didn't come with seat (Booster tether)
3	4.1	No place to install (Booster tether)
3	4.1	Haven't gotten around to installing (Booster tether)
2	2.7	Harness does not fit
1	1.4	Forgot to put it on
1	1.4	Don't know how to use it (Booster tether)
<u>1</u>	<u>1.4</u>	Didn't know harness was needed
73	100.0	Total

Misuse of Tether Strap

Table 32 indicates that nearly 80 percent of those not using a tether strap knew that the tether was required. About the same percentage of those having unoccupied seats not tethered (but requiring a tether) gave the same response. The reasons given for not using the tether strap are shown in Table 33. Fifteen percent stated that they didn't know a tether was necessary and four others claimed to be unfamiliar with the seat. A majority of individuals were reluctant to drill a hole or install a tether anchor. In addition, many individuals felt they would need the anchor installed in more than one vehicle. Several individuals stated that there was no place to install a tether in pickup trucks or station wagons or where the number of passengers precluded its use. In a few cases, the seat was bought used and the tether strap was no longer attached to the seat.

Table 32. Intentional versus unintentional misuse of tether straps for toddler seats.

<u>Tether Misuse</u>	<u>Occupied Seats</u>		<u>Unoccupied Seats</u>		<u>Occupied and Unoccupied Combined</u>	
	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>
Intentional	143	79.9	63	74.1	206	78.0
Unintentional	36	20.1	22	25.9	58	22.0

Table 33. Reasons for not using the tether strap for toddler seats (when required).

<u>Occupied</u>		<u>Unoccupied</u>		<u>Response</u>
<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	
28	15.6	8	9.2	Seat is moved from car to car
27	15.0	14	16.1	Didn't know that a tether was necessary
27	15.0	12	13.8	Tether strap too much trouble to install
22	12.2	1	1.1	No place to install tether
16	8.8	9	10.3	Car belt holding seat is good enough, tether not that important or necessary.
14	7.8	9	10.3	Doesn't want to drill hole in car for anchor
9	5.0	1	1.1	Couldn't figure out how to install
9	5.0	2	2.3	Not my car
8	4.4	9	10.3	Haven't gotten around to it yet
6	3.3	5	5.7	Bought seat used, tether did not come with the seat
5	2.8	2	2.3	Too many people in car - no room for tether
3	1.7	2	2.3	Other
2	1.1	0	0.0	Not our seat, just borrowed
2	1.1	7	8.0	Somebody else installed seat, thought it was OK
1	0.6	2	2.3	Borrowed car
1	0.6	0	0.0	Too much trouble to use
0	0.0	4	4.6	Don't know how to use it correctly
180	100.0	87	100.0	Total

### Vehicle Belt Incorrectly Routed

Table 34 shows that approximately 74 percent of those incorrectly routing the vehicle belt for occupied toddler seats did so unintentionally. For unoccupied seats, approximately 82 percent were unknowingly routing the belt incorrect. The difference in responses between occupied and unoccupied toddler seats, while small, may be due to the fact that belting information cannot be collected for unoccupied seats which require the vehicle belt to be routed around the child or a shield.

Tables 35 and 36 show the reasons for improper belt routing for toddler seats and infant seats respectively. Approximately 65 percent of those incorrectly belting toddler seats stated they did not realize the belt was routed incorrect, while 4.5 percent stated someone else installed the seat and they thought it was correct. Nearly 13 percent of those with toddler seats stated that they felt that it doesn't make a difference where the belt was routed while a few others incorrectly routed the belt to compensate for incorrect harnessing or to be quick. In a few cases, respondents stated the belief that incorrectly routing the vehicle belt would secure the seat better. About 75 percent of those incorrectly belting infant seats indicated they didn't realize the belt routing was incorrect.

Table 34. Intentional versus unintentional incorrect belting of the vehicle belt to secure the safety seat.

Misuse	<u>Occupied Seats</u>							
	Toddler Seats		Infant Seats		Booster Seats		All Seats Combined	
	Base	Percent	Base	Percent	Base	Percent	Base	Percent
Intentional	52	26.0	3	18.8	0	0	55	25.3
Unintentional	148	74.0	13	81.3	1	100.0	162	74.7

Misuse	<u>Unoccupied Seats</u>					
	Toddler Seats		Infant Seats		All Seats Combined	
	Base	Percent	Base	Percent	Base	Percent
Intentional	15	18.3	1	10.0	16	17.4
Unintentional	67	81.7	9	90.0	76	82.6

Table 35. Reasons for incorrectly using the car belt to secure toddler seats.

<u>Occupied</u>		<u>Unoccupied</u>		<u>Response</u>
Base	Percent	Base	Percent	
130	65.0	56	68.3	Didn't realize it was being used incorrectly
25	12.5	2	2.4	Doesn't make any difference where the belt goes just so it goes somewhere around the seat
13	6.5	1	1.2	Feels it is safer this way
9	4.5	9	11.0	Somebody else installed, assumed it was correct
7	3.5	3	3.7	Belt would not fit anywhere else
4	2.0	2	2.4	Belted it incorrectly to be quick (in a hurry)
3	1.5	1	1.2	Harness (or shield) not used, belt rerouted to compensate
3	1.5	2	2.4	Easier to use this way
2	1.0	1	1.2	Couldn't figure out how to install correctly
2	1.0	2	2.4	Other
1	0.5	1	1.2	Belt would not fit tighter
1	0.5	0	0.0	Defective auto belt
0	0.0	2	2.4	Usually correct, don't know why it is incorrect
200	100.0	82	100.0	Total

Table 36. Reasons for incorrectly using the car belt to secure infant seats.

<u>Occupied</u>		<u>Unoccupied</u>		<u>Response</u>
Base	Percent	Base	Percent	
12	75.0	7	70.0	Didn't realize it was being used incorrectly
2	12.5	0	0.0	Doesn't make any difference where the belt goes just so it goes somewhere around the seat
1	6.3	0	0.0	Uncomfortable for child
1	6.3	2	20.0	Other
0	0.0	1	10.0	Somebody else installed, assumed it was correct
16	100.0	10	100.0	Total

Vehicle Belt Not Used to Secure the Seat

Table 37 indicates that 75.5 percent of those not securing the seat to the vehicle intentionally did not use the vehicle belt. The response to this question was similar for toddler seats and infant seats but differed for booster seats, however, the sample sizes are small. The reasons for not using the vehicle belt are shown in Tables 38, 39, and 40 for toddler, infant and booster seats, respectively. Although several of the respondents indicated that they thought the belt was used, others indicated responses including the car belt broken/removed, the child removing the belt, and being in a hurry.

Table 37. Intentional versus unintentional non-use of the vehicle belt to secure the safety seat.

<u>Misuse</u>	<u>Occupied Seats</u>							
	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>Booster Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>
Intentional	26	76.5	10	76.9	8	57.1	44	75.5
Unintentional	8	23.5	3	23.1	6	42.9	14	24.1

<u>Misuse</u>	<u>Unoccupied Seats</u>					
	<u>Toddler Seats</u>		<u>Infant Seats</u>		<u>All Seats Combined</u>	
	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>
Intentional	8	47.1	0	0	8	44.4
Unintentional	9	52.9	1	100.0	10	55.6

Table 38. Reasons for not using the car belt to secure the toddler seat.

<u>Occupied</u>		<u>Unoccupied</u>		<u>Response</u>
<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	
8	23.5	8	47.1	Thought is was on
5	14.7	1	5.9	Car belt broken/removed
4	11.8	0	0.0	In a hurry
4	11.8	4	23.5	Other
3	8.8	0	0.0	Child took off belt
3	8.8	0	0.0	Only used on long trips
2	5.9	1	5.9	No safety belt (pickup truck/old car)
2	5.9	1	5.9	Forgot to put it on
1	2.9	1	2.9	Didn't realize that car belt was necessary to secure seat
1	2.9	0	0.0	Seat only used to let child see out of window
1	2.9	0	0.0	Seat turned sideway to allow it to recline more
0	0.0	1	5.9	Car belt doesn't fit through (or around) child seat
34	100.0	17	100.0	Total

Table 39. Reasons for not using the car belt to secure the infant seat.

<u>Occupied</u>		<u>Unoccupied</u>		<u>Response</u>
<u>Base</u>	<u>Percent</u>	<u>Base</u>	<u>Percent</u>	
3	23.1	0	0.0	In a hurry
2	15.4	1	100.0	Thought it was on
2	15.4	0	0.0	Too many people in the vehicle
2	15.4	0	0.0	Doesn't want to bother buckling/unbuckling every time (Infant Seat)
2	15.4	0	0.0	Only used on long trips
1	7.7	0	0.0	Forgot to put it on
1	7.7	0	0.0	Child care while in transit (crying, hungry, etc.)
13	100.0	1	100.0	Total

Table 40. Reasons for not using the vehicle belt to secure the booster seat.

<u>Base</u>	<u>Percent</u>	<u>Response</u>
3	20.0	Forgot to put it on
3	20.0	In a hurry
2	13.3	Other
1	6.7	Thought it was on
1	6.7	Car belt broken/removed
1	6.7	Doesn't want to bother buckling/unbuckling every time the seat is used
1	6.7	Seat only used to let child see out of window
1	6.7	Child took off belt
14	100.0	Total

### Infant Seats Facing the Wrong Direction

Of those using infant seats facing forward, 71.4 percent knew the seat was supposed to be used rearward as shown in Table 41. Table 42 shows the reasons given for facing the seat in the wrong direction. Over 25 percent knew the seat was supposed to face rearward but did not know why, and another 18.4 percent thought that the child was old enough to use the seat facing forward. However, in all observations of these seats (with the exception of 3 toddlers in infant-only seats) the observers stated that the children were definitely infants and should face rearward. Where a child was borderline in age (size) between an infant or toddler and was forward facing in a toddler seat, the child was classified as a "toddler facing the correct position". Some parents wanted to use the infant seat forward facing to keep an eye on the child and a few experienced difficulty using convertible seats in the rearward facing mode.

Table 41. Intentional versus unintentional improper facing of infant seats.

	Occupied Seats	
	<u>Base</u>	<u>Percent</u>
<u>Misuse</u>		
Intentional	35	71.4
Unintentional	14	28.6

Table 42. Reasons for using the infant seat facing the wrong direction.

<u>Occupied</u>		<u>Response</u>
<u>Base</u>	<u>Percent</u>	
13	26.5	Knew it was wrong but didn't think it made any difference
9	18.4	Thought child was old enough
8	16.3	Wanted to keep eye on the baby/parent doesn't like it
6	12.2	Thought is was correct or didn't know better
4	8.2	Knew it was wrong but too difficult to install facing correct direction
3	6.1	Child doesn't like it
3	6.1	Child is a toddler, child too big
1	2.0	Too difficult to place child in when in use
<u>1</u>	<u>2.0</u>	Doesn't recline properly when rearward
50	100.0	Total

## V. COUNTERMEASURES TO REDUCE THE MISUSE OF CHILD SAFETY SEATS

Based on the observed types of misuse and the reasons given for the misuse of child safety seats, several countermeasures are proposed. The countermeasures are categorized by harness/shield misuse, belt misuse, tether misuse, and infant seats facing the wrong direction. The countermeasures include modifications to seat design to simplify use and minimize opportunities for misuse, vehicle design modifications to better accommodate safety seats, and the implementation of educational programs to respond to specific types of misuse.

The viability of each countermeasure is assessed using the findings of this study. For example, a lack of parent's knowledge on how to properly use a seat was not identified as a major contributor to seat misuse (with the exception of belt routing). The primary factors related to the difficulty of installation and use, and comfort of the seat. This was especially true with regard to tether straps. Many individuals who used a toddler seat, requiring a tether strap, expressed an unwillingness to install the tether anchor. These circumstances indicate that changing seat or vehicle designs would be more effective than recommending educational programs for seats with tether straps. The results of the study do, however, indicate a need for education for other problems relating to misuse. The problem contributing to the misuse of safety seats relates to the parent's lack of knowledge regarding the hazards of misuse. Approximately 86 percent stated that they used the seat for the child's safety, however, 62.7 percent of these individuals misused the seat. Furthermore, since many older safety seats are currently in use, it is important to utilize educational campaigns to reduce misuse of existing safety seats.

### Countermeasures for Harness/Shield Misuse

Twelve countermeasures designed to increase proper harness/shield usage are presented in Table 43. Six countermeasures relate specifically to toddler seats, two for infant seats, three for booster seats, and one countermeasure relates to all types of seats.

The results of the survey indicate that harness/shield misuse would decrease if seats would be designed to be less complex, more convenient, provide more comfort for the child, and be more difficult for the child to undo. Treatments proposed for toddler and infant seats reflect these considerations. Many of the improved design concepts suggested in this report are already in use by some manufacturers. The poor designs or those which promote misuse should be eliminated. Treatments to promote harness use for booster seats relate to improved vehicle design to better accommodate tether straps or to install a 3-point safety belt in the rear seats of vehicles.

Although improved seat and vehicle design will reduce harness/shield misuse in the future, the only immediate solution is to promote education on the hazards of seat misuse. This is particularly important since, based on the results of this survey, many safety seats stay in use for several years. Table 43 lists the countermeasures for harness/shield use and also provides a justification of each countermeasure.

Table 43. Countermeasures for harness/shield misuse.

Countermeasure	Rationale
1. Prohibit seats with detachable shields. (Toddler Seats)	When shields are detachable they have a tendency to be left off, lost, or discarded. The Bobby Mac Champion has a detachable shield. Of the 64 observations of this seat in the toddler position, 57 (89 percent) did not use the shield. A few people noted that they had lost the shield, the seat was bought used without the shield, or the shield was "left in the other car". All six individuals using the Bobby Mac Deluxe II, which has an attached shield of the same type as the Bobby Mac Champion, were using the shield.
2. Encourage the design of seats with full shields. (Toddler Seats)	Full shields eliminate the need for harnesses which are often cumbersome to use. Seats which require a harness/shield combination can also be cumbersome and complex and parents can be lulled into a false sense of security if only the harness or the shield is in use. For seats with a full shield, misuse of the shield was 14.0 percent. Harness misuse for seats requiring only a strap harness was 42.0 percent, while harness/shield misuse for seats requiring both a harness and a shield was 42.2 percent.  Comfort and the ability to properly fit toddlers of all sizes is a problem with full shield toddler seats. For example, some of the seats with a full shield such as the Quick Step and the Co-Pilot are designed for older toddlers. In a 1982 Consumers Report (4) the Safe-T-Shield seat (full shield) was judged poorly for toddler comfort. The Ford Tot Guard, another seat with a full shield, was judged better for toddler comfort but poor on containment of the toddler.
3. Simplify use by requiring seats with a partial shield to have a one-piece harness/shield system. (Toddler Seats)	This countermeasure addresses the problem of partial restraint use. It reduces the complexity of use where both the harness and the shield is required. This countermeasure is intended to reduce the time and effort required to properly restrain the child. Seats with this type of system include the Century 200 and the Kantwet One Step.
4. Design seats with a harness pad instead of a shield. (Toddler Seats)	Several individuals indicated that the harness/shield was not used because it did not fit properly or was uncomfortable for the child (24.2 percent of those responding). In some cases, the shield was too big or bulky. This problem may be remedied in part by using a harness pad which is smaller than a shield. The harness pad would cause less discomfort for the child and could lead to less misuse. The harness pad and harness should come in one piece and be easy to use.



Table 43. Countermeasures for harness/shield misuse (continued).

Countermeasure	Rationale
<p>5. Design the harness system to be more difficult for the child to undo. (Toddler Seats)</p>	<p>Based on responses to the questions of why the child was not harnessed or was improperly harnessed, 23.4 percent indicated that the child took the harness off and another 3.9 percent stated that they did not bother to harness the child since the child always removes it. Specific types of countermeasures for this problem can include a release mechanism that is harder for the child to reach and/or undo or a better type of chest strap (connecting the two shoulder harness straps) thus preventing the toddler from wiggling loose.</p> <p>Making the harness release harder for the child to release or reach, may have undesirable side effects. The Federal Motor Vehicle Safety Standard #213 requires a 12 lb. force to open the harness buckle to deter undesirable release by children. This requirement ironically may have led to some misuse (i.e., the seat is more of a hassle to use), and toughening the standard may further discourage proper harness use.</p> <p>A device holding the harness straps together under the child's chin (or over the chest, if designed properly) should be developed to discourage children from removing or getting free from the harness while not hindering its use.</p>
<p>6. Eliminate the optional partial shield. (Toddler Seats)</p>	<p>Some seats are designed to provide full occupant protection by using only harness straps, but also provide an optional shield for added protection. When the harness and shield are provided as a separate system, there is a tendency to use the shield and not the harness because the shield is easier to use. Since the partial shield alone does not provide the full protection, the effectiveness of the seat is compromised. There were seven observed instances where the shield was used but the harness was not used on this type of seat.</p> <p>Some older toddler seats were equipped with an arm rest to make the seat look more comfortable or structurally sound. The arm rest did not provide any occupant protection. A federal regulation adopted in 1981 eliminated the use of the arm rest on safety seats since parents tended to not use the harness straps relying on the arm rest to restrain the child. The same problem may be occurring with optional partial shields. Although the partial shield offers some protection and is better than using no harness at all, it provides a false sense of security.</p>
<p>7. Design the belt routing to go through the frame not around the child. (Infant Seats)</p>	<p>It was found that 28.7 percent of infants were not harnessed to the seat. For seats in which the vehicle belt is attached to the infant seat over the child's lap, 40.8 percent did not use the harness while 5.8 percent did not use the harness where the vehicle belt attached to the frame of the seat.</p> <p>Therefore, those seats where the vehicle lap belt secures both the child and the seat may lead to a false sense of security and may discourage the parent to harness the child. On the other hand, it is better to have the lap belt securing the infant without the harness than nothing at all (as with seats secured through the frame).</p>

Table 43. Countermeasures for harness/shield misuse (continued).

Countermeasure	Rationale
<p>9. Design infant harness systems to be easier to use (Infant Seats)</p>	<p>Approximately 19 percent of those not using the infant harness claimed the harness did not fit, another 14.5 percent stated the harness was a hassle to use and another respondent stated the child was uncomfortable with the harness. Design modifications can be made in some seats to improve their use. For example, some harness systems have no buckle which necessitates maneuvering the baby under the harness straps (as with the Infant Love Seat). This is especially cumbersome when the child is dressed in bulky winter clothes and wrapped in blankets (these conditions were not experienced in this study). In this case a Y-shaped harness that buckles over the child, or possibly a partial shield, may offer the same or better protection with less hassle. This observation is supported by observed misuse differences between two infant seats. The Infant Love Seat has no buckle on the harness straps and was not harnessed 68.8 percent of the time. The Dyn-O-Mite seat, however, has the Y-shaped harness which buckles and was not harnessed only 20.0 percent of the time.</p>
<p>9. Require new cars to have 3-point vehicle safety belt systems in the back seat. (Booster Seats)</p>	<p>Approximately 71 percent of toddlers in booster seats located in the front outboard position were harnessed compared to 24 percent harnessing for booster seats for other positions. In addition, of the 47 toddlers harnessed in a booster seat, 76.6 percent were using the 3-point harness from the vehicle belt while 23.4 percent were using a tether harness. Nearly 50 percent of those not wearing a harness cited reasons related to an unwillingness to use a tether harness or to install a tether anchor. Several foreign car models (i.e., Volvo, Honda Accord) currently come equipped with 3-point safety belts in the rear seat. These same systems can be used in American-made vehicles and can offer additional safety benefits to all rear seat passengers. Since 52.1 percent of the booster seats were observed in the rear driver or outboard position this could result in a 43.1 percentage increase in harness use in those positions (based on belt usage for the front outboard position).</p>
<p>10. Require new cars to have tether anchorages installed on the rear deck lid. (Booster Seats)</p>	<p>Approximately 30 percent of those not using a harness in booster seats cited problems with using the booster tether such as; the seat is moved between two cars, do not want to drill a hole for a tether anchor, using someone else's car, and no place to install the tether. This information implies that harnessing would increase by approximately 30 percent if vehicles were equipped with tether anchorages. In addition, these anchorages could also be used for toddler seats requiring a tether strap.</p> <p>Several individuals, however, stated that they don't use the tether since it is a hassle to use, does not fit, or is uncomfortable. Even with the tether anchorages available, other problems may inhibit tether use for booster seats. Particularly with respect to the harness system used with the tether.</p>

Table 43. Countermeasures for harness/shield misuse (continued).

Countermeasure	Rationale
11. Require the booster harness and tether straps to be sold with the seat. (Booster Seats)	Currently the tether strap and harness is an optional item and is normally not included with the base price and sale of the booster seat. Three individuals stated they realized a tether strap was required only after they purchased the seat and did not bother to buy one. One other individual stated they did not know a tether strap was necessary. While the impact of this countermeasure may be small, the required sale and availability of the tether/harness may result in increased usage.
12. Educate the public on the hazards of harness/shield misuse. (All safety seats)	<p>Approximately 22 percent of the toddlers observed in safety seats were not secured by harnesses and another 18.4 percent were incorrectly harnessed. In addition, children in 28.7 percent of the infant seats and 61.5 percent of booster seats were not harnessed. However, 95.6 percent of those questioned realized harnessing was required and only a very small percentage claimed that they forgot to harness the child. This tends to imply that additional safety education programs should be directed at non-harnessing or incorrect harnessing of children in safety seats. One source for this can be improved warning statements in the manufacturer's instructions. However, 10 percent of those using seats never received written instructions for seat use and 28.2 percent installed the seats without bothering to use the instructions. Therefore, improving manufacturers instructions may not reach all those in need of the information unless they are affixed permanently to the seat.</p> <p>Other forms of education may include brochures specializing on seat misuse and commercials showing the results of crash tests with incorrect or non-harnessing. For the 8.9 percent of those not harnessing their child because they are only making a "short trip", special emphasis should be placed on the fact that a majority of accidents happen on short trips and the safety seat will not work unless used correctly.</p>

Countermeasures for Incorrect Belt Routing

Incorrect belt routing was noted as a major problem in the study. Approximately 74 percent of those incorrectly routing the vehicle belt did not realize they were belting the seat wrong. A majority of the others used the belt improperly to compensate for incorrect harness/shield use, or to simplify belt use. Therefore, countermeasures addressing this type of safety seat misuse are necessary. Countermeasures to improve incorrect belt routing may include educational programs as well as improved seat design to minimize the opportunity of incorrect belt routing. Since only one observation of incorrect belt routing for booster seats was observed and comparatively few infant seats were observed incorrectly belted, the countermeasures in Table 44 pertain primarily to toddler seats.

Table 44. Countermeasures for incorrect belt routing.

Countermeasure	Rationale
<p>1. Eliminate the open frame on toddler seats. Enclose the side of the frame leaving only the hole or slot for the belt routing.</p>	<p>Incorrect belt routing was noted in 28.1 percent of the toddler seats observed. However, for seats with an open frame, 37.0 percent of the seats were belted incorrectly while 14.0 percent of those with enclosed frames (having only the hole for the belt) were incorrectly belted. In addition, approximately 74 percent of those incorrectly using the belt did not realize the belt was incorrectly routed. This countermeasure is intended to eliminate the opportunity for incorrect belt routing.</p> <p>The seats with enclosed frames may be more difficult to use in older vehicles. Because of this, the back of the frame should be left open to facilitate securing the belt to the seat. The slots or holes for the belt routing must be large enough to accommodate the larger lap belt releases on older vehicles.</p>
<p>2. Install a warning sticker on the seat directing the user to route the belt at that location.</p>	<p>Nearly 65 percent of the people incorrectly belting toddler seats did not know where the belt should be routed and an additional 12.5 percent did not think routing made a difference. For the seats with open frames, a blaze orange warning sticker can be placed at the location where the belt is to be routed, the sticker may be worded "Route Belt Here". Some manufacturers have already begun doing this on newer seat models. Although data on correct usage of the seats with these stickers was not collected, the observers did note a higher frequency of correct routing. One problem with this countermeasure is that the sticker can wear away or be peeled off.</p>
<p>3. Educate parents on correct belt routing and the hazards of incorrect belt use.</p>	<p>Since incorrect belt routing was unintentional in 74 percent of the observations, special education is required for the use of individual seats. A primary means to accomplish this would be to improve the instructions packaged with each seat model and marking the seats to provide a constant reminder (i.e., better diagrams and more visible warnings). Since 28.2 percent of the respondents installed their seats without the aid of instructions, there needs to be a more widespread educational process. Improved pictures can be made on the seat box or packaging. Brochures showing the common misuse of the more popular seats could also be developed and distributed in conjunction with television commercials on the topics. In addition, 12.5 percent of those incorrectly routing the belt stated that it does not make a difference where the belt is routed. These individuals need to be educated on how the seat may fail during a collision when incorrectly used.</p>
<p>4. Encourage manufacturers to provide displays of the seats in proper use at retail stores.</p>	<p>This means of public education would require a child safety seat to be used with a doll harnessed in the seat and the seat secured to a mock vehicle. Currently, many stores have display models showing the seat, but they do not show its correct use. Pictures in the instructions or on the box showing correct seat use do not always provide the detail available from a model. Such a display would also be more helpful in selecting a safety seat for a particular vehicle.</p>

### Countermeasures for Not Belting the Seat

The vehicle belt was not used to secure occupied safety seats in approximately 5 percent of the toddler seats, 9 percent of the infant seats and 14 percent of the booster seats. While these percentages are relatively small, this misuse makes the safety seat virtually useless. The primary reasons for non-belt use include; not knowing the seat was not secured, defective vehicle belts, and user apathy. The primary countermeasure for this problem is education. People should be encouraged to always check and make sure the seat is secured to the vehicle. In addition, information warning or showing the hazards of non-belt use may be developed to eliminate the problem. Parents also should be encouraged to purchase seats to fit their vehicles as well as their children.

### Countermeasures for Tether Misuse

The data collected in this study as well as information from other studies indicate that a majority of people do not want to use a tether strap or install a proper tether anchor. Many of those with seats requiring a tether simply refuse to use the tether thereby greatly compromise the effectiveness of the seat. The best solution for this problem is to redesign the seats and eliminate the need for additional tether straps. However, if seats requiring tethers continue to be marketed, their proper use must be encouraged. Four countermeasures addressing tether misuse are proposed in Table 45.

Table 45. Countermeasures for tether misuse.

Countermeasure	Rationale
1. Redesign the seat to eliminate the need for a tether.	Nearly 87 percent of the toddler seats requiring a tether strap were observed without the strap in use. This corresponds to other observations of tether use in parked vehicles in the 19-city study (1). Of respondents not using the tether strap, 78 percent knew that it was required (occupied and unoccupied seats combined) but cited several reasons for not using the tether. Fifteen percent stated that the tether is too much trouble to install, 5.6 percent stated that the seat is used in more than one vehicle, and 12 percent stated there was no place to install the tether. The tether strap, when used, provides effective protection, however, it appears that there is a strong resistance to use the device and it would be best to redesign the seats to eliminate the need for the tether. Several seat models have been redesigned over the past several years to eliminate the need for a tether and only two major seat models currently in production (Strolee 599 and Child Love Seat) still require a tether strap in order to meet federal standards. Since tethers provide excellent protection when correctly used, tethers should be allowed as an option for those who wish to use them.

Table 45. Countermeasures for tether misuse (continued).

Countermeasure	Rationale
<p>2. Require new vehicles to have tether anchorages in the rear deck lid.</p>	<p>Of those not using the tether strap, 66.2 percent gave the following reasons for non-use including; they don't want to install the anchor, the seat is used in more than one car, or it is too much trouble to install the tether anchor. The availability of tether anchorages in all vehicles would be especially helpful for people who use the seat in more than one vehicle (54.6 percent of toddler seats). This countermeasure would also be helpful in tether use for booster seats. Provisions should also be made in pickup trucks and station wagons where there is no place to install a tether strap.</p>
<p>3. Educate the public on the need and use of tethers.</p>	<p>Approximately 22 percent of those not using tether straps did not know their seat required one. In addition, approximately 9 percent indicated that the vehicle belt holding the seat was enough to secure the seat and the tether was not necessary. For those not knowing a tether is necessary, demonstrations at the time of purchase and fully installed display models would assist in informing the user on how to properly secure the seat. Improved warnings and better diagrams on manufacturers instructions and the seat packaging may also assist in increasing tether use. For those who think that the strap is not necessary, warnings on manufacturers instructions and photographs or film clips of how an untethered seat will fail in a collision may help to stress the need for use of the tether.</p>
<p>4. Install a warning sticker on the top of toddler seats requiring a tether.</p>	<p>This countermeasure is intended to reach the 22 percent of parents who do not realize that a tether is needed, and to encourage other non-users to install the tether anchorage. An orange warning sticker would catch the eye of many users and having the sticker at the top of the seat would make it more visible than on the seat back where most instructions are placed.</p>

Countermeasures for the Incorrect Facing of Infant Seats

A high incidence of use of infant seats were observed incorrectly facing forward. The countermeasures developed to address this problem are described and justified in Table 46.

Table 46. Countermeasures for the incorrect facing of infant seats.

Countermeasure	Rationale
<p>1. Educate parents on the correct use of infant seats and why seats should be rearward facing.</p>	<p>One-third of the infant seats observed in the study were noted to be facing in the wrong direction. Of those misusing the infant seats, 28.6 percent did not know that the seat was being used incorrectly. Nine parents thought that the child was old enough to be forward facing and thirteen parents knew it was wrong but did not know why it was wrong. This implies that there is a lack of general knowledge on why infant safety seats should be rearward facing. While the manufacturers instructions can be improved to explain why infant seats should face the rear of the vehicle, educational programs in hospitals should be developed/improved to provide more information on the safe transport of children. The use of infant safety seats should be treated as part of the child basic health care presented to mothers of newborn infants at hospitals. While many hospitals have started such programs, this type of education should be required. In addition, the hospital could be a good location for a loaner or rental program for safety seats. A newborn child should not be allowed to leave a hospital without a safety seat in the vehicle.</p>
<p>2. Place a warning sticker on infant-only seats with an arrow to indicate which direction the child is to face.</p>	<p>The use of a warning sticker to remind people of proper direction for the infant seat would assist the 24 percent who did not know the seat should be rearward facing. This may also be applicable for convertible seats (which had a higher percentage used forward facing) with messages such as "for infants 0 to 12 months, face rear of car; for toddlers 12 months and older, face the front of car".</p>

### General Countermeasures

Other types of countermeasures to reduce the misuse of safety seats are also possible. The first countermeasure relates to the use of gift certificates for safety seats instead of buying these seats as gifts. The data shows that 23.4 percent of safety seats were obtained as gifts. The data also shows that 73.3 percent of the seats obtained as gifts were misused while 59.6 percent of those purchased new by the parents were misused. When parents are involved in the selection process, they are able to select a seat which they are likely to use and use correctly. This approach also allows the selection of a seat which will be compatible with their car, and comfortable for the child. In addition, the parents can benefit from any in-store training on the proper use of the seats.

The purchase and use of older seats, particularly those requiring tether straps and those manufactured prior to January 1, 1981, should be discouraged. The data collected in the study indicates that older seats tended to be misused more than newer seats. This may be in part due to portions of the seat being lost (i.e., shield, tether) or damaged over time. Manufacturer's instructions on seat use also tend to be lost or discarded for older seats. In addition, newer seat models are designed to be more comfortable and convenient to use. Educational campaigns can be developed to inform parents of the need to buy newer model safety seats and to discard seats that are old or no longer work.

The best medium for educating parents on safe methods of transporting their children is through hospitals and pediatricians. Child passenger transport should be considered a part of the normal preventive health care activities. Hospitals and health clinics can also be centers for safety seat loaner programs to encourage the use of safety seats.



## VI. REFERENCES

1. Perkins, D.D., Cynecki, M.J., Goryl, M.E., "Restraint System Usage in the Traffic Population", 1983 Annual Report, Goodell-Grivas, Inc., July, 1984.
2. Shellnes, A., Jewett, J., "Observed Misuse of Child Restraints", 27th Strapp Car Crash Conference, Society of Automotive Engineers, Warrandale, PA, 1983.
3. Child Safety Seat Identification Guide, Goodell-Grivas, Inc., May, 1984.
4. "Child Safety Seats", Consumer Reports, April, 1982.

VII. APPENDICES

APPENDIX A - CHILD SAFETY SEAT DATA COLLECTION FORMS

		No. _____
<b>A. GENERAL INFORMATION:</b>		
<b>OCCUPIED/UNOCCUPIED</b>		
A.1 Observer _____		A.1 _____
A.2 City _____		A.2 _____
A.3 Location _____		A.3 _____
A.4 Site No. _____		A.4 _____
A.5 Date _____ / _____ / _____		A.5 _____
A.6 Time _____ (AM - PM)		A.6 _____
<b>B. DRIVER/OCCUPANT INFORMATION:</b>		
B.1 Total Number of Occupants in Vehicle. _____		B.1 _____
B.2 Driver Using Restraint System? 1. Yes _____ 2. No _____		B.2 _____
B.3 Number of Child Safety Seats in Vehicle. _____		B.3 _____
<b>C. TODDLER SAFETY SEAT INFORMATION:</b>		
C.1 Harness/Shield? 1. Proper 2. Improper 3. Not Used 4. Not Required		C.1 _____
C.2 Belt? 1. Proper 2. Improper 3. Not Used		C.2 _____
C.3 Tether? 1. Proper 2. Improper 3. Not Used 4. Not Required		C.3 _____
Describe Improper Use		
C.4 Harness/Shield _____		C.4 _____
C.5 Belt _____		C.5 _____
C.6 Tether _____		C.6 _____
<b>D. INFANT SAFETY SEAT INFORMATION:</b>		
D.1 Harness? 1. Proper 2. Improper 3. Not Used		D.1 _____
D.2 Belt? 1. Proper 2. Improper 3. Not Used		D.2 _____
D.3 Rearward Facing? 1. Yes 2. No		D.3 _____
Describe Improper Use		
D.4 Harness _____		D.4 _____
D.5 Belt _____		D.5 _____
<b>E. BOOSTER SAFETY SEAT INFORMATION:</b>		
E.1 Harness? 1. Shoulder Belt 2. Tether 3. Not Used		E.1 _____
E.2 Belt? 1. Proper 2. Not Used		E.2 _____
Describe Improper Use		
E.3 Harness _____		E.3 _____
E.4 Belt _____		E.4 _____

Second Seat Observations on Back

Figure A.1. Child safety seat data collection form 1.

F.1 Observer \_\_\_\_\_

F.2 City \_\_\_\_\_

F.3 Location \_\_\_\_\_ OCCUPIED/UNOCCUPIED

F.4 Date \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

F.5 Time \_\_\_\_\_ (AM - PM)

F.6 Make/Model of Safety Seat: \_\_\_\_\_ F.6 \_\_\_\_\_

F.7 What is your relationship to the child using the safety seat? F.7 \_\_\_\_\_

1. Parent (a) Mother (b) Father

2. Babysitter (a) Female (b) Male

3. Sibling (a) Sister (b) Brother

4. Relative (a) Female (b) Male

5. Other (specify) \_\_\_\_\_

F.8 How old is the child? \_\_\_\_\_ (yrs./mos.) F.8 \_\_\_\_\_

F.9 What is the main reason that you use the seat? F.9 \_\_\_\_\_

1. Required by law

2. To keep the child from moving about in the car

3. For the child's safety

4. To allow child to see out of the car

5. Do not regularly use it.

6. Other (specify) \_\_\_\_\_

F.10 How was the seat acquired? F.10 \_\_\_\_\_

1. Purchased (a) New (b) Used

2. Obtained from "loaner" program

3. Gift

4. Borrowed from friend/relative

5. Other (specify) \_\_\_\_\_

F.11 How long have you had the seat. \_\_\_\_\_ (yrs./mos.) F.11 \_\_\_\_\_

F.12 Did you receive any instructions on the installation and use of the seat? F.12 \_\_\_\_\_

1. Yes 2. No

If yes, were they (a) written (b) verbal (c) both

F.13 Who installed the seat in the car? F.13 \_\_\_\_\_

1. Self

2. Spouse

3. Salesperson

4. Friend/Relative

5. Other (specify) \_\_\_\_\_

F.14 What method best describes how you or the person who installed this seat know how to do it? F.14 \_\_\_\_\_

1. Followed manufacturers written instructions

2. Installation was demonstrated

3. Had no help, figured it out for myself (or themselves)

4. Other (specify) \_\_\_\_\_

F.14a If answered Number 1, were the instructions easy to understand? F.14a \_\_\_\_\_

1. Yes

2. No (identify problems) \_\_\_\_\_

F.14b If answered Number 2, who demonstrated installation of seat? F.14b \_\_\_\_\_

1. Spouse

2. Friend/Relative

3. Child seat sales personnel

4. Loaner program personnel

5. Other \_\_\_\_\_

6. Don't know

F.15 Does the seat remain in this vehicle all the time? F.15 \_\_\_\_\_

1. Yes 2. No

F.16 Does \_\_\_\_\_ have a child safety seat law? F.16 \_\_\_\_\_

(State)

1. Yes 2. No

Figure A.2. Child safety seat data collection form 2.

\* The following questions pertain to specific misuse modes of the child safety seat and are asked only if that type of misuse is observed.

Child not using safety harness/shield:

F.17 Do you realize that your child did not have the safety harness (or shield) on? F.17 \_\_\_\_\_

1. Yes      2. No

F.18 Can you tell me why your child was not wearing the safety harness (or shield)? F.18 \_\_\_\_\_

Tether strap not being used correctly

F.19 Do you realize that this particular seat requires that a tether strap be used to properly secure the child seat in the car? F.19 \_\_\_\_\_

1. Yes      2. No

F.20 Can you tell me why the tether strap is not being used? F.20 \_\_\_\_\_

Car belt being used incorrectly (Incorrect routing):

F.21 Do you realize that the car belt securing the child is installed incorrectly? F.21 \_\_\_\_\_

1. Yes      2. No

F.22 Can you tell me why the car belt is not being used correctly to secure the child seat? F.22 \_\_\_\_\_

Car belt not securing child seat:

F.23 Do you realize that the car belt is not securing the child seat? F.23 \_\_\_\_\_

1. Yes      2. No

F.24 Can you tell me why the car belt is not securing the child seat? F.24 \_\_\_\_\_

Child facing the wrong way (Infant seats only):

F.25 Do you realize that the child seat is facing the wrong direction and that your infant should be facing toward the rear of the car? F.25 \_\_\_\_\_

1. Yes      2. No

F.26 Can you tell me why the seat is installed facing the wrong direction? F.26 \_\_\_\_\_

Figure A.2. Child safety seat data collection form 2 (continued).

## APPENDIX B - CHILD SAFETY SEAT DATA COLLECTION PROCEDURE

1. Observer has in possession a clipboard, a Child Safety Seat Identification Guide, NHTSA brochures, data collection forms, a letter with reference to Hardee's Regional Vice President and an envelope containing a copy of corporate agreement correspondence and a business card.
2. Upon arrival, the observer parks in an out-of-the-way space so as not to obstruct restaurant clientele. Notify the restaurant manager of the observer's presence and intentions. Present manager with envelope containing corporate letter of agreement and business card. Request that this manager inform other managers of observer's intentions.
3. To initiate data collection, observer should note number of entrances and amount of traffic flow for restaurant parking area. Observer should then be positioned on the curb near appropriate restaurant entrance being careful not to interfere with traffic flow.
4. Positioning should be made to allow observer to identify a vehicle equipped with a child safety seat (target vehicle). Only these vehicles will be observed in the study. Vehicles equipped with an "unsafe" child seat will not be included.
5. Upon identification of target vehicle, the observer will make note on abbreviated data collection form of time, number of auto occupants, number of children in safety seats and use of driver restraint system.
6. Observer will meet the target vehicle at its parking position. As the driver exits the vehicle, the observer should state to the driver that he/she is conducting a study of child safety seats and request permission to observe the child in the safety seat. An example of the opening conversation follows (the conversation should NOT be read):

Hello, my name is \_\_\_\_\_ . We are conducting a survey to learn more about the use of child safety seats and would greatly appreciate your voluntary participation and permission to observe your child and the safety seat. Hardee's has authorized us to give you coupons/cookies in appreciation for your participation.

If driver appears hesitant to cooperate, reassure them by offering the driver a child safety seat brochure and the following additional information:

No confidential information is being collected and we are not asking for your name, only information about your child safety seat. Your assistance will help us to increase the correct use of child safety seats for greater protection of children in cars. This interview should only take a few minutes of your time. Will you help us conduct the survey? If yes, ask, have you been surveyed before? (This question may not be applicable the first day.)

7. If permission and cooperation are not received, offer them a NHTSA brochure, the observer will thank the individual and abort the observation. Do not offer coupons/cookies unless permission is granted.
8. If permission and cooperation are received, the observer then observes/records the harnessing of the child and the installation of the seat.
9. Following the observation, an informal interview will be conducted. The interview will be comprised of the questions F.6-F.16 of data form. When conducting the interview, the observer should not mention the multiple choice responses to the questions with exception of F.14. The responses given by the individual should be written on abbreviated data collection forms.
10. If improper use of safety seat is observed, ask if the driver realized the impropriety (yes/no) and why the impropriety exists. Record responses in F.17-F.26. Then demonstrate/explain the proper use.
11. At the conclusion of the interview the observer should briefly review the survey form to make sure it is complete, neat and logical. The observer will present coupons/cookies in appreciation for their cooperation and also thank him/her.
12. Ask the driver to lock the car doors.
13. Observer should paperclip abbreviated form to long form with identical form number. When time permits responses should be transferred from abbreviated form to the most applicable response on long form.

14. If an individual approaches observers and questions their presence and intentions, the "To Whom it May Concern" letter with reference to Hardee's regional vice-president may be presented.
15. If observers are confronted with questions or problems of their own they may resort to the restaurant manager or the supervisor at Goodell-Grivas, Inc. depending upon the nature of the question/ problem.

APPENDIX C - MISUSE OF TODDLER SEATS BY TYPE OF MISUSE FOR SELECT SEAT MODELS

<u>Seat Model</u>	<u>Base</u>	<u>Total Percent Misused</u>	Percent Harness Misuse			Percent Belt Misuse		<u>Percent Tether Misused</u>
			<u>Not Harnessed</u>	<u>Incorrectly Harnessed</u>	<u>Not Belted</u>	<u>Incorrectly Belted</u>		
Strolee 500 Series	163	93.9	18.4	23.3	36.8	4.9	87.7	
Bobby Mac Champion	64	93.7	35.9	57.8	15.6	6.3	N/A	
Bobby Mac Baby Chair	20	100.0	30.0	70.0	10.0	10.0	N/A	
Century 100	30	50.0	23.3	13.3	30.0	3.3	N/A	
Century 200	44	40.9	6.8	0.0	40.9	0.0	N/A	
Century 300	33	78.8	48.5	15.2	45.5	6.1	N/A	
Child Love Seat	34	85.3	11.8	47.1	2.9	2.9	76.5	
Cosco-Peterson Safe-T-Seat	36	75.0	16.7	30.6	47.2	5.6	N/A	
Kantwet One Step	133	49.6	9.0	7.5	36.8	5.3	N/A	
Kolcraft Hi-Rider	22	54.5	27.3	22.7	18.2	4.5	N/A	
Collier-Keyworth Co-Pilot	37	10.8	2.7	8.1	0.0	0.0	N/A	



APPENDIX D - SUMMARY OF SELECT INDIVIDUAL COMMENTS

Table D.1. Individual comments on the ease of instructions by seat model.

<u>Seat Model</u>	<u>Comments</u>
Strolee 597	Problems adjusting harness. Tethering confusing. Tether instructions on installation difficult.
Strolee 599	Harnessing and belting confusing (infant position). Harnessing confusing. Tethering hard to understand. Also difficult to change from infant to toddler position. Tethering confusing. Small print/confusing diagrams. Instructions could have been more explicit: too limited. Tether instructions poor.
Strolee 500 Series	Harness straps confusing. Tethering was difficult in a station wagon.
Bobby Mac Champion	Doesn't understand how to use shield. Difficult to adjust harness straps as child grows. Use of harness confusing. It is a "pain" to use.
Century 200	Wasn't sure where lap belt went. Trouble assembling seat and harness straps.
Century 300	Belting instructions confusing. Couldn't figure out where seat belt went. In general, confusing.
Child Love Seat	Had trouble with harness straps.
Cosco-Peterson Safe-N-Easy	Seat is too big for small infants. Harnessing was confusing
Kantwet One Step	Need more diagrams. No padding on seat.
Kolcraft Hi-Rider	Where to route seat belt was confusing.
Kolcraft Redi-Rider	Hard to understand how to tighten belt.
Teddy Tot Astroseat	Hard to understand how to attach lap belt for infant position.
Dyn-O-Mite	Auto belting was confusing. Harnessing was confusing.

Table D.2. Individual comments on why the safety harness/shield was not used by seat model.

<u>Seat Model</u>	<u>Comments</u>
Strolee 597	Child is too big for toddler seat but too small for booster seat.
Bobby Mac Champion	Seat too hot. Have to replace padding.
Century 300	Child gets out of harness - "(parent) I can pull over, hit him, smack him on the head, and re-buckle him; within 5 minutes he has it undone again".
Cosco-Peterson Co-Pilot	Seat too hot to use shield.
Infant Love Seat	Harness too restraining. It looks like a straight jacket.

Table D.3. Individual comments on why the tether strap was not used by seat model.

<u>Seat Model</u>	<u>Comments</u>
Strolee 597	Tether is too complicated. I didn't know that a tether could be used in the front seat. I don't use it in the back seat either because it is too much trouble to install.
Other	Tethers inhibit quick removal of seat from the car during an emergency. Tether would not reach rear seat belt if routed over front seat - so we routed tether around front seat.

Table D.4. Individual comments on why the car belt was not used correctly to secure the child seat by seat model.

<u>Seat Model</u>	<u>Comments</u>
Strolee 597	Seat is impractical for compact cars when in back seat because it doesn't offer room for child's legs. In an accident, the legs would get broken.
Century 200	Salesperson demonstrated incorrectly.

Table D.5. General comments by seat model.

<u>Seat Model</u>	<u>Comments</u>
Bobby Mac Champion	The seat is too uncomfortable for child. Seat too low for child to see out window.
Kantwet One Step	Safety seat saved child's life when a bus totalled my 'Vette. Child didn't get a scratch.
Cosco-Peterson Co-Pilot	Had child in seat when I rolled over and totalled a van. Child didn't receive a scratch.