April 12, 2004

I-CAR ADVANTAGE Online™

Technical Information For The Collision Industry

Development Of Child Restraints

An Advantage article three years ago on infant seats only discussed inspection criteria after a collision (www.I-CAR.com/html_pages/about_icar/current_events_news/advantage/year_menu_archives/advantage_2001). This article is intended as both an update to that article, and to offer more insight on the complexity of these devices surrounding and protecting infants and children.

When discussing child restraint systems (CRS), there is a variety of information that must be understood. This includes:

- local use requirements.
- physical seat capabilities, styles, and function.
- inspection criteria for following a collision.
- general replacement criteria.
- places where a CRS can be inspected for proper use and installation.

CRS REGULATIONS

Until December 31, 1977, there were no standards requiring children to be secured in an appropriate CRS. But then came federal motor vehicle safety standard (FMVSS) 213 and Canadian motor vehicle safety standard 213, and by 1985, several areas had adopted CRS regulations. To read more about the implementation of CRS standards and when they were implemented into different U.S. states, select this link: http://web.utk.edu/~dhouston/articles/psr2001.pdf

To read more about Canadian CRS safety information, go to http://www.ama.ab.ca/cgi-ebs/consumer_info/safe_seat.jsp?dept=consumer+info&path=1&sec=03# or go to http://www.tc.gc.ca/roadsafety/childsafety/menu.htm

TYPES OF CHILD RESTRAINTS

The implementation of child seat requirements also brought mandates identifying different types of child restraints, for example rear-facing and front-facing restraints. A child should remain rear facing in a CRS until they are one year old and weigh nine kilograms (20 pounds). This is done using a rear-facing infant seat (see Figure 1). Keeping a child rear facing for this amount of time allows for development of a child's skeletal and muscular structure. Children remaining rear facing for longer periods of time reduces the chances of bodily injury caused by frontal collisions. When a child is properly secured rear facing and involved in a frontal collision, the CRS supports their entire body. By supporting the child's entire body, there is a reduced chance of bodily injury caused by hyperextension of the head, neck, or limbs.

An infant is not just a small adult. An infant's bodily proportions, especially the head compared to the body, are not equivalent to an adult that would be reduced to an infant's size. If an infant's body was proportionally enlarged to the height of an average adult, their head

Figure 1–This infant child restraint system is designed for a rear-facing passenger only.

would be disproportionately large and heavy compared to an adult. This is why an infant's body requires extra protection and support. At their Safety Training Centre in Gothenburg, Sweden, Volvo simulates the disproportionate weight of an infant's head by using a helmet with weight added to it. Using the helmet, adults are able to experience the problem of supporting such weight with weak neck muscles.

After a child grows to a weight above 9 kilograms (20 pounds), and is older than 1 year old, they can be graduated to a forward-facing child seat. This type of CRS may be referred to as a convertible child seat or a booster seat with harness. A convertible CRS is a seat that may be used as both a rear-facing child seat and a forward-facing child seat as long as the child's weight and height fit the criteria of the CRS. A booster seat with a harness is designed to be used as a forward-facing CRS. This seat must NEVER be placed rear facing.

After a child has reached a weight of 18 kilograms (40 pounds) they typically can no longer use a child seat that restrains them using a harness provided by the child seat maker. This is because in the U.S. and Canada, child seat harnesses or straps are not tested to a weight above 18 kilograms (40 pounds). Though this may not be true for every CRS made, it is the norm. To ensure that a CRS is being used properly, always read the label provided on the CRS to verify the maximum occupant weight the seat is designed to handle.

If a child reaches 18 kilograms (40 pounds), but is not big enough to sit in a vehicle and be properly secured by a three-point seat belt, an option to correct this problem is to use a booster seat. Booster seats lift the child up and away from the vehicle seat cushion. Doing this will help change the routing of the shoulder belt across a child's body. Another type of booster seat is a belt-positioning-booster/high-back booster (BPB). Like a booster seat, a BPB also provides back and headrest support for situations where an adjustable headrest is not available. This type seat (BPB) also uses a seat belt clip to hold the shoulder belt in proper position across the child's body.

To read more about the different types of child seats, follow this link: http://www.cherishedmoments.com/choosing-a-car-seat.htm#Booster%20seats and select: "Which car seats meet Federal Safety Standards?" Or go to http://www.nhtsa.dot.gov/CPS/safetycheck/TypeSeats/index.htm

CRS DAMAGE ANALYSIS-INSURANCE INSTITUTE FOR HIGHWAY SAFETY

After a CRS has been involved in a collision, it may or may not show visual signs of damage. There are differing thoughts as to whether a CRS MUST be replaced following every collision, or if the CRS should be replaced following a collision that meets certain criteria.

In an article published by the Insurance Institute For Highway Safety (IIHS) on April 15, 2000 on child restraints called "Tough Strong Durable," it says, "it's intuitively clear that a child restraint visibly damaged in a serious car crash should be replaced. But the need for replacement in less obvious cases has long been debated."

One state's law requires insurers to cover the cost of replacing a CRS used by a child regardless of crash severity and whether damage is visible. At the time the IIHS published their April 2000 article, they indicated another state was considering a similar law regarding child seat replacement.

In summary, the IIHS article concluded that not every CRS tested received damage following the initial collision simulation. The article also noted that some of the restraints initially tested provided

adequate protection to the test dummy following a second simulated collision.

To read more about this information from the IIHS, go to the National Highway Transportation Safety Administration (NHTSA) web site at http://www.nhtsa.dot.gov/people/injury/childps/ChildRestraints/ReUse/index.htm and select the April 15, 2000 publication.

Or go directly to the IIHS web site at: http://12.4.65.102/sr.htm and select the article from April 15, 2000.

CRS DAMAGE ANALYSIS-NHTSA

Recently NHTSA released a document titled "Child Restraint Re-use After Minor Crashes." This document identifies NHTSA's position on child seats involved in collisions.

To summarize NHTSA's position:

- child seats should be replaced following moderate or severe crashes.
- child seats do not automatically need to be replaced following a minor crash.
- a minor crash is one that meets ALL of the following criteria:
  - The vehicle was able to be driven away from the crash site.
  - The vehicle door nearest the safety seat was undamaged.
  - There were no injuries to any of the vehicle occupants.
  - The airbags (if present) did not deploy.
  - There is no visible damage to the safety seat.
- Clarifying the need for child seat replacement will reduce the number of children riding without a safety seat while a replacement seat is being acquired or if a seat is discarded and not replaced.

To read more about this information from NHTSA, select this link: http://www.nhtsa.dot.gov/people/injury/childps/ChildRestraints/ReUse/index.htm

CRS DAMAGE ANALYSIS-CHILD SEAT MAKERS

According to the Juvenile Products Manufacturing Association (JPMA) web site, "Do not use a car seat that is more than six years old or one that has ever been involved in a crash or one that is missing the manufacturer's label with the name of the manufacturer, the model number, and the date of manufacture."

To read more about this information from JPMA, select this link: http://jpma.org/industry/ProductInserts/carseats.htm

One child seat maker, Graco, has a "frequently asked questions" section on their web site. One of their questions, and the posted response is:

> **Question**: I was recently in an accident. Do I have to replace my child's car seat? There doesn't appear to be any damage.
>
> **Answer**: Yes. You must replace your child's car seat if it was involved in an accident, no matter what. Even if there appears to be no damage to the car seat on the surface, the impact and force of a collision can cause unseen structural damage to the interior of your car seat. Any such damage may prohibit your car seat from properly protecting your child in the event of a sudden stop or crash. Some insurance carriers will reimburse you for the replacement of a new car seat if it was in a crash. Check with your insurance carrier for more details.

Child seat makers have begun indicating when a CRS is made. This is done by either printing the build date on one of the seat labels, or by molding the date into the plastic of the seat (see Figure 2).

Figure 2–Child restraint manufacture dates may be an adhesive label or molded into the plastic of the seat.

Continued From Page 3

Graco also answers a question about the lifespan of an infant car seat:

Question: What is the suggested life span of my car seat and why?

Answer: Car seats have a suggested life span of six years. With the changes in legislation, automobiles and technology, we suggest that a car seat be replaced upon its sixth year from the date of manufacture.

If for any reason a CRS is removed from service, cut the restraint straps, disassemble as much as possible and using bright paint or marker, write DO NOT USE or DESTROY. Do not store CRS that are to be destroyed where anyone can acquire and reuse a CRS that is to be destroyed.

To read more about this information from Graco, select this link: http://www.gracobaby.com/customerservice/faq_category.aspx?catID=1

INSPECTING A CHILD SEAT FOR PROPER USE

No matter who uses child seats, there are seats that are used and installed incorrectly. A few ways to ensure that a CRS is used and installed properly is to read both the vehicle owner's manual and the CRS owner's manual. Not every CRS is designed to properly fit into every vehicle. This situation is not uncommon and something that must be properly dealt with to ensure a child is properly and safely secured.

So, if when trying to install a child seat into a vehicle, it appears that the seat is too long, tall, wide, or just does not tighten properly, the seat is probably not the correct seat for the vehicle. (See Figure 3) Before purchasing a child seat, ask a store owner/manager if you could try the seat in the vehicle to ensure a proper fit before making the purchase.

When a CRS is installed into a vehicle, there is the option to go to local hospitals, health departments, fire departments, or police stations to receive a free inspection regarding the use and installation of the child seat. (See Figure 4) Along with numerous public offices that provide this service, there also are organizations such as Safe Kids that conduct free child seat inspection clinics. These clinics are made up of volunteers. These volunteers may be anybody who wants to help make a difference by ensuring the ultimate safety of a child.

During an inspection, the CRS is inspected for:

- proper installation.
- proper angle.
- proper vehicle seat belt routing and locking.
- the child being properly restrained.
- proper routing and tension restraining straps.
- proper label attachment.
- the owners manual of the seat.
- the age, by locating the build date of the seat.
- recalls. To view recalls, select this link: http://www-odi.nhtsa.dot.gov/cars/problems/recalls/childseat.cfm

If, during a CRS inspection, a defect, recall, or misuse is identified, the problem is corrected and if child safety is not compromised, the CRS is placed back into service. If a seat is too old, damaged, or the incorrect size for the child, new replacement child seats are typically available for purchase so the child leaves an inspection in a properly fitting CRS.

One of the main goals of a child seat inspection event is for the child to leave safer than when they arrived.

To search for child seat inspection locations near you, select the links listed below.

Figure 3–Not every seat will fit properly in every vehicle.

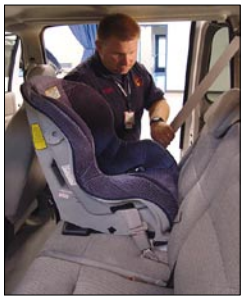

Figure 4–Many fire departments provide CRS inspections on a regular schedule.

Continued From Page 4

NHTSA
http://www.nhtsa.dot.gov/CPS/CPSFitting/Index.cfm

Safe Kids U.S.
http://www.safekids.org/ and select Find Coalitions and Events Near You

Safe Kids Canada
http://www.cfc-efc.ca/docs/skcan/00000020.htm

Seat Check
http://www.seatcheck.org/

BECOMING A CHILD SEAT INSPECTOR

If you or your organization are interested in becoming a child seat inspector, locate training offered in your local area by selecting the links listed below.

NHTSA
http://www.nhtsa.dot.gov/CPS/Training/ContactList.cfm

Safe Kids
http://www.safekids.org/tier2_rl.cfm?folder_id=182

CONCLUSION

Though there isn't a specific answer as to when or if a CRS requires replacement following a collision, there are guidelines in place to help determine which proper actions should be done to ensure a child's safety. When in doubt whether or not a CRS requires replacement, contact the child seat maker. They should know what is best for their product to provide the most safety.

To view a list of child seat makers and their contact information, select this link: http://www.nhtsa.dot.gov/CPS/csr2001/csrhtml/csManufacturers.html