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THE CREST PROJECT ACCIDENT DATA BASE

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Paper number: 347

ABSTRACT

The protection of children in cars is improving with the increasing use of better designed restraint systems. Indeed, when children are correctly restrained in appropriate child restraint systems (CRS) they are sufficiently well protected in moderate frontal impacts. However, the levels of protection afforded in severe frontal impacts and lateral crashes has needed further attention.
The CREST project, funded by the European Commission, was initiated to develop the knowledge on the kinematics behaviour and tolerances of children involved in car crashes. The final aim of the project is to propose enhanced test procedures for evaluating the effectiveness of child restraint systems (CRS). The method used in this project was to collect data from accident investigations and from reconstructed crashes in order to determine the physical parameters (measured on dummies) which correspond to various injury mechanisms, and is described in ESV 2001 – paper n°294. This paper presents the activity developed within Workpackage I of CREST, responsible for accident investigations. A presentation of the common methodology used is made. A general description of the data base of 405 documented accident cases in which 628 restrained children are involved is given as well as specific features of the reality of the restraint of children in cars, for example: age and size, CRS type, place, and a discussion on misuse and inappropriate use. Injuries in frontal and side impacts are also discussed.

INTRODUCTION

The objective of Workpackage I (WP I) of the CREST research programme is to acquire the necessary knowledge on injury mechanisms through an in-depth investigations of some 400 accident cases involving restrained children, using an additional child restraint system or just wearing the seatbelt. The accident data base contains cases which meet specific criteria that are relevant to the CREST programme. This accident data base is not representative of the real-world accident situation. The main aim of this accident investigation working group was to provide enough accident cases to determine the most common injury mechanisms that children were suffering from, and then have sufficient material to make a selection of cases that can be considered by Workpackage II for full-scale reconstructions and sled tests parametric studies. These injury mechanisms had to be reproduced with instrumented child dummies on which physical parameters were measured. About 50 different accident cases from the 405 have been selected for full-scale reconstruction and 90 complementary sled tests have been performed. A subgroup of WP I and WP II members was set up in order to make joint analysis comparing the reconstructions performed with the original accidents.

ORGANISATIONS

The five organisations involved in WP I have collectively established a CREST accident data base of 405 documented cases. These cases meet selection criteria of type of impact, age of the child, method of restraint and severity of injury. The Workpackage leadership has been fulfilled by the Laboratory of Accidentology, Biomechanics and Human Behaviour (L.A.B.).

The **L.A.B.**, based in Nanterre, France, is common to **PSA Peugeot-Citroën** and **Renault** and is working together with the Centre Européen d'Etudes de Sécurité et d'Analyse des Risques (C.E.E.S.A.R.). Most of the accident studies carried out there are retrospectives studies. Accidents are collected all over France, in co-operation with police forces. Each month, the L.A.B. is informed of all the registered accidents and according to some criteria, a selection of approximately 30 of those accidents are studied. During the CREST programme, the L.A.B. has tried to develop a collaboration with the emergency medical staff in order to make the investigation closer to the accident time in order not to loose the information concerning the child and his restraint system. Unfortunately, due to a lack of time in the emergency teams, the experience was not successful. In three different areas, the C.E.E.S.A.R. is doing systematic accident investigations, where all the accidents in which at least a person is injured are studied daily. Very few of these last accidents were filling the CREST criteria in terms of presence of restrained children and accident severity. The L.A.B. is also responsible for the management of the CREST accident data base.

The Accident Analysis Team of **ELASIS S.C.p.A**. is involved in WP I on the behalf of **FIAT Auto SpA**, Italy. Their team is performing multidisciplinary in-depth investigation of real world accidents. The collection area covers a part of the areas of Caserta and Naples in the South of Italy, and the team is operational 24 hours a day. Co-operation with local police forces, the Medical University of Naples and the Institute of Psychological Research in Turin have been developed. Unfortunately, in the area of their investigations, the use of CRS is not frequent and as a result , the team spread its operational area over all of Italy in order to collect accidents fulfilling the CREST criteria.

The **Institute for Vehicle Safety of the German Insurance Association (GDV)**, Germany is involved in WP I as an associated partner with RENAULT, France. GDV is an association in which most German insurers have joined together. At the Institute for Vehicle Safety in Munich, scientific research is performed in all areas of vehicle safety including accident analysis, biomechanics, injury assessment and prevention and the development of safety standards in close co-operation with the German traffic ministry and European Authorities.

The main method of GDV accident research is retrospective on the basis of the third-party insurance claims of German motor insurers. The sources of accident documentation are the police report, witness statements, expert assessments of the accident causes, course of events and damage, and medical reports. In order to have better quality information, and to fulfil the CREST criteria, GDV has developed an additional methodology to the one they normally use. This consists of contacts with involved accident partners, hospitals, external technical/medical experts and recovery garages. Most of the time, the deformations of the involved vehicles were estimated from the pictures of the police reports taken at the accident scene. After a deep analysis by the GDV team of experts, a detailed reconstruction was performed with the accident reconstruction program "PC-CRASH" in order to determine with the best precision possible the conditions of the accident.

The Accident Research Unit of the **Medical university of Hannover (MUH)** is involved in WP I as a partner associated with the BASt, the Federal Highway Research Institute, Germany. The collection of accident cases is prospective on the area around Hannover. A lot of information is taken directly at the accident scene and is completed by an examination of the vehicles on the following day and from medical reports as soon as they are available. For the CREST purpose, MUH had to extend the area of its activity in order to collect sufficient accident cases. A co-operation with the police forces of Lower Saxony was developed and then MUH made retrospective studies from the police reports containing enough information to fulfil the CREST criteria.

The Vehicle Safety Research Centre (VSRC) of the **Research Institute for Consumer Ergonomics**, Loughborough University, is an organisation specialising in accident investigation and crashworthiness in England. The accident collection is mainly from the area of the East Midlands where links are well established with police forces, hospitals, coroners and recovery garages. The studies are retrospective and the car deformations are used for the determination of the severity of the crash. The medical information is provided by hospitals and post mortem information is provided by HM Coroners. A questionnaire was established in order to collect all the necessary information about the accident circumstances, the CRS used, and the occupants' injuries. Whenever possible the parents of children involved were interviewed to elicit as much information as possible on the children, CRS used and installation in the car. Efforts were made to enhance the data provided to the CREST project, including a stronger collaboration with police forces, especially in obtaining information about the crash scene, and ensuring that post-mortem reports were provided for all fatally injured children, which is not possible for the other teams of WP I.

When put together, the accident cases provided by each team make a significant contribution to the field of accidentology and injury biomechanics.

METHODOLOGY

The original objective of WP I was to investigate 392 accident cases that might be considered for reconstruction by WP II. The method of case investigation and the sources of information vary between the organisations and include on-scene or post accident examination and different procedures for notification and access to medical records and personal information. However, common to all the investigators is information about the vehicles, the circumstances of the accident, information about the occupants and their injuries, and details about the restraint systems being used. It was necessary to develop a standard CREST form in order to ensure that the content, format and terminology used were common to all. The CREST form is an enhanced version of the ISO/FDIS 13218 report form –1- that has been adapted to the specific information necessary to describe the exact conditions of restraint of each occupant at the moment of the accident and more specifically to the child restraint system used at each place. Some details are really necessary for a good reproduction of the child kinematics in a reconstruction, such as the place available for the child between the front seatback and the rear bench, the inclination of the front seats, the presence of luggage in the rear compartment, the length of the static seatbelt or the harness strap, the type of rear bench, interaction with an airbag if any, exact locations of impacts of the body of the child on rigid parts of the car, the cause of injuries,... It was decided that all of the injuries of all occupants of all the vehicles involved in an accident have to be noted using the AIS 90 code –2- which is a standardised method of coding injuries.

It was also necessary to agree what constituted an interesting case for CREST. The original range of crash characteristics was reduced and clear case criteria were defined. These criteria were established and refined during the early months of the project and were confirmed in May 1997. Some of the early cases included in the accident data base do not meet the criteria, but it was decided to keep the ones that were frontal or side impacts in the data base as they were the basis of discussions and examples for definition of the criteria. Only some rear impacts have been excluded. The criteria definition is given in table 1.

From January 1996 to December 1999, 497 accident cases have been presented during 14 meetings. After a summary of the accident conditions, the configuration, and the global severity, pictures of all the vehicles involved in the accident were shown and a description of all the occupants and their injuries was given. The medical reports of children, information on the restraint systems used and their damage after the crash, and some pictures of the car interior were necessary to determine if the accident case was interesting or not. Every accident has been considered by all the WP I partners and a collective decision made about whether to include the case or not in the CREST accident data base, together with a recommendation in relation to its suitability for reconstruction. As a result of this process, the majority of the cases included in the accident data base meet the criteria, but a small number of cases have been included, by agreement, because they have special characteristics and bring other information of interest to the accident database.

Before the start of the project, each team involved in WP I made an estimation of the number of accidents with restrained children involved that could be brought during the 4 years collection period of the CREST program.

At least one child up to the age of 12 years correctly restrained in a child restraint system (CRS) or adult seat belt. Cases with misuse of CRS, such as inappropriate type of restraint according to the weight and size of the child, or incorrect fitting of the restraint into the vehicle, slack in harness or seatbelt, is included if the conditions of the misuse are well defined and possible to reproduce in a test of reconstruction.
The child or another restrained occupant is severely injured In a frontal or lateral impact, with at least one severe injury (AIS 2+) or fatality observed in the same vehicle.
Minimum of severity for frontal impact: The delta V has to be at a minimum of 40 km/h for the vehicle where the child is involved, even if the restrained child receives no CREST relevant injury (AIS 0 or AIS 1)
Minimum of severity for lateral impact: The intrusion on the passenger compartment has to be more than 200 mm, even if a child restrained on the struck side receives no CREST relevant injury (AIS 0 or AIS 1).
The place of the child in lateral impact: If the child is restrained in a CRS with a shell, there is no importance of the place he is seated on, even if there is not direct intrusion on that place. If the restraint system is a booster cushion and adult seat belt or if the child is only restrained by an adult seatbelt, he has to be seated on the struck side.
Type of obstacle and configurations: Car-to-vehicle or car-to-fixed-obstacle accidents are considered. Case vehicles are cars and passenger vehicles designed up to 9 occupants. Only frontal and side impacts are to be investigated for reconstruction. Multiple collisions and roll-overs can be selected only if the injuries are related to a single impact.

Table 1: CREST accident selection criteria

The initial target was 392 accident cases, but due to the definition and approval by the partners of selection criteria, and the changes of the real world situation in term of use of seatbelts in rear places, use of CRS, awareness of the importance of correct installation of CRS and the general improvement of safety in cars, the different partners had difficulties to reach their objectives. Thus it was decided to reduce the contribution of each partner and the total number was revised to 365. Each group made such effort as was possible in order to provide the maximum number of good quality cases and as a result the number of cases included in the data base has exceeded the original target and has reached 405. The repartition of accidents team by team is given in Figure 1.

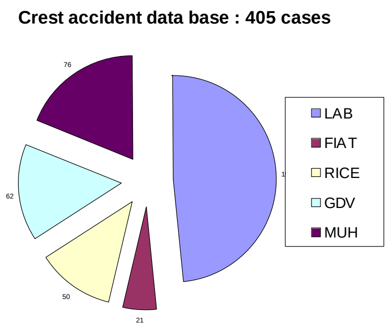

Figure 1 : repartition of accident cases

ACCIDENT DATA BASE

The CREST Accident data base, developed and modified by ELASIS, was used both to identify cases for reconstruction by WP II and as an accident data base for analysis. Tools have been developed to facilitate the management and the analysis of the data, but the analysis of this data base is limited because it is not representative of the real-world accident scene. Its contents have been selected according to the CREST criteria previously described. The architecture of the data base is given in Figure 2. Its philosophy is based on accidents. One accident implies up to three vehicles with at least one child involved and correctly restrained. The general information describing the accident configuration is included in a table with 20 fields, and including a plan of the accident scene with vehicles in position. For each vehicle involved in the accident, in addition to the description of the vehicle itself (40 fields), the static deformations and a picture of the vehicle are stored. Each occupant of each vehicle is entered in the data base. The information is more detailed for children (more then 20 specific fields) than for adults (9 fields). Each injury of each occupant is coded according to the AIS90 with 5 variables including the description of the injury, its severity and the reason of the injury if known.

This data base in its final version contains 405 accidents involving 430 cars with restrained children. Of these, 312 are involved in frontal impacts and the number of restrained children in this configuration is 460, and 118 vehicles have been involved in side impacts with a total of 168 restrained children.

The reason for the CREST Accident data base not being representative is largely coming from the crash severity in terms of impact severity. For example, more than 83 % of the children involved in frontal impacts are restrained in a car with a Energy Equivalent Speed (EES) over 40 km/h. The EES is the speed of a given vehicle against a rigid barrier to produce the same deformation as in the real impact. For the side impact configuration, more than 86% of the restrained children involved are seated in a car with more than 200 mm of intrusion on the passenger compartment. The severity of these impacts is going to limit the conclusions that can be drawn in the majority of studies from this data base.

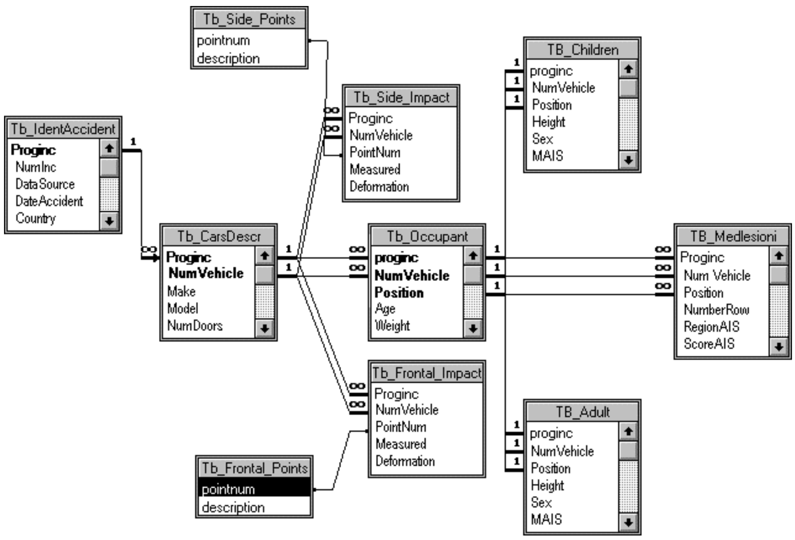

Figure 2 : accident data base architecture

DATA BASE ANALYSIS

In establishing the effectiveness of CRS many factors need to be taken into account. This is the case for each child in every vehicle, and when there is more than one child in a vehicle the circumstances are different for each child. Thus, even with a data base of 405 crashes there will be many scenarios where there are only a small number of examples. This said, some general aspects of the data are discussed below.

- Height and weight of children

For restraint approval to ECE 44, weight is the main parameter, but parents choosing CRS use age first and sometimes weight. Thus, the relationship between height, weight, and age must be considered.

The number of children where height is known is 257. The Figure 3 shows the distribution of the height of the children according to their age. The difference between the smallest and the tallest children in each category of age is always between 23 and 50 cm.

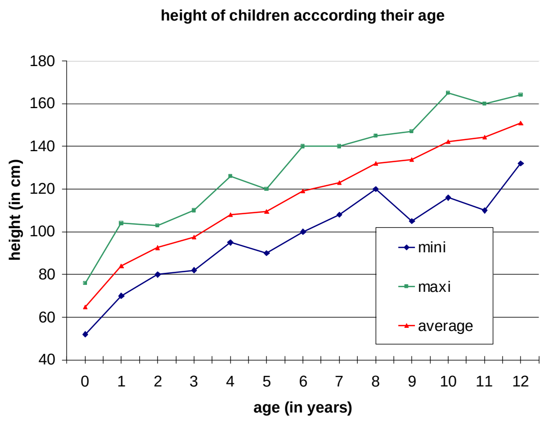

Figure 3 : height of children

In Figure 4, the repartition of the weight of children is shown. In the CREST accident data base, the information on the weight of 320 restrained children is available. The difference between the lightest and the heaviest child in each category of age is 7 kg for the young and goes up to 30 kg for 9 years and over.

This shows one of the difficulties in making a good quality reconstruction with child dummies which have fixed dimensions. Very often police forces and medical staff only notify the age of the child and not height and weight. A lot of interesting accident cases have not been considered for reconstruction, because the physical dimensions of the children involved were too far from the ones of existing child dummies. When the height and weight of one child is not known, if a reconstruction has to be carried out, the choice of the child dummy is only based on the age, and this parameter can affect the quality and relevance of the results of the test.

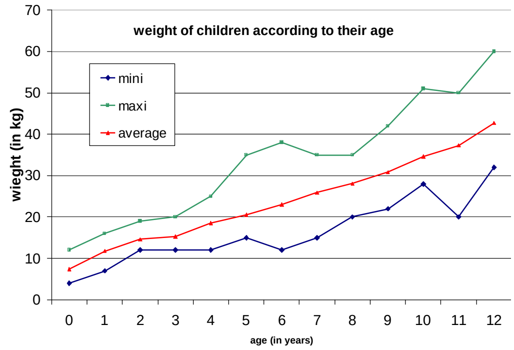

Figure 4 : weight of children

- Position of the child in the car

The different positions that children occupy in cars effect their risk of injury in different impacts. The positions have been put into three categories for this study because the types of restraints available in the cars are not necessarily the same according to those places. The first one which is the most commonly used is the lateral rear place (left or right), the second the front passenger seat, and the third one the rear centre place.

In Figure 5, the repartition of the child's place according to age is given using those three categories.

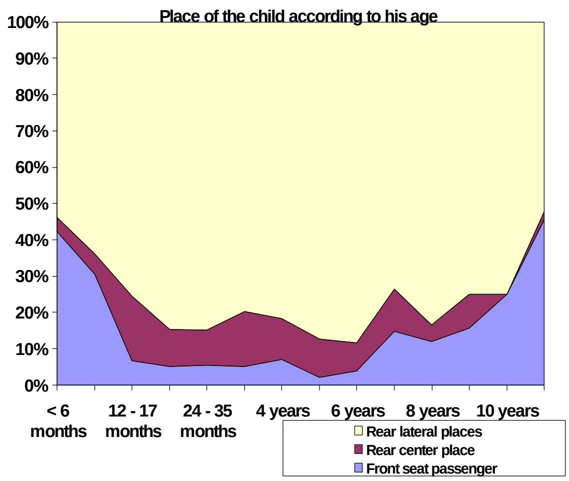

Figure 5 : place of children

The first thing that appears immediately is the use of the front passenger seat with very young children. This is of course due to the use of rearward facing systems for the first months of the life of a child in most of the European countries. This point is interesting because now, many new cars are equipped with a front passenger airbag and it is recognised that there is a risk of serious or fatal injury when there is an interaction between a rearward facing infant carrier and a deploying airbag. During the CREST accident collection period, no case has been included with rearward facing CRS and frontal airbag deployment, but even

if some car manufacturers are offering the possibility of disconnecting the passenger airbag, we have to be aware that the risk is higher now than it was during the period of this study. For older children, the front passenger seat is used by approximately 5% of them from 1 year to 7 years old and then the percentage is increasing with the age of the child up to 45% for 12 years old.
The rear centre place is continuously used by about 10% of the children from birth to 12 years old. For this study period, a lot of cars only had 2 point static belts in the rear centre place. More and more often, the car manufacturers are now offering 3 point belts with retractor systems, which allow the use of booster cushions. It will not be surprising then if in the next years, the proportion of use of the rear centre place increases.
The rear lateral place (left and right) remains for the moment the most common for a child to be seated in a car, always over 50%. This is coming from several factors of which the most relevant here is the fact that these places are equipped with 3 point belts that are required for the installation of most of the forward facing systems and which are the only ones that can be used with booster cushions. The fact that it is not allowed in every European country to install children in forward facing systems in the front passenger seat is reinforcing this high level of use.

-Misuse and inappropriate use

The CREST WP I partners have made a clear distinction between the misuse of a child restraint system (CRS) and the inappropriate use of a CRS.
Definition of a misuse within WP I: wrong fixation of a CRS to the car according to the user manual and / or incorrect use of the system itself (harness routing, slack in the harness, thoracic part of seatbelt under the arm,…)
For only 8% of the children involved in accidents of the CREST database a clear misuse has been found. However this number is an underestimation of what is really happening. This is coming from the fact that most of the studies were retrospective and very often, the CRS is not fixed anymore in the car when the vehicle is examined. Sometimes, the CRS is not in the car because it was broken and thrown away, or because the emergency staff took the child in his CRS, or simply because the parents have collected it in order to use it again. It seems that there may still be a lack of information on the risk of re-using a CRS after an accident.
As the proportion of misused CRS is small but important, and the reality is not known, it is not possible to see the effect of these misuses on the general level of safety offered to children with the CREST database. The only use possible is to establish a list of the misuses found according to the type of CRS:

Rearward facing CRS: no misuse has been seen
Forward facing CRS with harness: slack in the harness have been noted and also wrong fixation of the CRS with the seatbelt.
Forward facing CRS with shield: The sample is not big but it has been noted that those systems were sometime used without the shield.
Booster cushions (with and without backrest): slack in the seatbelt is the most common misuse. Those CRS have been also used with 2 point belts. Sometimes it has been clearly identified that the children has got the shoulder part of the belt in the back or under the arm (instead of on the shoulder).
Adult seat belt: the kind of misuses directly linked to the lack of comfort for a child wearing a three point belt are slack in the belt or shoulder part behind the back.

For the appropriate use of a CRS, it was easier to have a clear idea for each child.
Definition of inappropriate use: Use of a child restraint system was considered as inappropriate when the weight of the child using that CRS is not within the limits of the approval group. When the weight of the child is unknown, then the age is the criteria for the definition of the appropriate or inappropriate use of the CRS.
The Table 2 has been prepared in order to show the differences of the proportion of children using a non appropriate CRS according the age of the children.

Age	Total	% non appr./total
<6 months	26	23%
6-11 months	36	22%
12-17 months	45	4%
18-23 months	39	13%
24-35 months	73	12%
3 years	59	22%
4 years	71	27%
5 years	47	30%
6 years	52	56%
7 years	34	47%
8 years	42	79%
9 years	32	78%
10 years	28	
11-12 years	44	
Total	628	29%

Table 2: Inappropriate use of CRS

It can be seen from this table that in the CREST accident data base only children of 12 – 17 months and over 10 years can be said to be appropriately restrained. Between 18 and 35 months, less than 15% are inappropriately restrained. Nearly 25% of infants under 12 months are inappropriately restrained, many of whom will be in forwards facing CRS instead of rearward facing ones. The use of inappropriate CRS by children between 3 and 9 years causes concern for different reasons.

Children of 3, 4 and 5 years have a lower rate of inappropriate use (22, 27 and 30% respectively) but this group is still very vulnerable to injury, particularly when using the adult 3 point belt as the means of restraining both them and their CRS. The levels of inappropriate use of CRS use amongst the older children increases up to 9 years, and is largely attributable to them no longer using a booster cushion. This is a matter of education and the effects of social and peer pressure, as the children no longer want to use a 'baby' seat and their parents do not understand why they should still be using a booster cushion. Again it must be emphasised that, as the data in the CREST Accident data base is not representative, the situation may be different within the road population at large.
This can also be shown with the repartition of CRS use according to the age of children given on the Figure 6. The booster cushion is not used a lot after 7 years old, when its efficiency should be at its maximum.

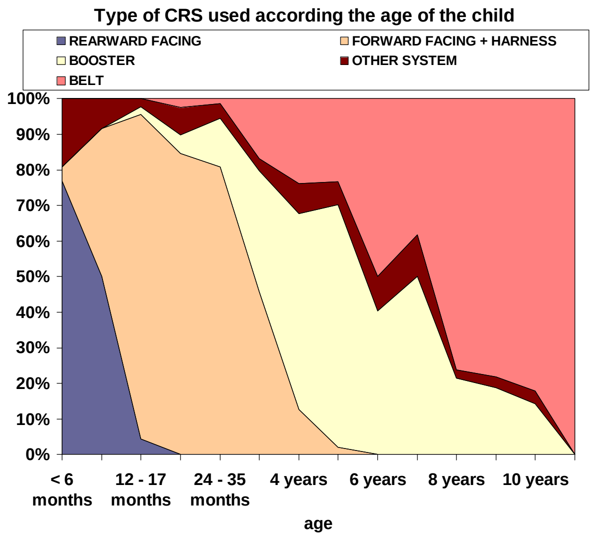

figure 6 : type of CRS according to the age

FRONTAL IMPACT

Comparison between different type of CRS: typical severe injuries.

Of course before focussing on the injuries of restrained children involved in the CREST accident data base, it has to be said again that it is <u>not representative</u> of the real-world scene, and can be only considered as representative of a selection of very severe accidents. The following study is based on the number of injuries of the restrained children according the body segment on which they occurred. Then a selection is done of the AIS3+ injuries.

<u>Rearward facing infant carrier / forward facing seat</u>: Due to the low number of children restrained with rearward facing devices, the results shown in the table 3 cannot be used for statistical analysis, but they can show a tendency of the typical injuries encountered in severe crashes according the type of CRS used. The number of severe head injuries is high and for rearward facing systems can come from an impact of the CRS with the dashboard. However, also important, and shown in Table 3, is the number of neck AIS 3+ injuries when children are using group 1 forward facing systems but no neck injuries at all with rearward facing systems. Another interesting point is that the number of limb fractures (upper and lower) is high for both types of CRS. The coding of limb fractures for children is different from the one used for adults which is the reason why very few of them are shown in AIS 3+ injuries analysis.

	Rearward facing		Forward facing	
Number of children	31		144	
Injuries:	AIS1+	AIS 3+	AIS1+	AIS 3+
Head	18	5	46	16
Neck	0	0	24	10
Chest	3	0	16	6
Abdomen	1	0	9	3
	AIS1+	fracture	AIS1+	fracture
Limbs	8	4	39	20

Table 3

<u>Number of children</u>: number of children with medical information.
<u>Injuries</u>: The number given for head, neck and limbs is the number of injuries

<u>Booster cushion + seatbelt / adult seatbelt only :</u>
When comparing the injuries occurring to children using a booster cushion and a seatbelt to those using only the adult seatbelt, in Table 4 it clearly appears that a lot of abdominal injuries are observed without a booster cushion. The kinematics of the child is then totally different due to a poor positioning of the lap section of the seatbelt.
In addition, it is be observed that there are more AIS3+ neck injuries occurring to children on boosters, whilst there are more AIS3+ chest injuries sustained by children using only the adult seat belt.
In both cases a lot of limb fractures have been observed.

	Booster cushion + seatbelt		Adult seatbelt only	
Number of children	108		148	
Injuries:	AIS1+	AIS 3+	AIS1+	AIS 3+
Head	39	7	44	8
Neck	22	11	25	6
Chest	24	9	45	18
Abdomen	28	9	68	27
	AIS1+	Fracture	AIS1+	fracture
Limbs	53	25	88	38

Table 4

Number of children: number of children with medical information.
Injuries: The number given for head, neck and limbs is the number of injuries

SIDE IMPACTS

- Severe injuries occurring in side impacts on children from birth to 12 years old.

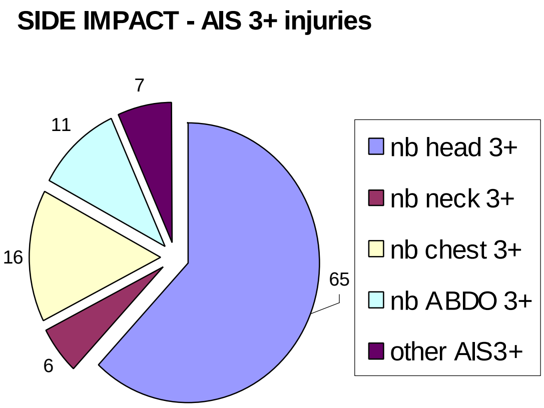

Figure 7

The CREST accident data base contains 168 restrained children involved in severe side impacts. Of these, 27 are not injured, and 115 of them have a detailed medical report (including 14 children fatally injured), and the total number of injuries is 424. When focussing only on the severe injuries (AIS 3+), in order to see where effort has to be put in priority to reduce the risk of these injuries occurring, their number is 105. The repartition of the injuries according to the different body segments is given in the Figure 7. The head is represented in 62 percent of all the severe injuries recorded in all types of CRS. When comparing the injuries for the different CRS types, severe head injuries always account for more than 50%. Thus, the protection offered to avoid head impacts on the rigid parts of the car or intruding object is currently not sufficient.

Severe injuries also occurred on the chest and the abdomen. They are mainly observed when the child is sitting on a booster cushion or just using the adult belt. For those systems, the chest accounted for 22% and the abdomen 16% of injuries. They have been rarely seen in CRS with a shell, either forward or rearward facing, where the protection of those body segments seems to be more efficient.

The neck appears to be less injured than the other body segments and the injuries noted had mainly occurred on young children using forward or rearward facing child restraint systems and their number is lower. Even though the number of injuries observed is low, it has to be said that each time a AIS3+ injury is observed on the neck in a side impact during the CREST program, the child has been fatally injured.

CONCLUSION

The CREST accident data base is not representative of real world scene but nevertheless can be useful for general studies focussing on severe impacts with restrained children. In addition to describing the approach taken and the accident investigation methods used, this paper has considered some important variables, such as the age and size of children, their position in the vehicle, the CRS type used, misuse and inappropriate use. Injuries in frontal and side impacts have also been discussed.

As a lot of parameters have been notified in the data base, it is very complete. However, the size of the sample should be increased in order to be able to confirm the tendencies of the studies already undertaken.

Other studies have been carried out on different issues, such as the effects of luggage loading on children's injuries, the effectiveness of the systems with shields, the comparison of CRS approved to R44.02 and/or R44.03 and the effects of misuse. However, the sample is not sufficient to have a clear view and the specific nature of the selection criteria of the accident cases are both factors which must be considered very carefully when drawing conclusions.

FUTURE ITEMS OF WORK

The knowledge on child safety should be further increased during the next years with the enlargement of the data base, and the expansion to address other specific items and studies. The protection of new born babies and, more generally, the rearward facing systems (including the group 1 rearward facing seats) in frontal and side impacts.

As the car restraint systems are changing some new items should be taken into consideration through accidentology investigations. These include a first evaluation of the ISOFIX systems, and also issues resulting from the interaction between CRS and advanced restraint systems, such as frontal airbags and lateral protection devices.
Some very general studies on the behaviour of car passengers should be conducted in different countries in order to have a better knowledge of the misuse situation, the inappropriate use of child restraint systems and the percentages of restrained children in cars. With such data, considerable steps forward can be made in the comprehension of the effects of mis- and inappropriate use of CRS and the identification of ways to reduce the amount of mis- and inappropriate use.

ACKNOWLEDGEMENT

This study was partly funded by the European Commission, Directorate General XII, through Standard, Measurement and Testing program, SMT4-CT95-2019 CREST Project.

The author wishes also to acknowledge all partners of the project: Fiat Auto-SpA, INRETS, PSA Peugeot-Citroën, Renault, TNO, TUB, RICE, BAST, GDV, MUH, VTI, Elasis.
and also Fondation MAIF, and Hospital and Polices forces that make possible such studies.

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