CHILD task 1.2. Overview report of research into the incorrect use of child restraints in selected countries

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Task 1.2
Overview Report Of Research Into The Incorrect Use Of Child Restraints In Selected Countries

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From contributions from Task 1.2 partners which are attached as Annexes
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Executive summary

In the developed world, motor vehicle collisions are a major cause of severe and fatal injuries to children. The purpose of child restraint systems is to reduce these injuries by preventing the child from contacting the vehicle interior during the collision and by absorbing and distributing the impact forces over the strongest parts of the child’s body. There are several types of child restraint available, each appropriate for children of a certain size.

Most countries mandate the use of child restraints to some extent but there are often gaps and exceptions, particularly as children get older. Through a combination of legislation and publicity it has been possible to change the behaviour of parents to such an extent that the use of child restraints is now higher than ever before. However, research shows that the majority of children are not restrained correctly and even with the most appropriate restraint for a child’s size, the way it is used can affect its performance. The result can be serious injury and death if the device is not properly secured to the vehicle or if the child is not well restrained within it.

The European Community project; CHild Injury Led Design (CHILD) aims to improve the knowledge of child biomechanics and injury tolerance and establish protection reference values for a new child dummy called the Q series. This will be achieved by reconstructing real accidents with the dummy. However, these reconstructions will usually be based on police reports, which may make it difficult to tell if the restraint was used correctly or not. To give an indication of the level of misuse, each partner in the CHILD project was tasked with producing a national literature review, forming a comprehensive review of the incorrect use of child restraints in the developed world.

Research in the USA shows that as many as 80% of child restraints are misused in some way. Child restraints may be misused in a variety of ways, including incorrect fitting, facing the wrong direction and the child not being properly secured in the restraint. There are also instances of inappropriate use; not ensuring the child restraint is of the correct type and size for the child.

Improved child seat design may reduce some forms of misuse; such as dedicated attachment systems to reduce the risk of the adult belt being incorrectly routed through the restraint.

Interviews with parents suggest that most do not have a good understanding of the installation and use of child restraints and of those that do, some still choose to misuse the restraint because they perceive there is some benefit in doing so. Parents generally behave in this way because they are not aware of the consequences of their actions. Research also shows that there is a link between certain demographic factors and misuse, such as academic achievement or socioeconomic status.

Two groups of children are most at risk when restrained inappropriately: infants using forward facing child restraints when they are less than one year old, and children using the seat belt when they should be using a forward facing seat or booster seat.

Improved child restraint designs are unlikely to address the issue of inappropriate restraint selection by parents. Instead, this must be addressed by awareness campaigns; there is a need to emphasise to parents that restraint laws provide a minimum level of protection and can differ from the best practice. For example, in some countries occupant protection laws allow children over 4 years of age to be restrained by an adult seatbelt without a booster cushion.
Child restraint misuse is associated with greater injury severity in real accidents. In particular, children in misused child restraints receive more head injuries than children who are correctly restrained. Inappropriately restrained children are also placed at a greater risk of injury than children using the correct restraint for their size and weight. However, it is important to note that the risk of sustaining injuries from misused or inappropriate child restraints is less than the risk of sustaining multiple serious injuries from travelling unrestrained.

Studies in the UK show that the percentage of correctly fitted child restraints is low, although their use is high. Information was obtained from small, local studies run by county councils, safety campaigns run by child product manufacturers and surveys from safety organisations. Studies show that parents are often not confident that their child is restrained correctly. Studies also show that instructions given with child restraints need to be clearer to increase the likelihood of correct fitting and parent confidence.

A proportion of child restraints used in the UK will have been purchased privately second hand and hence may not provide the best protection for the child. For example, Hampshire County Council Trading Standards Service conducted a study on the crash performance of second hand child restraints – all 15 child seats tested, failed to meet the R44 standard.

The major problem in Spain is lack of restraint use in general. Accident studies have shown that in a number of cases where the child was restrained using a child restraint; the restraint was either incorrectly fitted or not attached to the car at all. Early graduation to using an adult belt only as a restraint is also a problem, particularly for children in the 7-9 age group.

Swedish studies have found that 83% of children always use a seatbelt. However, the restraint use is not always correct or appropriate. In Sweden children under 3 should travel rear facing but one study found nearly 30% travelling forward facing. Another study showed that whilst the majority of parents believe their child to be correctly restrained, only 60% fully understood the correct restraint to use for their child and how to fit it.
1 Introduction

In the developed world, motor vehicle collisions are a major cause of severe and fatal injuries to children. The purpose of child restraint systems is to reduce these injuries by preventing the child from contacting the vehicle interior during the collision and by absorbing and distributing the impact forces over the strongest parts of the child’s body. There are several types of child restraint available, each appropriate for children of a certain size.

Most countries mandate the use of child restraints to some extent but there are often gaps and exceptions, particularly as children get older. Through a combination of legislation and publicity it has been possible to change the behaviour of parents to such an extent that the use of child restraints is now higher than ever before. However, research shows that the majority of children are not restrained correctly and even with the most appropriate restraint for a child’s size, the way it is used can affect its performance. The result can be serious injury and death if the device is not properly secured to the vehicle or if the child is not well restrained within it.

The European Community project; CChild Injury Led Design (CHILD) aims to improve the knowledge of child biomechanics and injury tolerance and establish protection reference values for a new child dummy called the Q series. This will be achieved by reconstructing real accidents. The injuries received by children in the accidents will be compared with the accelerations and forces measured by the dummies. Accident reconstructions rely on the accuracy of Police reports to describe the way in which the children were restrained. However, it is difficult to get an indication of whether the restraint system was used correctly. To give an indication of the extent of the problem, each partner in the CHILD project was tasked with producing a national literature review, forming a comprehensive review of the incorrect use of child restraints in the developed world.

This document is intended to summarise the contributions received from each partner in the CHILD project; the individual contributions have been included as annexes to this summary. Most partners have contributed a review of research conducted in their own country. However, since two partners were based in the UK, VSRC have reviewed all relevant information available in the UK and TRL have reviewed research on the subject of child restraint misuse from other developed countries. Unfortunately, information was only available from Canada, USA and Australia; to the best of the authors’ knowledge, no published research was available on this subject in other developed countries at the time of the search.

The full texts of each review of literature on the incorrect use of child restraints are contained in Annexes 1 to 4. Annex1 contains the review of literature from Non EC Countries by TRL; Annex2 contains information from the UK by VSRC; Annex3 contains a review of child restraint use in Spain by Idiada and Annex4 contains a review of incorrect restraint use in Sweden by Chalmers University.
2 Misuse

Misuse of a child restraint system is defined as any incorrect fitting of the restraint (e.g. having the adult seatbelt incorrectly routed) in the vehicle of incorrect positioning or restricting of the child within it (e.g. having the harness too loose).

2.1 Introduction

Countries outside the EC:

There are a wide variety of techniques used to measure child restraint misuse, such as observation studies, car inspection events and interviews. Transport Canada reported that 25% of child restraints were misused, in a roadside study observing cars at traffic lights and stop signs (Transport Canada, 1998). The National SAFEKIDS campaign in the USA inspected more than 17500 children at a check up event and found that 85% of restraints were misused in some way (Taft et al 1999). In a similar study Decina and Knoebel (1997) found over 80% of restraints were misused.

UK:

In the UK it is evident that the percentage of correctly fitted child restraints is low, even taking into account the scientific limitations of the car park surveys (checking days) from which this data is available. In the larger studies (GMTV/Britax, Pampers) only around 25 to 40% of child restraint systems are found to be correctly fitted. During a campaign carried out in Scotland in 2002 (Scottish In-Car Safety Initiative) 40% of child restraints were found to be incorrectly fitted but the initial findings of the 2003 campaign showed a decrease to 33% not being correctly fitted.

The picture of incorrect use is very similar for the smaller checking campaigns that are carried out at a more local level throughout the UK.

In the larger campaigns the levels of incompatibility between car and child restraint were between 9 to 20% and the combined categories that are cause for major concern (in need of major adjustments, incompatible with the car or condemned), range from 37 to 42% over the 3 years of the GMTV/Britax campaign, higher than the percentage of minor adjustments in this campaign, 30 to 38%. In the checks carried out by the Scottish In-Car Safety Initiative, 23% of child restraints were put into the major adjustments, incompatible or condemned category.

Spain:

In Spain, non-use of CRS continues to be the major cause of concern, since the majority of children still travel unrestrained on the Spanish roads.

Sweden:

Child restraint use and misuse were studied in Ostergötland, Sweden. 274 children were observed at supermarkets and child care centres and of those, almost 40% were in misused restraints. In Sweden, children under 3 years of age should be restrained in rear facing restraints. Nearly 30% of children under 3 years of age were found travelling forward facing, but the main misuse factor was seatbelt misplacement (Anund, 1998).

France and Germany have not provided any information on Child Restraint Misuse.
2.2 The effects of child restraint type or design on misuse

Countries outside the EC:

Almost all aspects of child restraint design are misused in some way. Researchers agree that some types of misuse are more serious than others but any misuse is likely to compromise the performance of the restraint. The design of child restraints has improved considerably in recent years but there is evidence that parents still find them difficult to use.

Misuse of the seat belt when it is used to attach the child restraint to the car is already being addressed by better design. In the latest development, ISOFix anchorages are found in most new cars around the world and child restraint regulations are being updated to encourage designs that use these anchorages. Another concern, however, is the way the child is held in the child restraint. In many cases identified in research studies, the harness was loose because it had not been adjusted correctly. As child restraints now have a single strap for adjustment, which should be easy to use, further improvements may therefore be necessary. Possibly self-adjusting harnesses or a ‘tell-tale’ device to alert parents to poor fittings (Lang et al, 2002) would reduce the likelihood of misuse.

UK:

In the UK, observations of child restraints being fitted as part of a study on instructions (Royal Society for the Prevention of Accidents) and comments from local checking days indicate that the most common cause of child restraints being incorrectly fitted is because they are too loose, with the restraint looking securely fitted, but being easy to move.

In a survey reported by Campbell et al (1997) the highest rate of incorrect fitting was found in two way seats, followed by rear facing infant carriers and forward facing seats. The lowest rate of incorrect use was found for booster seats.

During the RoSPA trials it is reported that with the two rearward facing infant carriers used many of the volunteers failed to put the handle into its lowest position, which is necessary to obtain a secure fitting and some volunteers found the correct routing of the seatbelt difficult, especially at the back of the restraint.

In a study of ISOFix attachment systems, TRL found that the 4 possible ISOFix systems trialled all resulted in lower rates of misuse than with the conventional CRS. Of the ISOFix systems the system with the webbing attachment, opposed to the rigid attachment, was more frequently incorrectly fitted, resulting in greater slack, especially when fitted for the second time (TRL).

Sweden:

Berg and Gregersen (1992 & Berg 1998) investigated the effectiveness of systems with child seat fastenings incorporated into the car seats or chassis with respect to correct mounting by parents. The results showed that these systems minimise incorrect mounting of child restraints; the ISOFIX system being ranked highest for ease of use and security of fastening.
Spain:
An investigation of crashes where the child restraint was found to no longer be attached to the car after the crash assumed the restraint had been fitted incorrectly and found that in the majority of cases, an adult belt had been used to attach the restraint to the car. This could imply that parents had struggled with this method of attachment the most or that this was simply the most common attachment method. In 27% of cases, it was believed that the restraint had not been attached to the car at all prior to the crash.

No information was available from any other countries.

2.3 The Effects of Parent Understanding on Misuse

Countries outside the EC:
Two approaches have been taken in the literature; researchers have tried to use the demographics of parents to see if particular groups are more likely to misuse child restraints and secondly, interviews have been carried out to gauge the knowledge and understanding of parents about child restraints. These results have then been used to recommend the provision of educational programmes where they are most needed.

Parent restraint misuse correlates with child restraint misuse so that parents who fail to use restraints themselves are more likely to misuse their children’s restraints (Cynecki & Goryl, 1986 and Eby & Kostyniuk, 1999).

Parents generally find buying restraints difficult and staff uninformed according to Glanvill (2000). Once the restraint has been purchased most parents choose to fit it themselves and consider this well within their capabilities (Decina & Knoebel 1997 and Glanvill 2000).

Most parents used the instructions to fit the restraint the first time, however, studies have shown that child restraints are more likely to be misused if regularly removed from the vehicle, implying the instructions may not be used after the first fitting (Cynecki & Goryl 1986, Decina & Knoebel 1997 and Eby & Kostyniuk 1999). Some parents also fail to use the instructions to secure the child in the restraint; parents who took this approach were more likely to misuse the restraint (Decina & Knoebel 1997 and Eby & Kostyniuk 1999). However, parents who did use instructions to fit the restraint were also found to misuse the restraint, implying that instructions may not be easy to understand.

Most parents interviewed in studies were unaware that they were misusing the restraint; however, some parents were shown to have been misusing the restraint intentionally. An example of this was parents knowingly using an infant carrier facing forwards because they wanted to be able to see their baby and could not place the infant carrier in the front seat (Weber 1989). Another example was parents leaving the restraint harness loose so as not to make their child uncomfortable (Eby & Kostyniuk 1999).

Low academic achievement has been linked to misuse (Eby & Kostyniuk 1999); better educated parents were more likely to use child restraints properly. A “hands on” approach to instruction has been shown to reduce mistakes in fitting and using restraints (Lane et al 2000). This approach may also benefit non English speaking populations within each country, although in general the focus is still on getting these groups to use child restraints.
In general age, gender and employment status have not been found to influence misuse and the only two studies comparing parents with other adult carers in terms of the likelihood of their misusing restraints had different findings so no conclusions may be drawn about this. (Cynecki & Goryl 1986, Decina & Knoebel 1997 and Eby & Kostyniuk 1999).

UK:

In the UK, the work of RoSPA regarding child restraint fitting instructions (A Review of Child Restraint Instructions) found many general problems with instructions that could lead to the incorrect fitting of the child restraint. Many issues are cited in the work but the overall conclusion is that the quality of instruction booklets needs to be standardised to bring the poorest examples in line with the good examples. It is also suggested that videos are provided as part of the fitting instructions.

A major problem of parent understanding is highlighted regarding how secure the restraint should be. It is commented that clearer advice to check the security of the fitting should be provided, with guidance on what is regarded as ‘secure’ and ‘insecure’. A Road Safety Officer suggested in a telephone conversation that some parents purchase seats believing that they are a universal fit and are suitable for all cars. (Where the term "universal" means "most vehicle seat positions.)

During a Scottish Police Force child safety campaign in 2001 a telephone line was set up to offer advice. Of the 165 callers who stated that they drove with children, 94% claimed to use a child or booster seat. Of those callers, only 54% stated that they were confident to fit the (child) seat. This obviously indicates that although most of these parents had the knowledge that they should be using a form of child restraint only around half felt that they then had the knowledge to fit it confidently.

No information was available from any other countries.

2.4 The Effects of Child Age and Weight on Misuse

Countries outside the EC:

The literature suggests that the age and weight of a child only affects child restraint misuse because children use different restraint systems as they grow and some are easier to misuse than others.

Several studies were conducted looking at children in the 0 to 4 age range but the results were inconsistent. Two studies found that the youngest children were more likely to be seated in a misused child restraint, whilst two others found there was no difference across the age range.

When age groups were compared, several studies found that children in the 5-9 age range were less likely to be seated in misused restraints than those in the 0-4 age range. However, this was probably due to older children being restrained with only an adult belt and therefore there being less chance of misuse.

Similar trends were reported for the effects of child weight on misuse. However, one study compared booster seat misuse with child weight and found that children under 40lbs (approximately 18kg) we twice as likely to be seated on a misused booster seat than those over 40lbs (Morris et al 2000).

No information was available from any other countries.
2.5 The Effects of Journey Type and Time on Misuse

Countries outside the EC:

There were few publications which considered the effects of journey type and time on misuse. A few studies considered the distance and time from the last stop and determined that these factors did not influence misuse; however, these studies were conducted in urban areas during daylight hours. One study found that restraints were used less during late night and early morning trips, possibly because parents allowed their children to lie down or sit in a different position at these times. These factors may also affect misuse but it is clear that further research is necessary in this area.

No information was available from any other countries.

2.6 Injuries Associated with Frequent Misuse Modes

Countries outside the EC:

Different studies have considered the additional risk to children in an accident, based on the type of misuse of the restraint but findings vary. Glanvill (2000) found that 25% of misuse faults were so serious that they put children at greater risk of death or injury, whilst Weber (2000) found that most types of misuse were relatively minor.

It is difficult to identify incidences of misuse from real accident data; however, several accident reconstruction studies have effectively shown that misuse of child restraints was associated with greater risk of injury. Children in misused restraints receive more head injuries but misuse is also associated with a higher incidence of abdominal injury (Sweitzer et al 2002).

No information was available from any other countries.

2.7 Child Restraint Use Levels

UK:

Although not perhaps defined as misuse the simplest form of lack of protection for children is not using an appropriate child restraint at all.

The TRL roadside restraint use surveys in the UK indicate that the levels of restraint use in the rear decrease as children get older, from 98% for 0 year olds to 83% for 10-13 year olds (April 2002, LF 2087), although this survey doesn’t indicate whether the type of restraint used is appropriate, which is especially relevant for the younger age groups. From 1996 to 2002 rear restraint use has increased for all age groups, which is likely to have been aided in part by the diminishing proportion of pre 1987 cars (which did not require rear seat belts) in the vehicle fleet.

The other study to record restraint use (Scottish Executive 2002) doesn’t distinguish between the front and rear seats but indicates a similar reduction in restraint use from 87% for the under 5 year old group to 82% for the 5 to 13 year group. It also shows that for the adult banded age groups from 14 years upwards, restraint use is higher than for the two child age groups (<5 and 5-13 years). This is an indication that adults may not be able to protect their children as well as they can themselves, maybe through lack of knowledge or money.
Sweden:
In the study covering the west of Sweden (Anund, Sörensen & Yahya, 1999) it was estimated that overall, 83% of children always used a seatbelt. The study also found that approximately 25% of children travelled without a child restraint in at least one out of every 20 trips.

Spain:
A high percentage of children (varying from 30% to 40%, depending on the city) travel every day unrestrained or inappropriately restrained. The utilisation of restraint system decreases as child age increases, especially above 3 years old. One Spanish study showed that for children of three years old, more than 50% travelled without being restrained in a child restraint. For children aged seven to nine years of age, 80% travelled without a child restraint. The study does not indicate what proportion of these children may have been restrained using an adult belt.

No information was available from any other countries.
3 Inappropriate Use

Inappropriate use is defined as the child being restrained in the wrong type of restraint for their size, age or weight.

3.1 Introduction

Countries outside the EC:

This section summarises the research on the inappropriate use of restraint systems by children in cars. Children most at risk of being inappropriately restrained were the focus for the review, which also considers what factors might be associated with inappropriate restraint use and the consequences, in the event of a crash.

Spain:

Early graduation to adult seat belts is a serious problem in Spain, since almost no children between 7 and 9 years of age use booster seats. When these children are restrained, they normally use the adult seat belt. Rollovers account for almost half of the fatalities. For appropriately restrained children, lateral crashes are the most dangerous event. The study has shown that unrestrained children suffer 2.5 times more serious injuries than appropriately restrained children, and 1.8 times more than inappropriately restrained children.

France and Germany have not provided any information on Inappropriate use of Child Restraints.

3.2 The effects of child restraint type and design on inappropriate use

Countries outside the EC:

Before considering the effects of design, it is important to establish the weight and size of children for whom each type of child restraint is appropriate.

For each of the restraints listed below, the child has outgrown the restraint when their head is above the top of the seat back.

Infant Carrier – Designed to be used by children aged 0-1 year, under 9kg in weight.

Convertible Seat – Designed to be used by children from birth until they are 18 months old and 13kg in weight. May be used rear or forward facing but children less than one year old must not travel forward facing.

Forward Facing Child Seat – Designed to be used by children over one year in age until they reach 18kg in weight (4 years of age).

Combination Seat – As above but has higher seat back and removable harness so it can be used as a booster cushion when the child reaches 18kg in weight (4 years of age).

Booster Seat – Used to raise the child’s height and make it safer for them to use an adult seatbelt. May be used by children from 18kg to 36kg or 45kg in weight depending on the design.
Children at risk are usually those using restraint systems too advanced for their development. The two groups most at risk are infants placed in forward facing seats and children restrained by an adult seatbelt when they should be using a booster seat.

Child restraints are provided with instructions and labels illustrating when it is appropriate to use them forward facing and it was shown in Section 2.3 that some parents deliberately restrain their child facing forward before it is appropriate to do so; it is therefore unlikely that seat design is to blame for this type of inappropriate use.

It is also unlikely that the failure of some parents to use a booster seat to restraint their children is due to booster seat design, as occupant protection laws in most states in the USA only require that children under 3 be appropriately restrained.

**Sweden:**

Occupant restraint laws are also more likely to influence inappropriate restraint use than design in Sweden, where currently it is only mandatory for children of 6 years of age and below to be restrained using a child restraint. No literature relating specific design issues to inappropriate use was available.

No information was available from any other countries.

### 3.3 The effects of parent understanding on inappropriate use

**Countries outside the EC:**

Studies in the USA indicate that parents may be unaware of the consequences of inappropriate use of certain restraints. For example, one study (Vaca et al 2002) showed that the majority of parents (over 90%) are aware that children under one year of age and 9kg should travel rear facing, whilst another (Cody et al 2003) indicated that only 74% of infants were actually correctly restrained. Vaca et al (2002) also showed that only 46% of parents could identify booster seats as the appropriate restraint for children of 18kg to 27kg in weight. In this case state laws are most likely to be the cause of parents’ misconceptions.

**Sweden:**

In Sweden it is recommended that all children under three years of age travel facing rearwards (Anund, Sörensen & Yahya, 1999). There was found to be a significant correlation between the percentage of forward facing children under three and both the educational level of parents and their household income. There was also a link between misuse and whether the parents were immigrants; it was believed that this was because these parents had not received or investigated the necessary information. Overall, most parents were convinced that their child was correctly restrained, even though survey results indicated that less than 60% actually understood correctly which restraints they should have been using.
3.4 The effects of child age and weight on inappropriate use

Countries outside the EC:

The research summarised in the previous sections has shown there is a relationship between age and inappropriate restraint use. The relationship is not uniform; instead, there is a sharp increase in inappropriate use when children reach 4 years old. This is explained by the occupant protection laws. When children reach four years of age, most countries no longer mandate the use of a child restraint. Many children are therefore inappropriately placed in restraint systems designed for adults or are even unrestrained.

Sweden:

Anund, Sörensen & Yahya (1999) found that there was a correlation between the age of the child and the use of a child restraint. Among one to two year olds 7% travelled without a child restraint in at least one out of 20 trips, whilst 30% of 3-9 year olds travelled without a child restraint for at least one out of 20 trips.

Spain:

Research indicates that, in general, inappropriate use was highest for infants and children aged 4-6. The research study does not indicate the possible causes of these trends.

No information was available from any other countries.

3.5 The effects of journey type and time on inappropriate use

Countries outside the EC:

It was not possible to find any significant literature on the effects of journey type and time on inappropriate use. Restraint use is less during late night and early morning hours (Agran et al, 1998), but generally, little is known about the circumstances in which parents might vary the way they restrain their children.

Spain:

One Spanish study compared restraint use on different types of road. In general, use rates were low as has already been indicated in previous sections. Inappropriate use was higher for more major roads but this is likely to be because restraint use was more frequent on these roads and not indicative of any relationship between journey type and inappropriate use of restraint.

No information was available from any other countries.
3.6 Injuries associated with inappropriate use

Countries outside the EC:

Data from the Crash Injury Research & Engineering Network is reported to show that inappropriately restrained children are nearly three and a half times more likely to suffer a severe injury than appropriately restrained children (Cody et al, 2002).

As indicated in previous sections, the two groups most at risk are infants less than one year old restrained in forward facing child restraints and children restrained by an adult belt when they should also have a booster seat.

Infants under one year old are vulnerable to cervical spine injury when restrained forward facing, due to their proportionally large head and loose spinal ligaments (to allow for rapid growth). The spine can be stretched and the spinal cord damaged, resulting in quadriplegia or death.

Children aged between 2 and 5 restrained by an adult belt tend to rotate out of the belt due to their higher centre of gravity and thus sustain head injuries. Slightly older children have different kinematics but still do not engage the lap belt properly and are at risk of sustaining chest, abdominal and lower extremity injuries as a result. However, risk of injury from an adult belt is still less than the risk of sustaining severe injuries when unrestrained.

Spain:

Research suggests that the majority of children restrained inappropriately, who are killed on Spanish roads, suffer head injuries.

Sweden:

Child fatalities in Sweden between 1992 and 1997 were reported by Wenäll (2001). In cases where children were inappropriately restrained head injuries predominated (this was also the case for unrestrained children).

No information was available from any other countries.
4 Second Hand Child Restraints

UK:

As a safety product, it is necessary for child restraints to comply with performance requirements laid down in regulations and standards. However, their sale falls within the market of nursery products. This market is considerable and consists of both new and second hand retail sales, with the associated consumer protection legislation and statutory obligations. There is also a considerable private activity of sale, exchange, loan and gift of nursery goods. This activity ranges from private sales and small advertisements, to loaning between friends and family and handing down from one to the next child.

Although products sold second hand in a business context can still be assessed under the terms of the General Product Safety Regulation, there is no requirement for assessment of a child restraint sold privately or passed on as an exchange or gift.

No information has been found about the size of this private trade, either in value or frequency. Unfortunately within the information available, it is not defined as to whether a second hand car seat is one bought second hand or passed on from friends or family.

As a consequence of this trade in child restraints, the life expectancy of each product sold new is considerably longer than the period of use that is possible for the type of restraint (for example a Group 0 infant carrier can be used for a child up to 9 months, but the product will still be fit for use after the infant has grown out of it).

During this life cycle a number of events could happen, which may affect the condition and crash performance of the CRS. Examples are given below, together with the possible consequences, but the list is not exhaustive.

Throughout the period of use of the CRS the state of the art of CRS design is changing. The relevant standards are updated, new designs are introduced, improved materials are used and the vehicles in which the CRS are used are also changing.

First time parents are particularly likely to be using second hand child restraints; this is reflected in statistic from the Baby Products Association (BPA) that 60% of group 0 child restraints are second hand.

From information gathered there are problems with CRSs. Regarding the provision of fitting instructions, one of the recommendations from the RoSPA study on child restraint fitting instructions was that instruction booklets and on-product stickers should be more durable. Knowledge about the history of the CRS and previous involvement in an accident was found to be an issue in a study carried out by Hampshire County Council Trading Standards Service. This was a large study looking at the crash performance of second hand child restraints, with all 15 failing to satisfy the criteria of R44.03.
<table>
<thead>
<tr>
<th>Event</th>
<th>Consequence</th>
<th>Influence on crash performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The harness will be adjusted frequently</td>
<td>Wear and tear of the webbing and slack may be introduced to the system</td>
<td>Slack in the harness can cause or exacerbate injuries</td>
</tr>
<tr>
<td>The cover will be removed for washing</td>
<td>This may involve removing the harness, which may not be correctly replaced</td>
<td>Misrouting of the harness is known to contribute to injury</td>
</tr>
<tr>
<td>The harness will be removed for adjustment</td>
<td>The harness may not be replaced correctly or adjusted correctly</td>
<td>Slack in the harness can cause or exacerbate injuries</td>
</tr>
<tr>
<td>and/or cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cover may be replaced</td>
<td>If the original cover is no longer made a newer version may be available,</td>
<td>An old CRS may not perform as well in crash conditions</td>
</tr>
<tr>
<td></td>
<td>giving the impression that the CRS is newer than it really is</td>
<td></td>
</tr>
<tr>
<td>• Wear &amp; tear</td>
<td>Materials will degrade</td>
<td>Materials may not perform as expected in crash conditions, with a</td>
</tr>
<tr>
<td>• Moisture (accidents and cleaning)</td>
<td></td>
<td>reduction in performance.</td>
</tr>
<tr>
<td>• Temperature extremes</td>
<td>Damage may occur that is not noticed</td>
<td>May reduce the performance of the CRS</td>
</tr>
<tr>
<td>(heat in the sun and cold overnight in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage may be caused</td>
<td>Damage may occur that is not noticed</td>
<td>May reduce the performance of the CRS</td>
</tr>
<tr>
<td>due to repeated refitting and other use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and other use such as storage, dropping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage may be caused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>as the result of use in a crash</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15
5 Conclusions

The level of restraint use and misuse varies from country to country but misuse and inappropriate use are world-wide problems. In every country where a literature search was carried out, the literature implied that a significant proportion of child restraints were being used incorrectly in some way.

Common problems included:

- Incorrect fitting of the restraint, often due to incorrect routing of the seatbelt or the seatbelt being tightened insufficiently to hold the restraint in place.
- Incorrect restraining of the child in the restraint – in particular, failure to tighten the harness sufficiently.
- Use of adult seatbelts only as a restraint for children between the ages of 4 and 10 years.
- Use of infant carriers facing forwards instead of rearwards.

It was also apparent that occupant protection laws were often a source of parents’ misconceptions about the safest way to restrain their child and this is an area where change could make an impact on correct restraint use in many countries.

Where restraint fixture systems were trialled, the ISOFix system was found to be the best system currently available in most countries for ease of use for parents.

Little evidence has been found in any country to link either journey type or time, or child age or weight to incorrect use. Particular children have a higher risk of being inappropriately restrained because of the type of restraint (e.g. infant carrier) rather than their particular characteristics.

In the UK, the use of second hand child restraints was shown to be a potential cause of reduced protection from the restraint in an accident. It is not known how widespread this problem is in the UK or if it is also a potential problem in other countries.
6 Recommendations

It is recommended that those responsible for accident reconstructions within the CHILD project should be aware of the most common restraint use problems identified by the review and listed above. It is important that the most common modes of incorrect restraint use are kept in mind when reviewing accident data so that a decision can be made as to whether to fit the restraint correctly in the reconstruction or not.

Recommendations for reducing the most common incorrect uses of child restraints are as follows:

- Improvements in child restraint design, particularly in producing a dedicated attachment system that does not require use of the adult seatbelt, would reduce the amount of incorrect fitting of child restraints by parents.
- Clearer instructions and labelling on restraints, as well as making instructions more durable would also be likely to reduce the amount of incorrect fitting and use of restraint systems.
- Better parental education is required, as parental understanding was shown to be a major cause of restraint misuse and inappropriate use, regardless of location. In many cases it was apparent that parents were not aware of the consequences of incorrect restraint use. Parents should be informed:
  - That they should use child restraints
  - Why it is important to use child restraints
  - The consequences of not using a child restraint for their child
  - Why it is important to use restraints correctly and the consequences of not doing so

Although it is impossible to inform all parents on the correct installation of all restraints, they should be made aware of general safety aspects applicable to all seats, as well as being encouraged to use specific manufacturers instructions for all aspects of child restraint use. Hands on instruction and training for parents in how to fit restraints correctly may be useful in overcoming educational barriers.

- Occupant protection laws should be easily available and understood by parents, as well as covering appropriate restraint systems for all occupant groups – i.e. appropriate restraints should be specified for all children under 12 years of age, additional to the adult seatbelt.
7 References


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Campbell, MacDonald, Richardson (1997). High levels of incorrect use of car seat belts and child restraints in Fife - an important and under recognised road safety issue. Injury Prevention 3(1) 1997 pp17 – 22.


Scottish In-Car Child Safety Initiative www.protectchild.co.uk/protectchild03/pages/03pages/frame03.html www.scotland.gov.uk/library5/transport/sbws-09.asp


Annex 2 Task 1.2 Incorrect Use of child Restraints in the UK – VSRC 13-02-04
Workpackage 1
Task 1.2
Child Restraint Use and Misuse: Annex 2 UK Data

Prepared by

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Rachel Grant
Vehicle Safety Research Centre
Loughborough University
United Kingdom

February 2004
Executive Summary

This is the contribution regarding child restraint use and misuse in the United Kingdom for Task 1.2 of the CHILD project. Discussion points from this document are compiled with the information from other countries in a further overview document.

Published literature is scarce regarding child restraint use in the UK so this study has taken a broader view and included information from restraint manufacturers, parenting magazines, trading standards, baby product manufacturers, road safety organisations, police forces and local council’s road safety units.

Information from roadside surveys in England indicate that the levels of restraint use in the rear decreases as children get older, from 98% for 0 year olds to 83% for 10-13 year olds but that since 1996 to 2002 rear restraint use has increased for all age groups. Another study in Scotland indicates a similar reduction in restraint use from 87% for the under 5 year old group to 82% for the 5 to 13 year group.

In the UK it is evident that the percentage of correctly fitted child restraints is low, even taking into account the scientific limitations of the car park surveys (checking days) from which this data is available. In the larger studies (GMTV/Britax, Pampers) only around 25 to 40% of child restraint systems are found to be correctly fitted. The picture of incorrect use is very similar for the smaller checking campaigns that are carried out at a more local level throughout the UK.

Observations of child restraints being fitted as part of a study on instructions (Royal Society for the Prevention of Accidents) and comments from local checking days indicate that the most common cause of child restraints being incorrectly fitted is because are too loose, with the restraint looking securely fitted, but being easy to move.

During a Scottish Police Force child safety campaign in 2001 a telephone line was set up to offer advice. Of the 165 callers who stated that they drove with children, 94% claimed to use a child or booster seat. Of those callers, only 54% stated that they were confident to fit the child seat. This indicates that although most of these parents had the knowledge that they should be using a form of child restraint only around half felt that they then had the knowledge to fit it confidently.
In a survey reported by Campbell et al (1997) the highest rate of incorrect fitting was found in two way seats, followed by rear facing infant carriers and forward facing seats. The lowest rate of incorrect use was found for booster seats.

The study by RoSPA regarding child restraint fitting instructions found many general problems with instructions that could lead to the incorrect fitting of the child restraint. Many issues are cited in the work but the overall conclusion is that the quality of instruction booklets needs to be standardised to bring the poorest examples in line with the good examples. It is also suggested that videos are provided as part of the fitting instructions. During the trials it is reported that with the two rearward facing infant carriers used many of the volunteers failed to put the handle into its lowest position, which is necessary to obtain a secure fitting and some volunteers found the correct routing of the seatbelt difficult, especially at the back of the restraint.

The use of second hand child restraints can be a potential problem due to the parents possibly not knowing if the child restraint has been involved in an accident, instructions and on-product stickers being missing, the performance of the restraint degrading through wear and tear and possible sunlight exposure, and that older restraints will not be designed to R44.03. Hampshire County Council Trading Standards Service carried out a large study on the crash performance of second hand child restraints, with all 15 failing to satisfy the criteria of R44.03.
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1. Introduction

This is the contribution regarding child restraint use and misuse in the United Kingdom for Task 1.2 of the CHILD project. Discussion points from this document are compiled with the information from other countries in a further overview document.

Published literature is scarce regarding child restraint use in the UK so this study has taken a broader view and included information from restraint manufacturers, parenting magazines, trading standards, baby product manufacturers, road safety organisations, police forces and local council’s road safety units, that carry out child restraint ‘checking days’.
2. Overview of Child Restraint Use

TRL Roadside Surveys

Since 1988 TRL have conducted six monthly surveys of car seat belt use in the UK. Observations are made at 32 sites between Crowthorne in the South and Nottingham in the Midlands. Shown in the figures below are the survey results since October 1996 to April 2002 (the most recently available, LF2087). In the latest surveys around 28,000 cars have been observed. The survey does not comment whether the restraint use is a seat belt or child restraint and whether it is appropriate or not.

![Rear Seat Occupant Restraint Use](image)

**Figure 1. Rear Seat Occupant Restraint Use in the UK (TRL)**

In the April 2002 survey the rate of seat belt use for rear seat occupants was 98% for 0 year olds, 97% for 1-4 year olds, 87% for 5-9 year olds and 83% for 10-13 year olds. For the majority of the years illustrated in Figure 1 seat belt use decreases with age. Over the 6 years from 1996 to 2002 rear occupant seat belt use has increased for all age groups. Since August 1987 all cars have been required by law to have rear seat belts fitted, as time passes, the number of cars not fitted with rear seat belts will naturally decrease, 96.8% of cars observed in 2002 had rear seat belts fitted.
Since April 1999 the survey has recorded restraint use rate for 0 to 13 year olds by speed limit (Figure 2). It appears that for both males and females that restraint use is higher on roads where the speed limit is greater than 40 mph.

As front seat passengers, all children are recorded as being in the 0-13 year old category in the survey. As in the rear it is evident that restraint use is higher for children than adults, 95% of children are observed to use the seat belt in the front seat passenger position.
Scottish Study

‘Seat Belt Wearing in Scotland – A Second Study on Compliance’ Scottish Executive

This research was conducted in 2002 at 21 sites across Scotland and published in 2003.

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt; 5</th>
<th>5 - 13</th>
<th>14 - 16</th>
<th>17 - 29</th>
<th>30 - 59</th>
<th>&gt; 60</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>1,387</td>
<td>1,807</td>
<td>408</td>
<td>7,237</td>
<td>21,980</td>
<td>5,799</td>
<td>38,618</td>
</tr>
<tr>
<td>Minimum %</td>
<td>64.9%</td>
<td>57.4%</td>
<td>62.5%</td>
<td>84.2%</td>
<td>84.0%</td>
<td>89.3%</td>
<td>84.6%</td>
</tr>
<tr>
<td>Maximum %</td>
<td>97.4%</td>
<td>99.1%</td>
<td>100.0%</td>
<td>96.0%</td>
<td>97.6%</td>
<td>98.5%</td>
<td>96.8%</td>
</tr>
<tr>
<td>Overall %</td>
<td>87.0%</td>
<td>81.9%</td>
<td>90.0%</td>
<td>91.0%</td>
<td>93.7%</td>
<td>95.4%</td>
<td>92.6%</td>
</tr>
</tbody>
</table>

Table 1. Use of Restraint (%) by Site and Age Group for Car Occupants (ref ‘Seat Belt Wearing in Scotland – A Second Study on Compliance’)

It was found that 13% of children from birth to 4 years old were unrestrained along with 18% of 5 to 13 year olds (Table 1). For birth to 4 years old only 8 of the 21 sites recorded wearing rates above 90%. No separate results are given to distinguish between front and rear seat child occupants. The use of a restraint was recorded if it was ‘appropriate’ for the under 5 and 5-13 years age groups, but no indication is given on whether age, weight or height or a combination was used to form this judgement. No separate results are given for different types of child restraints and seat belts by age.
3. Literature Review

Dedicated Child Attachment System ISOFix

Richard Lowne and Marianne Le Claire, TRL, Berks, UK

Peter Roy and Ian Paton, Middlesex University, UK

TIP 3:19-29 2002,

This study involved user trials on four proposed ISOFix systems (prototypes produced by Britax), including a ‘control’ group who were asked to install, remove and then reinstall a conventional CRS. Of the 29 subjects, 13 (45%) fitted the CRS well, 8 (28%) had minor errors and 8 (28%) were not fitted correctly.

It was found that the 4 possible ISOFix systems trialled all resulted in lower rates of misuse than with the conventional CRS. Of the ISOFix systems, the system with the webbing attachment, opposed to the rigid attachment, was more frequently incorrectly fitted, resulting in greater slack, especially when fitted for the second time.

A Novel Approach to Solving Child Car Seat Misuse

Peter Archer, Britax Excelsior Ltd

67th Road Safety Congress. Safer Driving – The Road to Success, March 2002

This article introduces the Britax Fit-Finder website tool (www.britax.co.uk) and how it can reduce the possibility of the child restraint not being suitable for the vehicle. For the majority of cars sold in the UK the website gives advice on whether a selected Britax child restraint is appropriate for that car. Information is given down to seat level.
4. Field Studies of Misuse

4.1 Introduction
In the UK a range of organisations, such as restraint manufacturers, parenting magazines, trading standards, baby product manufacturers, road safety organisations, police forces and local council’s road safety units, carry out child restraints checks throughout the year. These are not as such scientific field studies, as they are foremost for the benefit of the general public and the promotion of child safety. However some of them give some overall statistics on the levels of incorrect use discovered.

The scientific rigour of these studies varies and the majority are observational field trials in which the objective is more to inform parents than to collect objective data.

4.2 Method
The majority of the surveys are carried out in car parks, usually of large supermarkets. Typically, parents are given advice on whether the child restraint is suitable for their particular vehicle, whether the child restraint is suitable for the child, if the child restraint is in a suitable condition and obviously whether it is adjusted properly. Incorrect fitting is usually categorised by whether minor or major adjustment is needed.

It must be borne in mind that these checking days are carried out in different areas of the country by different types of staff who are likely to have differing criteria. Especially for the smaller surveys the number of checks must be taken in account.

Even for the larger surveys that check a large number of seats, maybe up to 1,000, this is unfortunately likely to be only a very small proportion of the number of children in that area.

Also the population sample is not fully representative, as those who don’t want or don’t believe they need advice, and those who can’t afford a CRS and carry children without a CRS, will not participate. In fact even the venues chosen will influence the population sample.
4.3 Rates of Misuse

4.3.1 Large Area Surveys

**Pampers Fit Stop Campaign**

In both 2002 and 2003, summer checking days were organised by Pampers (a baby products manufacturer), in conjunction with the Royal Society for the Prevention of Accidents (RoSPA) and Britax England in supermarket car parks.

During the 2003 campaign 2,800 child seats were checked and 64% of these were found to be incorrectly fitted.

- 2% were condemned
- 9% were incompatible with the car
- 53% needed some form of adjustment, such as tightening the belts.
- 36% were correct

During the 2002 campaign 4,000 child seats were checked and 71% of these were found to be incorrectly fitted.

- 3% were condemned
- 13% were incompatible with the car
- 55% needed some form of adjustment, such as tightening the belts.
- 29% were correct

**Britax/GMTV Campaign**

This is a very high profile week long campaign that takes place annually. It has been running since 2001. Britax staff and road safety officers check child restraints at locations in England, Wales and Scotland, for correct installation. The promotion of the campaign takes place through a morning television program called GMTV. The program is watched by nearly six million people each morning and it is reported that a large majority (75%) of all housewives with young children watch GMTV each month. The definition of housewife is not clear and therefore it is not clear what
proportion of all relevant parents are reached in this campaign.

During these campaigns leaflets are also distributed throughout UK supermarkets.

2003 campaign (1300 seats were checked):

- 2% were condemned
- 15% were incompatible with the car
- 20% had to have a major adjustment
- 33% had to have a minor adjustment
- 30% were correct

2002 campaign (more than 1000 seats were checked):

- 4% were condemned
- 20% were incompatible with the car
- 18% had to have a major adjustment
- 30% had to have a minor adjustment
- 28% were correct

2001 campaign (more than 1000 seats were checked):

- 1% were condemned
- 16% were incompatible with the car
- 20% had to have a major adjustment
- 38% had to have a minor adjustment
- 25% were correct
Each year the percentage of correctly installed child restraints has increased, from 25% in 2001 to 30% in 2003, although this figure is obviously still low.

The percentage of seats that were condemned, due to missing or broken parts, has stayed below 5% and in 2003 was 2%, although this is still about 26 seats out of the whole sample.

During the 3 years the percentage of child restraint needing major adjustment or being incompatible has been between 15 and 20%. It is noted that the cheaper priced car seats seemed to fit fewer cars.

**Mother and Baby Magazine**

In June 1999 the BBC reported on a survey carried out by Mother & Baby magazine in which 60% of the child car seats checked were not fitted correctly. Nine out of 10 parents surveyed said they had difficulty in fitting the seats, one in five said they let their children sit unrestrained in the car and many parents were unaware of the dangers of fitting a rear-facing child seat in the front of a car with airbags.

In another Mother & Baby survey in January 2001, four out of every five child car seats were found to be incorrectly fitted. Only 6% of the parents surveyed said they were offered proper fitting advice from the shop where they bought the seat and the magazine found that more than half of all car seats for children were bought second
hand.

The magazine identified the main problem as "buckle crunching" where the buckle of the adult seat belt rests on the front of the child car seat. In severe collisions the buckle can snap putting a child's life at risk.

Other risks stem from the incorrect routing of the adult seat belt, the insecure fastening of the child seat or the safety belt securing the child seat.

**Scotland - Scottish In-Car Child Safety Initiative**

Co-ordinated by the Scottish Road Safety Campaign, the In-Car Child Safety Initiative organises car child seat clinics across Scotland.

The 2003 campaign ran for 4 weeks and included 40 car clinics. The data from all the centres (1376 seats checked) were not available at the time of writing, however the following results have been calculated from the figures available so far (902 checked seats).

- 13% of seats were considered incompatible or condemned
- 35% needed minor adjustments
- 10% needed major adjustments
- 10% other/information given
- 33% were found to be fitted correctly

During the 2002 campaign, 2,000 seats were checked at the car seat clinics across Scotland and 40% of these were not fitted correctly.

**Scotland - Police Forces**

In 2001 supermarket car park safety events were carried out in association with Kwik Fit, Scot FM, Golden Casket Group and the local authorities throughout Central Scotland, and covering the area served by Strathclyde, Lothian and Borders, and Fife Police Forces. They were carried out during August and September.

Of the 488 child seats checked, 65% were judged to be incorrectly fitted.
A telephone enquiry line was also set up during the campaign. Of the 165 callers who stated that they drove with children, 94% claimed to use a child or booster seat. Of those callers, only 54% stated that they were confident to fit the (child) seat.

When asked who originally fitted the child seat, 54% said the supplier or retailer, with the remainder saying that they fitted it themselves or had a friend install the equipment.

An information pack was issued, and of those who received the pack, 54% stated that they rechecked the fitment of child safety equipment as a result of receiving the information, while a further 9% said that they purchased new child seats as a result.

Child restraint checking days were also carried out by Dumfries and Galloway Constabulary in 2001 (in conjunction with Britax and Safeway). The number of vehicles checked is not recorded, but 75% of seats checked were not fitted correctly, were facing the wrong way or were incompatible with the vehicle. This is stated as being a reduction of 12% on the 2000 percentage of 87%.
4.3.2 Local Authority Surveys

Southwark Trading Standards Services (London)

Telephone conversation with a representative from Southwark Trading Standards. They have a campaign called ‘Seatwise’ which promotes the correct use of child seats. In September 2002 about 60 vehicles were checked at a shopping centre. No actual figures were recorded but it is thought that only around 10 were correctly fitted.

Hampshire County Council Trading Standards Service (Southern England)

Child restraint safety checks are carried out each year in Hampshire in conjunction with Britax, Hampshire Road Safety Unit and local district councils.

2003 Campaign

In the safety checks 63% of the 225 seats examined were not correctly installed, but the majority of these problems were quickly corrected with minor adjustments.

Of all the car seats, 24% required major adjustment or repair or were deemed to be incompatible with the vehicle. It is reported that some of these seats would provide little or no protection for the occupant in the case of a major accident.

2002 Campaign

Of the 228 seats checked 64% failed. However 78% of these failures were corrected on site and passed. Officials were particularly concerned that 14% of the car seats examined were found to be either faulty or unsuitable for the user's vehicle.

2001 Campaign

Of the 234 seats that were checked, 53% failed. 77% of the failures were corrected on site and passed.

2000 Campaign

More than half (128) - 60% - of the 212 seats checked were found to be unsafe or wrongly fitted.
Rotherham Road Safety Unit (Northern England)

At a Safety Day organised by Rotherham Road Safety Unit (in conjunction with Britax) on June 21st 2003, 60 seats (inc. new seats) were checked:

- 24% of seats were considered dangerous
- 20% needed minor adjustments
- 12% were new and fitted on site
- 44% were found to be fitted correctly

In June 2002, 41 seats (inc. new seats) were checked:

- 19% of seats were considered dangerous
- 17% needed minor adjustments
- 44% were new and fitted on site
- 20% were found to be fitted correctly

East Sussex County Council Trading Standards (South East England)

During 1998, 3 child restraint check days were organised by East Sussex County Council Trading Standards Officers (in conjunction with Road Safety staff and Sussex Police).

A total of 152 child seats were examined. 124 (81.5%) of these seats were new and 28 (18.5%) were second hand. Results showed that 110 (72%) of the seats passed the check and 42 (28%) failed. The reasons why seats failed included poorly or incorrectly fitted seats or that the seat was second hand and the owner did not know its history.

Leeds Road Safety Promotion Unit (Fit Safe Sit Safe scheme) (Northern England)

Telephone call to Road Safety Officer concerning two events in 2003 held under the Fit Safe Sit Safe scheme. One day saw 40 vehicles being checked with 18% correctly fitted and 15% completely unsuitable. During the other event, 70 vehicles were
checked with 75% of the seats being incorrectly fitted.

Two events were carried out between 2000-2001 in Leeds with between 70 and 80 seats checked at both events. Up to 85% of seats were found to have some problem with regard to the fitting of the seat in the car, or the fitting of the child in the seat. It is reported that an alarming number of babies under 9kg were found to be sitting in front facing seats, when they should have been seated in rear facing seats.

**Common fitting problems identified by Leeds Road Safety Promotion Unit (Fit Safe Sit Safe scheme)**

These are the comments published by this organisation from their experience of child car seat checking:

**The seat belt may be too short to go around the infant carrier/child seat**

Firstly in the front seat, ensure the seat is as far back as possible this will create more seat belt length. Alternatively fit new seat belts or choose an alternative child seat which needs a much shorter webbing length.

**Sculptured Upholstery**

Some car seats are curved upwards at the edges to make the ride more comfortable for an adult passenger. This means that when the child seat is in position it rocks from side to side instead of sitting firmly in place. Although this seems quite worrying, the seats effectiveness in a frontal impact should not be affected. There may be some adverse effects in a side impact but the child is still much safer than if unrestrained.

**Solution:** Use a centre lap belt or a fitting kit (if approved for such use).

**Offset anchorage points**

Some mounting points for rear seat belts are positioned over the wheel arch rather than at the back of the seat. This means that when the belt is threaded through the back of the child seat it does not lie tightly against the frame, allowing considerable forward movement.

**Solution:** Use a centre lap belt or a fitting (if approved for such use).
Buckle crunching

When the seat belt is threaded through the child seat frame it is important that the buckle does not lie across any part of the frame and edge or tubular component. If the seat belt cannot be adjusted so that only the seat belt webbing lies against an edge of the frame the child seat will not be safely restrained. The seat belt buckle could come apart or distort in an accident.

Solution: Try a different seating position in the car or use a fitting (if approved for such use).

Fitting Kits are designed by the manufacturer to be used with specific seats. Check to see if your particular child seat can be fitted with a kit, and make sure you buy the correct one.

Derbyshire County Council (East Midlands, England)

2003 Campaign:

More than 340 seats were checked at town-centre venues and supermarket car parks in Derbyshire during the first 4 weeks of an ongoing two-month campaign, with 70 per cent being found to be faulty or not fitted correctly. During the first four weeks staff found that 104 child restraints were correctly fitted, 222 were incorrect but could be put right and 17 were totally unsafe.

2002 Campaign:

During the two-week campaign in 2002 more than half of the 250 child car safety seats checked in supermarket and town centre car parks in Derbyshire failed their test. It is reported that although most of these problems were minor and corrected on the spot - such as loose straps - in the event of an accident the fitting error could have proved fatal.

The Royal Borough of Kensington and Chelsea (London)

In 2002, 74% of the car seats checked in the Royal Borough of Kensington and Chelsea were incorrectly fitted.
4.4 The Effects of Child Restraint Design & Parent Understanding


High levels of incorrect use of car seat belts and child restraints in Fife - an important and under recognised road safety issue.

Injury Prevention 3(1) 1997 pp17 – 22

Surveys of the correct use of child restraints were carried out during August and September 1995 as part of a general study of restraint use in Fife, Scotland. Restraint use for 269 children was observed based on standards adopted from the Child Accident Prevention Trust (CAPT).

Of the 68 booster seats, 16 were fitted incorrectly (24%), 9 were not attached to the seat through the hooks or ears and for 4 restraints the belt was twisted such that function would be impaired.

Of the 25 two-way seats, 15 (60%) were fitted incorrectly. Of these 10 of the seats were not secured tightly, in 7 cases the retaining strap was not tight, and a further 3 seats were not secured according to the instructions.

In the forward seat (toddler seat) group, 22 out of 63 (35%) were incorrectly fitted. 9 seats were not secured tightly, 8 seats were not secured according to the instructions and in 6 cases the retaining strap was not tight.

Of the 18 rear facing infant carriers, 8 (44%) were incorrectly fitted, 4 with the retaining strap not tight and 3 not secured according to the instructions.

The parents were also asked on the origin of the child restraint, with 72 (80%) being purchased new. In 59 cases the adults were asked on the level of instruction from the point of sale. The level of correct use with those given some kind of instruction or demonstration compared to those not given any was 60% and 53% respectively. Only 1 of the 59 was demonstrated and fitted.
A Review of Child Restraint Instructions – RoSPA (March 2001)

This work by the Royal Society for the Prevention of Accidents (RoSPA) involved trials of child restraint fitting instructions, using 58 volunteers split between six different restraints, two group 0+, 2 group 1, 1 group 1, 2, 3 and one group 2, 3.

Published Comments - RoSPA Study:

- Generally, the volunteers found the booklets daunting because of the amount of information they contained, and so expected to find fitting the restraints a difficult task.

- Small print size and the need to cross refer between pages within the booklets caused particular problems and complaints. The volunteers also felt that placing diagrams and supporting text together was the most helpful layout.

- Of the fifty-eight volunteers, only five gave the instructions for the restraint they fitted top marks for helpfulness, despite the fact that almost everyone studied them for as long as they thought necessary. Two volunteers gave their seat only 1 out of 5, and four gave 2 out of 5. Most gave 3 or 4 out of 5.

- Although many volunteers gave average or above average ratings for ease of understanding, this was not always reflected in their ability to fit the restraint correctly.

- From observation of volunteers studying instructions, it is clear that most people focus mainly on the diagrams. However, the quality of illustrations in the instruction booklets was very variable.

- Volunteers generally gave lower scores for the text than the diagrams. Many commented that there was too much text, sometimes in print that was too small, and sometimes they felt much of it was irrelevant or even unnecessary. A frequent comment was that it was difficult to isolate the essential information from the non-essential.

- Where instructions were provided in more than one language, volunteers generally did not find this to be a problem, except in four cases where volunteers gave scores of 1 out of 5. It was noted that that the other languages used besides English were all European (French, German, Spanish, Italian, Dutch and Portuguese), none were Asian.
• Some instruction booklets were printed on flimsy paper and quickly became crumpled, suggesting that they would not last very long. On-product instructions were often not seen, and in some cases had already begun to peel off.

Fitting Problems

Although the purpose of the project was primarily to assess how easily people were able to understand and use child restraint instructions, observers did note a number of common fitting problems.

• When the restraint was incorrectly fitted, this was most often because it was far too loose. Usually, the restraint looked securely fitted, but it was easy to move or even up-end with just one hand.

• The most common mistake was not pulling the seat belt through the restraint as tightly as possible, leaving it too loose.

• A related problem was that many volunteers failed to check that the restraint was secure, but relied on a visual inspection to check the seat belt was routed through the restraint correctly.

• With the two baby seats, many volunteers failed to put the handle into its lowest position, which is necessary to obtain a secure fitting.

• Some volunteers found routing the seatbelts difficult, especially at the back of the restraint.

Recommendations

These are the recommendations from the RoSPA project that would reduce the amount of misuse.

• The quality of instruction booklets needs to be standardised to bring the poorest examples in line with the good examples.

• Print size should be as large and prominent as possible (it is too small in several of the booklets examined).
• There should be as little cross referencing between pages as possible.

• Clearer advice to check the security of the fitting should be provided, with guidance on what is regarded as ‘secure’ and ‘insecure’ (e.g. ‘If the seat will move forward more than 1 centimetre it is too loose’).

• Manufacturers should consider providing booklets for the significant numbers of people in Britain for whom English is their second language, for example Hindi, Punjabi, Urdu, and Chinese.

• Instruction booklets should be more durable.

• Manufacturers should consider issuing instruction videos with child car restraints, similar to those provided with other equipment such as gardening and fitness products (some manufacturers do produce videos).

• Even with clear instructions, many people will still find it difficult to fit child restraints. Greater availability of trained fitters at retail outlets is required.

• Further research is needed to investigate which type of instructions are preferred by car seat users, but are also the most effective.

• The ISOFIX system should be introduced as soon as possible.
5. Second Hand Child Restraints

Hampshire County Council Trading Standards Service

In this work, 15 second hand child car seats were purchased from retailers, car boot sales and small ads, and tested to R44.03. All 15 failed to meet the European Regulations.

On one of the seats the adjusters on the shoulder harness failed, allowing the dummy to leave the seat. A further five car seats failed to prevent the child's head from exceeding the R44.03 limit and two did not offer any impact protection at all.

Out of the 15 safety seats purchased only three came with installation instructions and the work highlights that the overall look of second-hand seats can be deceptive with seats appearing to be in better condition than they actually are. One of the seats tested had a new cover but was much older than it appeared to be and another had more than likely been in accident previously.

Child Alert Website

This website gives general advice on child restraints but also has this information from the Baby Products Association (BPA) regarding second hand child seats.

- 25% of all baby products are sold or handed on ‘second hand’
- Over 60% of group 0 car seats are second hand. These seats are used for very young babies (0-13kg or up to 15 months)
- 1st-time mums are particularly susceptible to falling foul of defective equipment, as they often have no previous performance experience of using equipment for babies/young children.

To find more information the marketing firm used by the BPA was contacted but the information was gathered from general questionnaires that the company uses for marketing information. The data can be commercially purchased by organisations, but are not available to the public.
6. Discussion

6.1 Child Restraint Use Levels and the Effects of Child Age on Misuse

The TRL roadside restraint use surveys indicate that the levels of restraint use in the rear decrease as children get older, from 98% for 0 year olds to 83% for 10-13 year olds (April 2002, LF 2087), although this survey doesn’t indicate whether the type of restraint used is appropriate, which is especially relevant for the younger age groups. From 1996 to 2002 rear restraint use has increased for all age groups, which is likely to have been aided in part by the diminishing proportion of pre 1987 cars (which did not require rear seat belts) in the vehicle fleet.

The other study to record restraint use (Scottish Executive 2002) doesn’t distinguish between the front and rear seats but indicates a similar reduction in restraint use from 87% for the under 5 year old group to 82% for the 5 to 13 year group. Interestingly this study states that it records appropriate use, which may account for a 10% lower use rate for 0 year olds compared to the TRL data. It also shows that for the banded age groups from 14 years upwards, restraint use is higher than for the two child age groups (<5 and 5-13 years). This is an indication that adults may not be able to protect their children as well as they can themselves, maybe through lack of knowledge or money.
6.2 The Effects of Child Restraint Design on Misuse

In a study of ISOFix attachment systems, TRL found that the 4 possible ISOFix systems trialled all resulted in lower rates of misuse than with the conventional CRS. Of the ISOFix systems the system with the webbing attachment, opposed to the rigid attachment, was more frequently incorrectly fitted, resulting in greater slack, especially when fitted for the second time.

In the survey reported by Campbell et al (1997) the highest rate of incorrect fitting was found in two way seats (60%, 15 of 25), followed by rear facing infant carriers (44%, 8 of 18) and forward facing seats (35%, 22 of 63). The lowest rate of incorrect use was found for booster seats (24%, 16 of 68).

Leeds Road Safety Promotion Unit mention that ‘buckle crunching’, where the seat belt buckle can come apart or distort in a crash, would be possible with some of the child restraint fittings that they see. This may occur in an accident if the seat belt buckle is allowed to contact any part of the child restraint frame. This risk has also been identified in Mother & Baby magazine checking campaigns.
6.3 Misuse Levels

Even within the scientific limitations of the surveys (checking days) commented on in this report it is evident that the percentage of correctly fitted child restraints is low in the UK. In the larger studies (GMTV Britax, Pampers) only around 25 to 40% of child restraint systems are found to be correctly fitted. In the 2002 campaign in Scotland (Scottish In-Car Safety Initiative) 40% were found to be incorrectly fitted but the initial findings of the 2003 campaign show a decrease to 33% not being correctly fitted.

The picture of incorrect use is very similar for the smaller checking campaigns that are carried out at a more local level. Although the checking days run by East Sussex Council Trading Standards in 1998 reported that 72% of seats passed the check.

The levels of incompatibility between car and CRS were from 15 to 20% in the GMTV/Britax campaign (2001 to 2003) and 9 to 13% for the Pampers campaign (2002 to 2003).

The combined categories that are cause for major concern (in need of major adjustments, incompatible with the car or condemned), range from 37 to 42% over the 3 years of the GMTV/Britax campaign, higher than the percentage of minor adjustments in this campaign, 30 to 38%. In the checks carried out by the Scottish In-Car Safety Initiative, 23% of child restraints were put into the major adjustments, incompatible or condemned category, 24% in both the 2003 Hampshire and Rotherham 2003 campaigns.
6.4 Inappropriate Use

During two events organised by Leeds Road Safety promotion Unit they report that an alarming number of babies under 9kg were found to be sitting in front facing seats, when they should have still been seated in rear facing seats. This indicates a lack of knowledge regarding appropriate child restraint type for some parents.

With no other similar information it is not possible to say whether this is representative.
6.5 Common Fitting Problems

Although the primary purpose of the RoSPA project on child restraint instructions was to assess how people were able to understand and use child restraint instructions, common fitting problems were also noted. The most common cause of the child restraint being incorrectly fitted was because it was too loose, with the restraint looking securely fitted, but being easy to move. With the two baby seats (rearward facing infant carriers) it is reported that many of the volunteers failed to put the handle into its lowest position, which is necessary to obtain a secure fitting. Also, some volunteers found the correct routing of the seatbelt difficult, especially at the back of the restraint.

Common fitting problems have also been noted by Leeds Road Safety Promotion Unit. These are practical problems due to the physical design of the car.

They have found that seat belts can be too short to fit around the child restraint and the upholstery of some car seats is curved upwards at the edges, so that when the child seat is fitted it moves from side to side instead of sitting firmly. They have also found that some mounting points for rear seat belts are positioned too far forward, rather than at the back of the seat, so that when the belt is threaded through the back of the child restraint it does not lie tightly against the frame, allowing forward movement.
The Effects of Parent Understanding on Misuse

The work of Royal Society for the Prevention of Accidents (RoSPA) regarding child restraint fitting instructions (A Review of Child Restraint Instructions) found many general problems with instructions that could lead to the incorrect fitting of the child restraint. Many issues are cited in the work but the overall conclusion is that the quality of instruction booklets needs to be standardised to bring the poorest examples in line with the good examples. It is also suggested that videos are provided as part of the fitting instructions.

A major problem of parent understanding is highlighted regarding how secure the restraint should be. It is commented that clearer advice to check the security of the fitting should be provided, with guidance on what is regarded as ‘secure’ and ‘insecure’, an example of ‘If the seat will move forward more than 1 centimetre it is too loose’ being suggested. In the trials undertaken in the study, ‘the most common mistake was not pulling the seat belt through the restraint as tightly as possible, leaving it too loose’, ‘usually, the restraint looked securely fitted, but it was easy to move or even up-end with just one hand’.

During two events organised by Leeds Road Safety promotion Unit they report that an alarming number of babies under 9kg were found to be sitting in front facing seats, when they should still be seated in rear facing seats. This indicates a lack of knowledge regarding appropriate CRS type for some parents.

A Road Safety Officer with the Rotherham Road Safety Unit suggested in a recent telephone conversation that some parents purchase seats believing that they are a universal fit and are suitable for all cars. It was also mentioned that when child restraint are sold through mail order or catalogue there is no information at the point of sale to benefit parent understanding. On the positive side, it is felt that more of the correct message regarding child restraints is getting through to health workers who in turn advise new parents. Best practise would be for parents to purchase seats from a supplier who will check that the seat is suitable for their vehicle.

During a Scottish Police Force child safety campaign in 2001 a telephone line was set up to offer advice. Of the 165 callers who stated that they drove with children, 94% claimed to use a child or booster seat. Of those callers, only 54% stated that they were confident to fit the (child) seat. This obviously indicates that although most of
these parents had the knowledge that they should be using a form of child restraint only around half felt that they then had the knowledge to fit it confidently.

Only 6% of parents surveyed in a Mother & Baby magazine survey said they were offered proper fitting advice from the shop where they bought the seat although this survey was carried out in 1999 so the situation may have improved.
6.7 The Effects of Journey Type and Time on Misuse

Since April 1999 the TRL survey on restraint use has recorded data for 0 to 13 year olds by speed limit and it appears that for both males and females that restraint use is higher on roads where the speed limit is greater than 40 mph.

As these roads are more likely to be encountered on longer trips, although this is a generalisation that people tend to live around 30 mph and 40 mph roads, it would seem that restraint use is higher on longer trips.
6.8 Second Hand Child Restraints

Child restraints are safety products which are designed to protect infants and children when travelling as occupants in passenger cars. As a safety product, several issues are important, including the specification of design, the materials used and compliance with performance requirements as laid down in regulations and standards.

However, the sale of CRS for young children (infant carriers and child seats) falls within the market of nursery products, and as a consequence, the products must compete with other nursery products on price, consumer appeal, fashion and novelty.

The nursery product market is considerable and consists of both new and second hand retail sales, with the associated consumer protection legislation and statutory obligations. However, there is also a considerable private activity of sale, exchange, loan and gift of nursery goods. This activity ranges from private sales at second hand markets (eg car-boot sales) and small advertisements, cash exchange between friends, loaning between friends and family and handing down from one to the next child, within families and between friends.

No information has been found about the size of this private trade, either in value or frequency. Unfortunately within the majority of the information available on second hand car seats it is not defined as to whether a second hand car seat is one actually bought second hand or passed on from friends or family. Examples include information collected during restraint checking days in 1998 East Sussex County Council during which Trading Standards Officers found that of the 152 child seats examined, 28 were second hand and as part of the Scottish survey reported by Campbell et al (1997) parents were also asked on the origin of the child restraint. The results were that 80% were purchased new, with the remaining 20% presumably being second hand.

As a consequence of this trade in child restraints, the life expectancy of each product sold new is considerably longer than the period of use that is possible for the type of restraint (for example a Group 0 infant carrier can be used for a child up to 9 months, but the product will still be fit for use after the infant has grown out of it). It is not unusual for a CRS to be used for several children, either within one family or sold/passed on to another household. Indeed use by 4 or 5 children would not be unreasonable.
During this life cycle a number of events are likely to happen which may affect the condition and crash performance of the CRS. Examples of these events are given below, together with the possible consequences, but the list is not exhaustive.

<table>
<thead>
<tr>
<th>Event</th>
<th>Consequence</th>
<th>Influence on crash performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The harness will be adjusted frequently</td>
<td>Wear and tear of the webbing and slack may be introduced to the system</td>
<td>Slack in the harness can cause or exacerbate injuries</td>
</tr>
<tr>
<td>The cover will be removed for washing</td>
<td>This may involve removing the harness, which may not be correctly replaced</td>
<td>Misrouting of the harness is known to contribute to injury</td>
</tr>
<tr>
<td>The harness will be removed for adjustment and/or cleaning</td>
<td>The harness may not be replaced correctly or adjusted correctly</td>
<td>Slack in the harness can cause or exacerbate injuries</td>
</tr>
<tr>
<td>The cover may be replaced</td>
<td>If the original cover is no longer made a newer version may be available, giving the impression that the CRS is newer than it really is</td>
<td>An old CRS may not perform as well in crash conditions</td>
</tr>
<tr>
<td>Wear &amp; tear</td>
<td>Materials will degrade</td>
<td>Materials may not perform as expected in crash conditions, with a reduction in performance.</td>
</tr>
<tr>
<td>Moisture (accidents and cleaning)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature extremes (heat in the sun and cold overnight in winter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage may be caused due to repeated refitting and other use such as storage, dropping</td>
<td>Damage may occur that is not noticed</td>
<td>May reduce the performance of the CRS</td>
</tr>
<tr>
<td>Damage may be caused as the result of use in a crash</td>
<td>Damage may occur that is not noticed</td>
<td>May reduce the performance of the CRS</td>
</tr>
</tbody>
</table>

Throughout the period of use of the CRS the state of the art of CRS design is changing. The relevant standards are updated, new designs are introduced, improved materials are used and the vehicles in which the CRS are used are also changing.

The implications of all of these different forms of trade and the lengthy life expectancy of the product are pertinent to the crash performance of the child restraints.
Consumer protection legislation requires that the product sold is fit for its purpose, meets any appropriate design and/or performance standards and account is taken of foreseeable misuse by the consumer. This applies to products sold new. Issues relating the design or performance of a product which are not addressed in the relevant standard falls under the General Product Safety Regulation. Products sold second hand in a business context can still be assessed under the terms of the General Product Safety Regulation. In addition, most reputable retailers of CRS provide advice on the suitability of the CRS for the child and the fit of the CRS in the vehicle. However, there is no requirement for assessment of a child restraint sold privately or passed on from one owner to another as an exchange or gift.

The Child Alert Website quotes the Baby Products Association (BPA) regarding second hand child seats saying that ‘1st-time parents can be particularly susceptible to falling foul of defective equipment, as they often have no previous performance experience of using equipment for babies/young children’. This is reflected in statistic from the BPA that 60% of group 0 child restraints are second hand.

The advice generally given to those obtaining a CRS second hand includes:

− Make sure that the fitting instructions are available with the CRS;
− Check for signs of damage and wear and tear;
− Confirm that the CRS has not been involved in an accident.

It should be possible to follow these guidelines when receiving a CRS from family or friend. However, when buying a CRS from an unknown source, such as a second hand market, the buyer is dependant on being informed to look for these issues, the honesty of the vendor and having sufficient funds to make a choice between a good and a bad purchase. The expression ‘buyer beware’ is particularly pertinent in this situation.

From information gathered there are problems with CRS obtained second hand relating to these areas of advice.

Regarding fitting instructions, one of the recommendations from the RoSPA study on child restraint fitting instructions was that instruction booklets and on-product stickers should be more durable. Some instruction booklets were printed on poor paper and in some cases on-product stickers had already begun to peel off. This implies that
instructions aren’t likely to last very long and be useful and clear to ‘second hand’ users, leading to an increase in the likelihood of incorrect use. Out of the 15 safety seats purchased in a study by Hampshire County Council Trading Standards Service only three came with installation instructions.

Knowledge about the history of the CRS and previous involvement in an accident was found to be an issue in the same study carried out by Hampshire County Council Trading Standards Service. This was a large study looking at the crash performance of second hand child restraints, with all 15 failing to satisfy the criteria of R44.03. The dangers of parents not knowing the history of second hand child restraint are highlighted in this study with one of the seats having a new cover but being much older ‘underneath’ and the researchers thought it likely that another had already been involved in an accident. It is also commented that exposure to the sun could weaken the plastic components on older seats.
6.9  Child Restraint Fitting and Checking in the UK

This Task 1.2 document regarding child restraint use gives an overall feel of the organisations that undertake checking days in the UK, specifically presenting information from those who collect data on whether child restraints are fitted correctly or not. For a more detailed picture of the scope of child restraint fitting by retailers and subsequent checking in the UK, readers should refer to the Royal Society for the Prevention of Accidents (RoSPA) document ‘A Review of Practical Child Restraint Fitting Schemes’, (www.rospa.com), which is based upon questionnaires sent out by RoSPA. This report was published by RoSPA just as this task 1.2 document was being finalised.
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- Pampers Fit Stop Campaign  

- Britax/GMTV Child Restraint Checking Campaign  
  [www.britax.co.uk/gmtv_news.htm](http://www.britax.co.uk/gmtv_news.htm) 
  [www.britax.co.uk/gmtv_news.htm](http://www.britax.co.uk/gmtv_news.htm)

- Mother and Baby magazine  
  June 1999  [news.bbc.co.uk/1/hi/health/362571.stm](http://news.bbc.co.uk/1/hi/health/362571.stm) 
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- Scottish In-Car Child Safety Initiative  
  [www.protectchild.co.uk/protectchild03/pages/03pages/frame03.html](http://www.protectchild.co.uk/protectchild03/pages/03pages/frame03.html)  
− Southwark Trading Standards Services
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  SafetySeatFitting.htm and personal correspondence.

− East Sussex County Council Trading Standards

− Leeds Road Safety promotion Unit (Fit Safe Sit Safe scheme)
  www.leeds.gov.uk/pageView.asp?style=0&identifier=200214_941799343&view
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  www.rospa.org.uk/pdfs/road/child_restraints.pdf