

# INVESTIGATION OF THE PROTECTION OF CHILDREN IN MINIBUSES AND COACHES

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## ABSTRACT

The draft European Directive on the use of seatbelts requires passengers of minibuses and coaches to use the safety systems (seatbelts) provided. As the wording stands, this requirement applies to children over 3 years, but the need for additional protection is not clear. This need has long been recognised in cars where the requirements for protection vary according to the size of child and the characteristics of both the vehicle and the crash. However, this knowledge base does not adequately address what means of protection children need in minibuses, buses and coaches.

Research has been commissioned by the UK Department for Transport to determine the requirements for seatbelts and restraint systems in minibuses and coaches in relation to children. Information is being gathered about exposure, accidents, operational issues of use, practicality and liability and the fit of existing seatbelt systems for different age groups of children and particularly those under 3 years.

## BACKGROUND

Children are vulnerable road users, whether as vehicle occupants or as pedestrians and cyclists. Their vulnerability is a function of factors associated with their anatomical, physiological and psychological development. Children are smaller than adults affecting how they fit the adult environment, what they can see, and what forces they can withstand; their bodies are less well developed, their bones less dense and strong, their muscles less well developed in relation to their body weight; and children's mental processing systems are not fully developed, so their abilities to make spatial, distance and speed judgements are less accurate than those of adults. These, and all of the other factors which increase the vulnerability of children, need to be considered when protecting them in the road environment.

As passengers of minibuses, buses and coaches, children are required to exist within an environment primarily designed to accommodate adults. There will therefore be some areas where compromises need to be made in order to address the needs of the whole population, including the design of the seat and restraint assembly. The issue under consideration in this paper is that of child occupant protection in crash conditions in minibuses and coaches.

Unlike cars, in which there has been a requirement for seatbelts to be fitted and used for many years, the requirement for seatbelts in large passenger carrying vehicles has only recently become an issue. Society has become more aware of the need to improve the level of protection of all road users, and as large scale improvements have been achieved, so attention is moving to issues where smaller improvements are yet to be made. In relative and absolute terms, as will be discussed later in this paper, the number of minibus, bus and coach occupants injured or killed each year is small. However, there is still an opportunity to reduce the number of road casualties by addressing occupant safety within these vehicles.

The EC Common Position on compulsory seatbelt use (Common Position (EC) No 63/2002) currently under discussion requires passengers of minibuses and coaches to use the safety systems provided. As the wording stands, this requirement applies to children over 3 years of age, but there is some concern about the appropriateness of one seat/seatbelt system for children of all ages, and whether there is a need for additional protection for at least some of the younger age group (specifically children under 3 years) as is the case in passenger cars. Thus consideration needs to be given to whether additional protection such as rearward facing infant carriers, child restraints with an additional harness and booster seats and cushions should be used for younger children.

The need for additional protection for children in cars has long been recognised, where the requirements for protection vary according to the size of child and the characteristics of both the vehicle and the crash. There is some understanding of the injury mechanisms, tolerances and criteria of the different age groups between 0 and 12 years in cars but this knowledge is not directly transferable to the situation in minibuses and coaches. The crash conditions are very different in larger vehicles and the seating and occupant restraint systems are not the same. Thus the forces to which the occupants are subjected can be very different, with different injury outcomes. However, the boundaries are becoming less clear. Eight seater MPVs are becoming more commonplace as family passenger cars and the similarities between these and minibuses are probably greater than between minibuses and coaches, in terms of occupant protection.

### PREVIOUS RESEARCH

In order to establish the scale of the issue it is necessary to review what is currently known about the amount of relevant travel undertaken by children, the accident data and relative risks.

Within the United Kingdom, National Travel Survey data indicate rates of killed or seriously injured (KSI) road users by the number of kilometres, journeys or hours travelled. As shown in Table 1 bus and coach travel is the safest form of road transport.

**Table 1.**  
**UK National Travel Survey 1999**

Mode of travel	KSI Rate per 100 million:		
	Km	Journeys	Hours
Car	4	55	171
Van	2	23	80
Motorcycle/ moped	139	1623	5382
Pedal cycle	88	327	1069
Foot	63	50	251
Bus/coach	2	14	35
Rail	0.33	8	16
Water	5	168	90
Air travel	0.007	26	7

The Vehicle Safety Research Centre at Loughborough University has previously undertaken two relevant research studies.

The first resulted in a report 'Assessment of Passenger Safety in Local Service PSVs', and was undertaken on behalf of the Department for Transport (DfT). This study assessed the impact of the Public Service Vehicle Accessibility Regulations made under the Disability Discrimination Act (DDA) (1995) and the Disabled Persons Transport Advisory Committee (DPTAC) (established under section 125 of the 1985 Transport Act).

The second was an analysis of selected European data reported in 'Real World Bus and Coach Accident Data from Eight European Countries', for Task 1.1 of the Enhanced Bus and Coach Occupant Safety project (European Commission 5<sup>th</sup> Framework Project no. 1999-RD.11130). This report is a collation of European data that identifies the important issues in bus and coach occupant safety. However, there are difficulties in comparing data from different countries and a lack of detailed data about accidents involving children.

Both of these studies required the analysis of UK accident data on minibus, bus and coach accidents.

Whilst it is possible to answer some of the questions with regard to adults by reviewing previous research into bus and coach occupant safety, the research previously mentioned has identified the general paucity of information concerning bus and coach crash safety. In particular there is very little in-depth data describing the nature of crash injuries and their causation. Further, many questions with specific regard to children remain unanswered. A current research programme being undertaken in the UK will supply, wherever possible, the additional information to complete the picture. This UK research programme is described below.

### CURRENT WORK PROGRAMME

The detail of this paper is based on current research commissioned by the Vehicle Standards and Engineering Division of the Department for Transport in the UK. This study, 'Seatbelts: requirements for minibuses and coaches', is a three year study with 2 modules. The relationship of these two modules is described overleaf:

## Module 1 Child Protection

Phase 1 Child Protection (M1P1)

Phase 2 Child safety – recommend and develop cost effective measures (M1P2)

## Module 2 Anchorage Evaluation

The contract was awarded to TRL Limited, on the basis of a joint research proposal submitted by TRL Limited and the Vehicle Safety Research Centre (VSRC) at Loughborough University. As the main contractor, TRL Limited will undertake the activities in order to recommend and develop cost effective measures and also to conduct the anchorage evaluation. As the subcontractor to TRL, the VSRC will undertake the research in Module 1 Phase 1. Whilst Modules 1 and 2 run in parallel and are largely independent of each other, within Module 1 the findings of Phase 1 - child protection will influence the detail of the work programme of Phase 2. To this end, the VSRC's work programme is being managed in close collaboration with TRL.

The focus of this paper is the research being undertaken in Module 1 Phase 1 by the VSRC. The research project started in June 2002 and this phase is planned to run for 24 months, but with the intention of reaching working conclusions at 18 months in order that those undertaking Phase 2 have sufficient duration for their activities. To date, 8 months of the project have elapsed and, as such, methodologies are established, data collection activities are in place, some data have been gathered, but as yet, considered analysis cannot be undertaken or assumptions substantiated.

What follows, therefore, is a discussion of the methodologies used and, where possible, data are presented. Many questions remain unanswered, but indications are given if the authors feel there is sufficient evidence to do so.

It should be noted that as there is no requirement for seatbelts to be fitted in city buses and those where there are standing occupants, these vehicles will not be included in this study. However, in the analysis of national accident data it is not possible to distinguish between buses and coaches.

The issues addressed in Module 1 Phase 1, fall into the following areas of activity with the associated questions being addressed:

### **Exposure**

How many children travel on minibuses and coaches? What is the risk of injury to children in minibus and coach accidents?

### **Accident scenarios**

When children sustain injuries, what is the nature and severity of those injuries? What are the crash circumstances in which children sustain injuries?

### **Injury mitigation**

What method of occupant protection affords the best protection to children? Do such methods of child occupant protection have injury causing or exacerbation potential? Are there special issues associated with children under 3 years of age?

### **Ergonomics issues**

Do the seatbelts on minibuses and coaches fit all children over 3 years of age properly and all children under 3 years of age properly? If not, which children do they fit/not fit properly? What must be done in order to ensure that those children whom they do not fit properly are also protected?

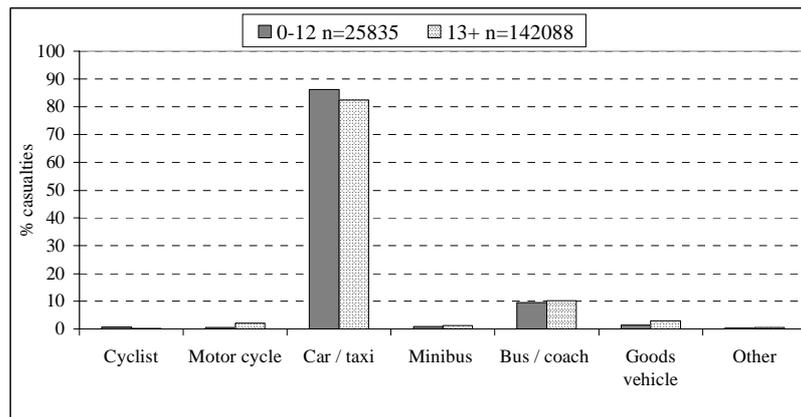
### **Operational issues**

Whatever method of occupant protection is recommended what are the operational implications that have to be considered? What recommendations must be made about design, installation, maintenance, management, use and liability?

Firstly the national accident picture will be described in some detail and then the other issues will be described, together with a summary of the information gathered to date and future plans.

### **NATIONAL ACCIDENT DATA**

British national road accident data, commonly called 'STATS 19', has been analysed for general trends in minibus and coach accident circumstances. The overall criteria for an accident to be included in these records are that a person must have been injured in an accident on a public highway. The accident forms are submitted to the Department for Transport (DfT) by each of the 50 police forces in Great Britain. This analysis has been undertaken for the period 1999-2000, in order to complement that undertaken in the ECBOS project for the period 1994-1998. The ECBOS study involved a comprehensive analysis of the national data, but the passenger population at that time was almost entirely unbelted. The more recent years of 1999 and 2000 may include belted occupants and, whilst this level of detail is not available it was hoped that there might be trends in injury severity that can be compared with the earlier data analysis. A summary of this analysis is presented in the following figures and tables.



**Figure 1. Distribution of injured passengers (all severities) by mode of transport.**

**Table 2.  
Frequency Of Accidents Involving Multiple Casualties – All Severities**

Number of casualties/vehicle – all ages				Number of casualties/vehicle – children 12 years and younger			
	Minibus	Bus/Coach	Total		Minibus	Bus/Coach	Total
<b>1</b>	534	10062	10596	<b>1</b>	107	847	945
<b>2</b>	140	1413	1553	<b>2</b>	17	32	49
<b>3</b>	78	452	530	<b>3</b>	9	16	25
<b>4</b>	37	184	221	<b>4</b>	7	5	12
<b>5</b>	33	117	150	<b>5</b>	1	4	5
<b>6</b>	25	52	77	<b>6</b>		2	2
<b>7</b>	16	38	54	<b>7</b>	2	2	4
<b>8</b>	13	27	40	<b>8</b>	1		1
<b>9</b>	10	25	35	<b>9</b>	3	1	4
<b>10</b>	7	14	21	<b>10</b>	1		1
<b>&gt;10</b>	20	89	109	<b>&gt;10</b>		2	2

Figure 1 above shows the distribution of injured passengers across the different modes of transport, the data being classified into two groups: those casualties older than 12 and those 12 years and younger. Clearly car occupants constitute the majority for both groups, however in each case 1 out of every 10 injured passengers was travelling by bus/coach. The number of minibus casualties is relatively small.

Although minibus and bus/coach accidents occur infrequently there is a greater potential for higher numbers of casualties per accident than for other modes of road transport. Table 2 above shows the frequency of accident by multiplicity of casualties at all injury levels whilst Table 3 overleaf shows the same for killed and seriously injured (KSI) passengers. These tables illustrate the comparative paucity of accidents involving multiple child casualties when compared with casualties of all ages.

**Table 3.**  
**Frequency Of Accidents Involving Multiple Casualties – KSI**

Number of KSI casualties/vehicle – all ages			Number of KSI casualties/vehicle – children 12 years and younger				
	Minibus	Bus/Coach	Total		Minibus	Bus/Coach	Total
<b>1</b>	87	1374	1461	<b>1</b>	10	54	64
<b>2</b>	27	132	159	<b>2</b>	2	6	8
<b>3</b>	12	36	48	<b>3</b>	3		3
<b>4</b>	4	17	21	<b>4</b>			
<b>5</b>	5	18	23	<b>5</b>		1	1
<b>6</b>	2	7	9	<b>6</b>			
<b>7</b>		9	9	<b>7</b>			
<b>8</b>	2	3	5	<b>8</b>			
<b>9</b>		4	4	<b>9</b>			
<b>10</b>	1	7	8	<b>10</b>			
<b>&gt;10</b>		18	18	<b>&gt;10</b>			

**Table 4.**  
**Percentage of KSI Casualties - Minibus And Bus/Coach Accidents**

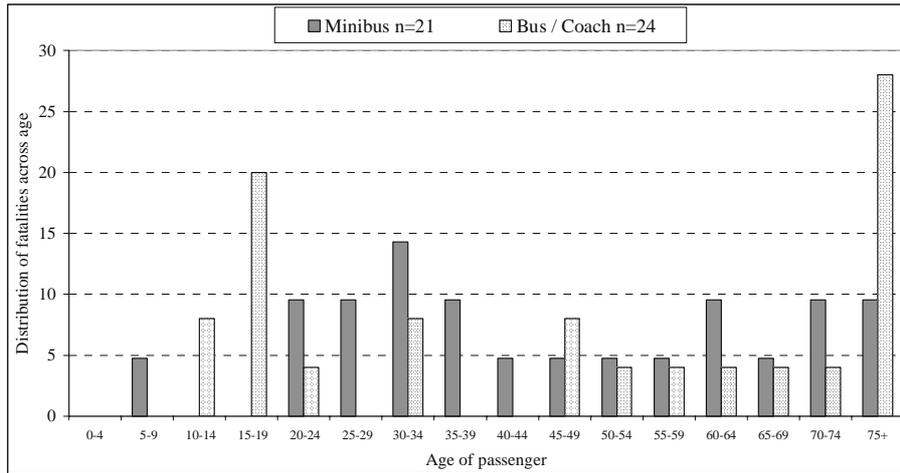
	12 years and younger	Older than 12 years
Minibus	8.98	12.64
Bus/coach	2.89	6.27

Table 4 above gives the percentage of KSI casualties within each group when the casualties are grouped by age (child < 12 years or adult) and vehicle type. The data indicates that for both minibus and bus/coach accidents, the older age group have a higher frequency of serious and fatal injury outcome. This is a significant result at both the 5% and 10% level in the case of bus/coach accidents ( $\chi$ -square = 51.138,  $p=0.00$ ) but at the 10% level only for minibus accidents ( $\chi$ -square = 3.413,  $p=0.065$ ).

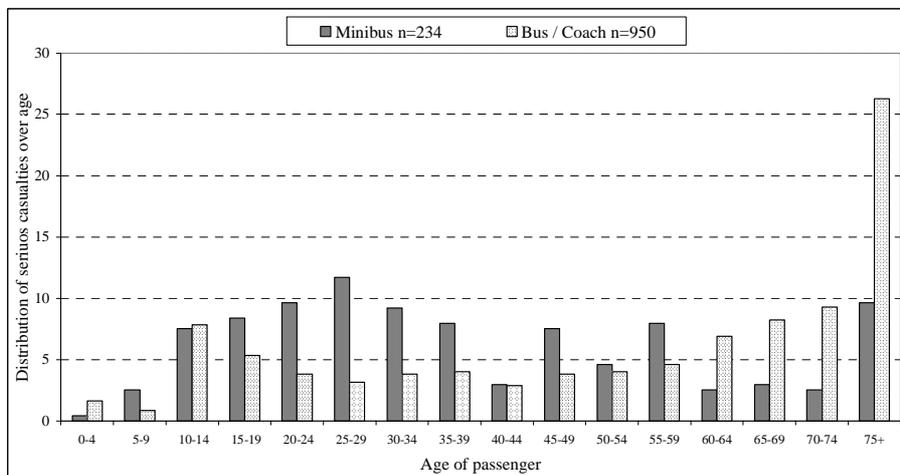
The highly significant result for bus and coach casualties may be explained by the contribution of elderly people to the casualty population, who have

been shown to be particularly vulnerable on public transport buses (Kirk 2003).

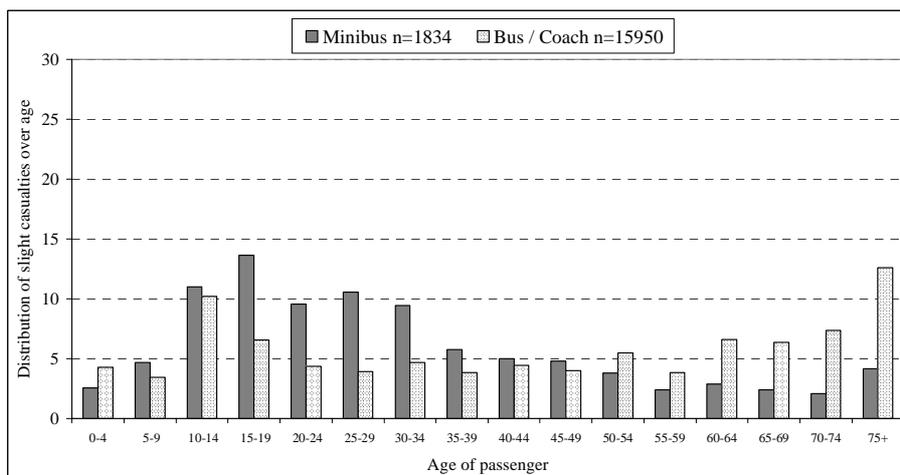
Considering the severity of injury by mode of transport and age, figures 2, 3 and 4 overleaf all indicate an under representation in the age groups of interest for this study, which are age groups 0-4 years, 5-9 years and part of the 10-14 category. This, however, needs to be set in context with some of the exposure data being collected.



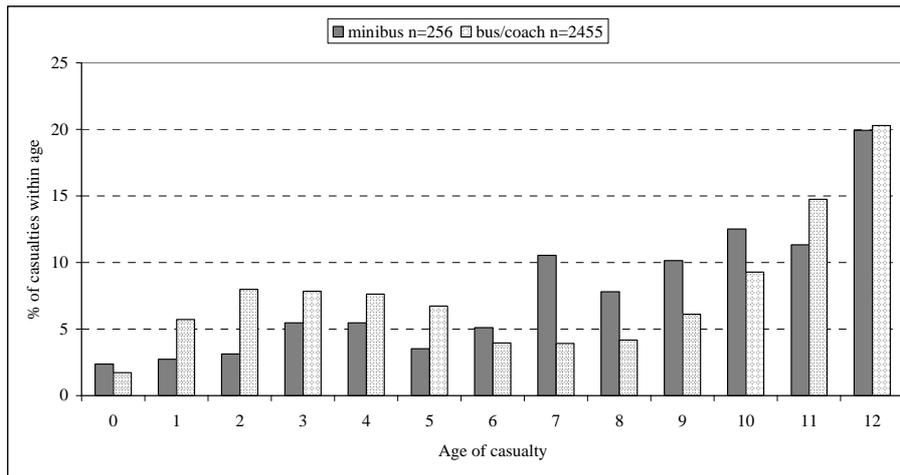
**Figure 2. Age distribution (%) of fatalities**



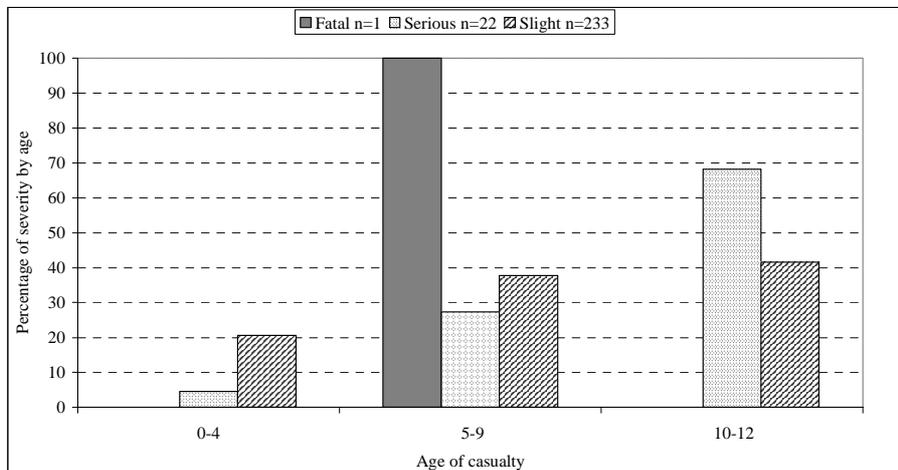
**Figure 3. Age distribution (%) of serious casualties**



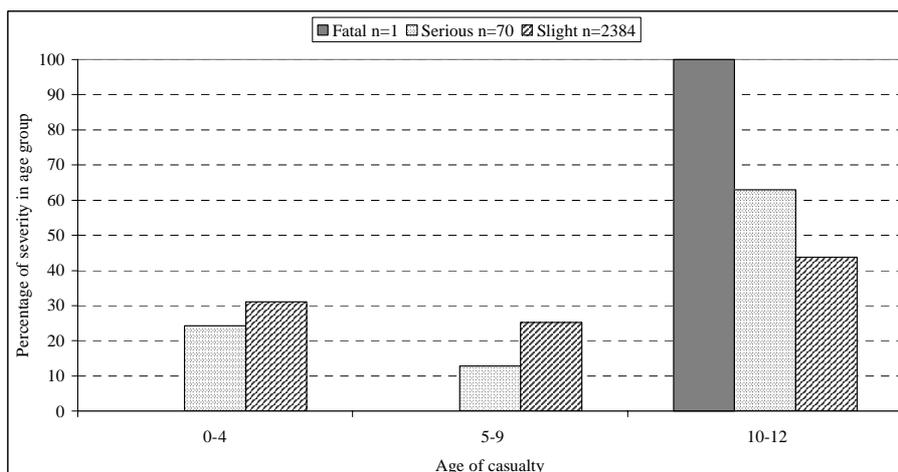
**Figure 4. Age distribution (%) of slight casualties**



**Figure 5. Child age distribution all severities**



**Figure 6. Child severity by age – minibus accidents**



**Figure 7. Child severity by age – bus/coach accidents**

Considering casualties for children age 12 years and younger, figure 5, on the previous page, shows these to be 10 times more likely to be a bus/coach passenger than a minibus passenger, with the highest proportion in both cases being for children of secondary school age. Discounting the single fatality, the distribution of injured children is an increasing function of age for minibus accidents (figure 6) whilst for bus/coach accidents (figure 7) the lowest proportion is found in the 5-9 year age group. This, to some extent, can be explained by the inclusion in these accidents of those occurring on public transport buses where there will be a number of unrestrained pre-school children travelling with parents or carers.

Table 5 contains STATS19 data using the variable 'school pupil casualty' and shows the number of casualties occurring to school children either specifically on journeys to or from school or 'other journey'. The counts are given by severity, vehicle type and school use. There are twice as many slight casualties when the journey is not to or from school for both minibus and bus/coach travel. There are over four times more seriously injured children when the minibus is not on a journey to and from school, but the proportions are very similar for bus/coach travel.

**Table 5.**  
**Child Severity By Type Travel To/From School**

<b>Number of casualties</b>	<b>Fatal</b>	<b>Serious</b>	<b>Slight</b>	<b>Total</b>
Minibus – school	1	4	86	91
Bus/coach school	0	38	771	809
Minibus - other	0	18	146	164
Bus/coach other	1	32	1598	1631
<b>Total</b>	<b>2</b>	<b>92</b>	<b>2601</b>	<b>2695</b>

At a later date all of the accident data presented here will, where possible, be put in to perspective using the exposure data also being collected. This will enable more conclusions to be drawn regarding the risk of injury by age and mode of transport. As previously mentioned this travel to/from school accident data will be of particular importance when analysed in conjunction with the local education authority records on transport to and from school.

## **EXPOSURE**

In order to establish the risk of injury to any given road user, it is necessary to collect exposure data, that is information about the number of journeys, the distance travelled, the type of journeys made, in this case by each of the different ages of children, in each of the different forms of transport. It is then possible to set this information against the number and type of accidents and injuries, in order to establish the relative levels of injury risk.

A sample area was taken within the county borders of Leicestershire and Nottinghamshire. These two counties are adjacent geographical areas with self-contained local governments, education authorities and police authorities. It is therefore possible to relate the data from these authorities to the National Transport Statistics and STATS19. Using this geographical area, as far as possible, enables the collection of data on a manageable scale, whilst being able to make comparisons.

Within the local area defined above information has been requested from existing sources concerned with the transport of children of different ages. In fact sources that were anticipated might collect, hold or analyse such data have been approached, but in reality not all do so.

The main sources that have been approached are the 2 local education authorities, all the state and private primary schools (children up to 11 years) and secondary schools (children 11 years and over) within the 2 authorities and the PSV operators that run school bus services for these schools.

In addition, state and private nurseries, playgroups and play-schemes, other local services and local youth groups, such as the Rainbows/Brownies/Guides and Beavers/Cubs/Scouts have been approached. However, due to the extremely large number of such organisations, a further division in area was made, covering a proportion of Leicestershire and Nottinghamshire, which can also be defined within the STATS19 dataset.

Finally, national coach operators that run services to, and through, the larger geographical area defined have been approached for information.

From all of these organisations the information requested included quantitative data to enable the numbers of vehicle and passenger kilometres travelled to be estimated and qualitative data concerning the availability of restraints and policies concerning their use.

Whilst, ideally, the data should be gathered according to the age grouping to be used in the later analysis of accident data, in practise the nature of the organisations has determined the age groupings for which data are available. For example, information from schools, where recorded, is according to year groups, which straddle age years. A good example of this is at age 12, the upper age limit of the study. Most (but not all) children in Leicestershire and Nottinghamshire transfer from one school to another at the end of year 6. At some point during their first year at middle or senior school (year 7) they will have their 12<sup>th</sup> birthday. Thus, data needed to be collected from secondary schools for only some of this first year group. However, it would be unreasonable to expect the school staff providing this data to differentiate between the 11 year olds and the 12 year olds going on the same school trip, for the sake of our study.

From the childcare, academic and youth activity organisations information has been requested for the academic year 2002-2003 on a term by term basis. From the operators, information has been requested from their operating years (whether this is the financial/tax years or other defined period).

As yet very little data have been collected as the data process is ongoing. As a consequence there are insufficient data to be able to make any conclusions about the frequency and distribution of journeys.

However, the travel statistics provided by the 2 education authorities about transport to and from state schools will be analysed in conjunction with the STATS19 accident records for the same areas. This will provide reasonably accurate information on injury risk for those journeys to and from school.

## **IN-DEPTH ACCIDENT CASES**

The Fatal Accident Database, held by TRL Limited, contains detailed records of fatal crashes. Examination of this database has commenced to provide additional information about crash circumstances. It was anticipated that the very recent cases in the Fatal Accident Database might include some child seatbelt related injuries from minibuses and coaches. However, it was anticipated that the number of such cases was likely to be very small, due to the level of restraint use during the period from which cases are collected. Cases for the period 1999-2001 have been requested for review, these amount to a single bus/coach accident (child aged 12) and 2 minibus

accidents (children aged 6 and 1). More recent cases may not yet be available from the Fatal Accident Database and so these will also be requested from the local police authority.

It was also considered that, if appropriate, data relating to child seatbelt injury patterns of car occupants in both the Fatal Accident and the Co-operative Crash Injury Study (CCIS) databases might also be reviewed. Whilst the crash circumstances associated with these injuries may be substantially different than for coach occupants, comparisons may be possible between 6-8 seater MPVs and minibuses. As yet it has not been decided whether this process will be initiated.

In much the same way as for the exposure information, the organisations described previously have been asked for accident/injury records for the children that have been involved in accidents. The collection of this information is different than the journey information, and where records include all accidents (including trips, bumps, fights, etc), only injuries resulting from crashes or near misses are of interest.

In order to supplement the information from LEAs, schools, childcare organisations and operators, for this category of information the Vehicle Inspectorate have also been approached for information regarding crash circumstances and injuries sustained. Further data has been gathered from recent police records of bus and coach crashes. STATS19 data files from recent years have been used to identify appropriate crashes and police, local authority and other available files have been accessed for further information on relevant crashes. Recent cases are being followed up as these have the highest likelihood of involving restrained children. The cases examined in this manner may not be available on the Fatal Accident database as they are either too recent or have not involved fatally injured occupants.

The definitions of injury severity used in the STATS19 data are:

**Fatal Injury:** Includes only those cases where death occurs in less than 30 days as a result of the accident.

**Serious Injury:** Hospital in-patient, e.g. fracture, internal injury, severe cuts and lacerations, crushing, concussion or severe general shock. Injuries to casualties who die 30, or more, days after the accident from injuries sustained in that accident.

**Slight Injury:** Receive or appear to need medical treatment, e.g. sprains, bruising, cuts judged not to be severe and slight shock requiring roadside attention.

Data are available for Great Britain, which includes England, Scotland and Wales. Two 'vehicle type' codes are available, one for minibuses, the other includes both buses and coaches but unfortunately there is no way to distinguish between a local service bus or coach.

At this stage several cases have been followed up which involve minibuses where a child was seriously or fatally. Cases involving buses or coaches will also be reviewed.

Once the records have been received from the police, injury information can be requested from relevant hospitals to complete the investigation. This process is simplified if permission is obtained from the casualty or in the case of minors their parent or guardian.

When these cases are followed up in detail, those that provide relevant information to the study will be consolidated and the information passed to TRL Limited. However, it is worth noting that this process is not always fruitful. In some cases, on close examination, the details of the crash are not the same as presented in the summary, and are not relevant. Despite this, useful information can be obtained and the process will be repeated when STATS19 data for the next year becomes available.

### **New Investigations**

In addition to the consideration of retrospective accident data records described above new accident data is being gathered from several sources. The investigation of current accidents may enable a more detailed view of the causation of injuries and the effectiveness of any restraint systems employed to be obtained.

New in-depth crash injury data will be gathered by investigating new accidents that occur during the course of this study. Accident notifications are being monitored from local police systems, the Vehicle Inspectorate network, the national and local media and other studies in child crash injury causation. Whenever possible vehicles involved in crashes will be examined and the crash

circumstances analysed, injury information gathered from hospitals attended by casualties and supplemented by questionnaire information.

Key data gathered, wherever possible, from each of the above sources includes:

- Accident scenario
- Direction of impact
- Degree of overlap
- Collision severity
- Mass of collision partners
- Degree of crush
- Other information to support selection of appropriate crash pulses
- Age, gender and mass of each casualty
- Details of restraint used
- Injury location by body region
- Details of injury type and mechanism
- Influence of vehicle damage and restraint condition on injuries

This detailed crash information is of particular importance as the basis of the activities being undertaken by TRL Limited.

As anticipated, relevant crashes involving restrained children are proving to be rare events. These current monitoring procedures will remain in place throughout the data gathering period of the project. A case example is given below where the vehicles involved have been examined, but no injury information is available at present.

A Ford Transit minibus was involved in a frontal left side offset collision with a Vauxhall Corsa. The minibus was carrying five children home from school. The driver of the minibus is reported to have leg injuries, his adult passenger seated towards the rear suffered serious head injuries, and the children sustained only minor injuries. This needs to be confirmed through the hospital records as some heavy contacts associated with some of the child seating positions were found. Evidence of seat belt use was found for the driver and all of the five children, but none for the adult passenger. Two booster cushions were found in the minibus and there is evidence to suggest that at least one was being used, although this has to be confirmed.



The driver of the Vauxhall Corsa is reported to have leg injuries whilst the passenger was killed. Both occupants were belted.



It is anticipated that it will be possible to obtain information about the scene of the crash. Additional information will be sought about the occupants of the minibus. Until detailed medical information is obtained it is not possible to comment on the suitability of the restraints used by the children. However, it is anticipated that this accident case will provide invaluable data to the study.

### **ISSUES OF FIT**

This part of the study has not commenced yet but is now the main priority. The aim is to make an assessment of the effectiveness of seat belts for child occupants in minibuses and coaches. In order to do this it is necessary to establish how current seat belts fit the child population. Particular attention will be given to children under 3 years of age (and equivalent size and weight) as the needs of this group must be clarified. The seatbelt fit information is as important an issue for investigation as obtaining exposure and crash injury data and such information does not appear to be available, due to the relatively recent introduction of seatbelts in minibuses and coaches.

It is proposed, therefore, to undertake a review of seat belt fit. This review will take the form of user trials designed to accommodate the main issues of importance, and will include:

- A range of vehicles – representing those commonly used to transport child occupants
- Different positions in the vehicle – which may pose different restraint and use issues
- A range of seat belt installations – 2 point and 3 point belts - with regard to anchorage locations and geometry
- A range of children ages 0-12 years, taking account of the relevant anthropometric dimensions, the requirements for child restraint use and the issues of attitude, such as 5 year olds being 'too old' to use a booster
- The effects on seat belt fit of the use of a sample of generic child restraints – such as rearward facing infant carriers, booster seats and cushions
- Attitudes and opinions of the participants (children and adults, whether parents or responsible adults) to the issues of seat belt and child restraint use.

This element of the study is essential to the relevance of the findings of this research programme. Without knowing how well the range of existing seat/seatbelt assemblies fit children it will not be possible to evaluate whether they might contribute to the injury statistics, and how large that contribution might be. An assessment of the size of children who experience poor fit of seat/seatbelt assemblies is necessary. This population needs to be considered against a range of seat/seatbelt assemblies available in the fleet. Particular attention needs to be given to children under 3 years of age. In addition the required and common usage of child restraint systems in cars need to be considered as it may be that issues of use and solutions have relevance in determining solutions in the minibus and coach environment.

The information obtained will then enable suitable restraint solutions to be proposed and evaluated. The authors are confident that the programme of trials will provide this essential information.

### **OPERATIONAL ISSUES**

In addition, consideration is being given to the operational issues associated with the use of seat belts and child restraints by child passengers. These issues are being raised with the Local Education

Authorities, operators and other stakeholders and views are invited on such matters as authority, liability and other practical and procedural matters which influence the use of seat belts and child restraints by children. However, as yet it is not possible to report on these findings.

## DISCUSSION

The methodology described in this paper forms the basis of research funded by the UK Government in order to better understand the issues of the restraint of children in minibuses and coaches.

National Accident statistics go some way to describing the injury situation for children in minibuses and coaches. However, the statistics do not provide sufficient detail about the injury patterns or the extent of seatbelt use or effectiveness. Indeed, the number of accidents involving children is small and the number of child casualties is small. It would appear that children are slightly less severely injured than their adult counterparts, and more likely to be passengers on a bus or coach than a minibus, but the circumstances of those injuries remain unclear.

It is clear that there is little accurate exposure data currently available either for adults or children. Information is currently being collected about the number and nature of journeys being made by the different age groups, but there is insufficient to present here. The authors are confident that the LEA records of transport to/from school will prove useful when analysed in conjunction with the comparable STATS19 accident data.

Analysis of detailed accident case data is possible in a relatively small number of cases, but as yet there are very few cases that contain children using seatbelts or child restraint systems. It is hoped that sufficient detailed cases will be available to provide information for the subsequent elements of the research programme.

The issue of fit of adult seatbelt systems that are available in the current fleet, for the different ages of children of interest, has yet to be addressed but is now a main priority. This evaluation will provide information that currently does not exist and will substantially move the discussion about the appropriate protection of children on minibuses and coaches forward, particularly with regard to the restraint of children under 3 years of age.

The operational aspects associated with the use of seatbelt systems and additional child restraint

systems on minibuses and coaches has yet to be addressed. Information will be obtained and used to ensure that the solutions proposed and evaluated have practical application.

This research programme aims to inform the vehicle safety world about the protection of children on minibuses and coaches. The approach being followed for this research has been described and the analysis of accident data that has been undertaken so far have been summarised. The continuing research will endeavour to answer the questions raised.

## CONCLUSION

At this stage of the research programme initiated by the UK Department for Transport it is not yet possible to report on the level of protection that might be afforded by seatbelts and additional child restraint systems. However, the authors are confident that, as the research programme continues, valuable information will be contributed to this European debate, specifically with regard to children under 3 years of age.

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National 'STATS19' road accident data is collated by and supplied to the Vehicle Safety Research Centre by the Department for Transport. Those who carried out the original collection of the data bear no responsibility for the further analysis or interpretation of it.

STATS20, Instructions for the Completion of Road Accident Report Form STATS19, Transport Statistics, Department for Transport, London.