Synthesis title:

Buses and Coaches

Category: Drivers

Other Relevant Topics:

▶ Tyres (Vehicles)

▶ Rural Roads (Roads)

▶ Urban Roads (Roads)

▶ Road Works (Roads)

Keywords:

**Bus, Coach,
Safety,
Speed,
Fatigue**

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

▶ Department for Transport

▶ The Royal Society for the Prevention of Accidents (RoSPA)

▶ Road Safety GB

▶ Parliamentary Advisory Council for Transport Safety (PACTS)

▶ RoadSafe

▶ RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact **help@rospa.com** or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

Key facts

- A total of 4,998 buses and coaches were involved in reported accidents in 2016.

- Of the RTIs that were attended by police and in which a contributory factor was reported, a total of 1,670 buses or coaches had at least one contributory factor recorded.

- Among bus or coach drivers to which at least one contributory factor was assigned, 84 per cent were assigned at least one driver error or reaction factor.

- In 2016, there were no reported fatality amongst bus or coach drivers. The number of bus or coach drivers who were seriously injured was 20 and the number who were slightly injured was 330.

(RRCGB, DfT, 2017)

- 17 per cent of RTIs occurring on major trunk roads which resulted in injury or death were sleep-related.

(C. Fourie *et al*, 2010a)

- Fleet managers interviewed were all convinced of the need to improve fatigue management in the transport industry. They felt that the human and financial costs currently associated with fatigue, particularly in the road transport industry, are unacceptably high.

(C. Fourie *et al*, 2010b)

- Studies conducted over the last four decades in cities on almost every continent show that bus drivers, when compared to workers in other jobs, are more likely to experience a variety of conditions such as heart disease and high blood pressure, digestive disorders, and musculoskeletal problems.

(MFL Occupational Health Centre, 1998)

Summary

Bus and coach drivers can be exposed to a wide variety of risks during the course of their service. These can include:

- Violence and abuse from passengers;
- Fatigue caused by long working hours and high stress levels;
- Conflicts with other traffic, including aggressive drivers;
- Industrial injury;
- Speeding/dangerous driving; and,
- Substance abuse.

These risks will vary depending on the type of vehicle that is being driven; for example an urban bus driver may be more at risk of violence while a coach driver could be more susceptible to fatigue.

Where possible, these risks can and should be mitigated. Mitigation can take a variety of forms dependent on the risk but may include:

- Fatigue Risk Management Systems;
- CCTV and assault shields;
- Ignition Interlock Devices; and,
- Speed limiters.

The research suggests that a significant risk for drivers in the commercial transportation industry is that of fatigue. One study suggested that driver fatigue is a significant factor in approximately 20 per cent of commercial transport RTIs, but this research included goods, as well as passenger vehicles.

Fatigue may be more of a problem for coach drivers due to longer driving distances on motorways, but given the amount of distractions and high level of concentration needed by urban bus drivers, fatigue may also be an issue for this group. Fatigue can be effectively managed by a Fatigue Risk Management System (FRMS). This is a scientifically-based data-driven system which manages employee fatigue in a flexible manner appropriate to the level of risk exposure and the nature of the operation. FRMS can be used in addition to prescriptive hours of work limitations. The traditional method of mitigating driver fatigue has been to limit driver's time at the wheel. This is a consideration that is incorporated into FRMS ensuring that the system includes traditional methods as well as newer more scientific approaches.

Violence is a very real threat to bus and coach drivers, particularly public transport drivers working on urban routes. Training, physical deterrents (such as assault shields) and CCTV can all help to reduce the risk to drivers and assist in capturing perpetrators. Reducing the causes of passenger frustration can also reduce assaults and conflict. The most common causes of conflict are fares and late running buses; the anger in relation to these can be reduced by good information.

Substance abuse appears to be an uncommon problem amongst bus and coach drivers. However, given the large number of passengers that they transport, this behaviour would have a much more significant risk on public/passenger health. Ignition Interlock Devices seem to be one effective way of preventing drink-driving in the commercial transport industry. These prevent the engine from being started until the driver has successfully passed a breathalyser test.

The large mass of the vehicles and the number of passengers they transport means that buses and coaches can cause significant damage and injury if they are involved in collisions. Speed control of buses and lorries is therefore a vital aspect of road safety.

Speed limiters have been proven to significantly (by 26 per cent) reduce the involvement of HGVs in RTIs. All new buses and coaches, as well as larger, older buses and coaches in the UK, are now required to have speed limiters installed. Therefore, this should mitigate the speed related risks associated with driving buses and coaches.

Methodology

The scope of this synthesis is restricted to bus and coach driver safety, i.e. passenger safety is not covered although the impact that drivers' actions can have on them is acknowledged.

Driver safety refers to the condition of a bus or coach driver being protected from (or unlikely to cause) danger, risk or injury. The risks can take a variety of forms, from fatigue and substance abuse, to the threat of violence from passengers or dangerous driving. Although the drivers themselves may contribute to some of these risks, they still present an opportunity to cause harm to the driver and so, where possible, attempts should be made to prevent or mitigate them.

This synthesis was compiled during August - September 2012.

Note
This review includes statistics from Reported Road Casualties Great Britain 2011, which were the latest available data when the review was written. In December 2017, statistics from Reported Road Casualties Great Britain were updated to Reported Road Casualties Great Britain 2016.

A detailed description of the methodology used to produce this review is provided in the Methodology section of the Observatory website at http://www.roadsafetyobservatory.com/Introduction/Methods.

An outline of the steps taken to produce this synthesis is provided below:

- **Identification of relevant research** – searches were carried out on pre-defined research (and data) repositories. However, some additional information sources were consulted, which included http://www.ingentaconnect.com. Search terms used to identify relevant papers included but were not limited to:
  - 'Bus driver safety';
  - 'Coach driver safety';
  - 'Bus safety';
  - 'Coach safety';
  - 'Commercial vehicle safety';
  - 'Commercial driver safety'; and,
  - 'Passenger vehicle safety'.

A total of 37 pieces of relevant research were identified.

- **Initial review of research** – primarily involved the ranking of the research, based on key criteria, to ensure the most relevant and effective research went forward for inclusion in this synthesis. Key criteria included:
  - Relevance – whether the research makes a valuable contribution to this synthesis.
  - Provenance – whether the research is relevant to drivers, road safety policies or road safety professionals in the UK. If the research did not originate in the UK the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
  - Age – Newer research is likely to include newer technologies, techniques and materials which may be more effective in achieving driver safety. Therefore, newer documents were given greater weight.
  - Effectiveness – whether the research credibly proves (or disproves) the effectiveness of a particular measure on bus and coach driver safety.

Following initial review 21 pieces of research were taken forward to form the basis for this synthesis.

A guidance document (ISO 39001) produced by the International Standardisation Organisation was highlighted during the searches. While this document is relevant to safety management it was felt that industry standards would not be included in this synthesis as practitioners would be working with all appropriate standards. ISO 39001 was released at the end of 2012 and at the time of synthesis production there was no evidence available on its effectiveness on bus and coach safety.

- **Detailed review of research** – key facts, figures and findings were extracted from each piece of research to highlight the relevant topic issues.

- **Compilation of synthesis** – the output of the detailed review was analysed for commonality and a synthesis written in the agreed format. Note that the entire process from identifying research to compiling the synthesis was a time-bound exercise.

- **Review** – the draft synthesis was subjected to extensive review by a subject matter expert, proof reader and an independent Evidence Review Panel.

Definitions and terminology

- For the purposes of this synthesis, buses and coaches are vehicles that can carry 8 or more passengers (this therefore includes mini-buses). While mini-buses are included, the majority of research identified focuses on large commercial buses and coaches.

- A bus is defined as a large motor vehicle carrying passengers by road, especially one serving the public, on a fixed route and for a fare.

- A coach is also a large motor vehicle used for carrying passengers by road but is designed for longer distance travel, often having a separate luggage hold and passenger facilities such as more comfortable seating and toilets.

- Some of the research relates to drivers of heavy goods vehicles and while not all lessons learned will be directly applicable to bus and coach drivers, it was felt that there is enough synergy to include it in this synthesis.

- The terms bus and coach are used throughout the synthesis and a definition has been provided above. However, some reports (particularly those from the US) use these terms interchangeably. Where this occurs the term used in the report is repeated in the synthesis as it is not always possible to be certain which vehicle the report is referring to. Changing the terminology based on the assumption that it is one or the other could cause misunderstandings with the interpretations.

Key statistics

This section collates key statistics relating to buses and coaches.

Accidents and casualties

- A total of 7,223 buses or coaches and 742 minibuses were involved in reported accidents in 2011.
- 872 buses or coaches and 115 minibuses were involved in Killed or Seriously Injured (KSI) RTIs.
- 6,351 buses or coaches and 627 minibuses were involved in Slight Injury RTIs.
- In 2011, there were no reported fatalities amongst bus or coach drivers. The number of bus or coach drivers who were seriously injured was 15 and the number who were slightly injured was 474.
- In 2011, there were 5,688 bus or coach passenger casualties of all severities. Seven of these passengers were fatally injured (all aged 60 years or over), and 310 were seriously injured.

(Kilbey et al, 2012)

- In a Sheffield based study it was found that buses account for only 3 per cent of traffic on roads, yet bus passengers make up 24 per cent of all passenger casualties in the region.

(Sheffield City Council, nd)

- In a study of bus RTIs statistics in the North East of England between 2006 and 2010, 2,656 casualties were reported. Of these, 185 were the driver, 2,102 were passengers, and 369 were pedestrians.

- During the same period, the number of casualties on buses and coaches has been steadily increasing, whilst the number of total casualties in any RTI vehicle has been falling.

(P. Slater and S. Shield, 2011)

Contributory factors

- In those road accidents that were attended by police and in which a contributory factor was reported, 4,422 buses or coaches were involved.
- 2,942 contributory factors were assigned to buses or coaches at these attended RTIs (each accident can have more than one contributory factor). 2,204 buses or coaches had no contributory factor assigned.
- Of the contributory factors assigned to buses and coaches, 41 per cent could be attributed to driver error or reaction.
- The contributory factors 'Failed to look properly' and 'Sudden braking' were assigned to 695 and 735 buses or coaches respectively. These were the highest ranking contributing factors, being around 1 ½ times more common than the next factor which was 'Failed to judge other persons path or speed'.

(Kilbey et al, 2012)

This review includes statistics from Reported Road Casualties Great Britain 2011, which were the latest available data when the review was written. In December 2017, statistics from Reported Road Casualties Great Britain were updated to [Reported Road Casualties Great Britain 2016](.).

- 17 per cent of Road Traffic Collisons occurring on major trunk roads which resulted in injury or death were sleep related.

(C. Fourie *et al,* 2010a)

- The driver section of a review into fatal bus RTIs in America noted that in a review of 293 fatal bus accidents, there were a number of driver error factors which contributed to the incidents:
  - Fifteen bus drivers (5 per cent) were coded as inattentive, and two as drowsy or asleep at the time of the RTI.
  - Drinking was reported in 1.7 per cent of the bus drivers, which while being a low percentage is still significant given the number of passengers that these drivers are responsible for.
  - Overall, 9.5 per cent of bus drivers involved in a fatal RTI had a previous speeding conviction. Drivers of buses in the 'other' bus category had the highest percentage of previous speeding convictions, while transit bus drivers had the highest incidence of previous RTIs (fatal and non-fatal).
  - Failure to yield was the most common driver factor (10.2 per cent), followed by careless/inattentive (5.1 per cent), and failure to keep in proper lane (4.1 per cent).

(A. Matteson *et al*, April 2011)

Health risks

Bus and coach drivers appear to be at a high risk of a number of health problems related to their sedentary occupation, the restricted position they often work in, and the high levels of stress that their job can entail.

- German bus drivers are typically rejected following legal health tests with a mean age of 50.1 years, often after less than 20 years of driving.

- Only 5 per cent of German bus drivers are allowed to continue to the usual retirement age of 63 years.

(M. Gobel *et al,* 1998)

Safety culture and risk reduction

Driver attitude and behaviour can have a strong impact on safety. The following study investigated 'high-risk drivers' amongst HGV and bus companies, as well as possible ways of managing this group.

- Large individual differences have been seen in the rate of driver involvement in traffic 'near-miss' incidents, and 12 per cent of the drivers in the study were associated with 38 per cent of the incidents.

(CTBSSP, 2004)

Speed limiting

Although already widely fitted to buses and coaches in the UK, speed limiters are not fitted to all passenger transport vehicles (vehicles under 10 tonnes registered before 2001). The two studies below demonstrate that speed limiters could provide safety benefits to this group of vehicles.

- A UK study showed that the RTI involvement rate for speed-limited lorries fell 26 per cent between 1993 (when mandated) and 2005.

- Overall, a positive picture emerges from speed limiter users who participated in the written survey. Fifty-six percent of respondents indicated speed limiters were either 'successful' or 'very successful' in reducing RTIs, and 64 per cent reported speed limiters were either 'successful' or 'very successful' in reducing speeding violations.

(CTBSSP, 2008)

Research findings

Summaries of key findings from several research reports are given below. Further details of the studies reviewed, including methodology and findings, and links to the reports are given in the References section.

There are a number of different factors which can impact upon road safety as outlined below.

- As with all motor vehicles, RTIs involving buses and coaches can be caused by a number of factors such as:
  - Fatigue;
  - Distractions; and,
  - Drug or alcohol abuse.

- Addressing the following issues could help to reduce the impact of the factors listed above:
  - Detecting and reducing driver fatigue;
  - The elimination of driver distractions;
  - Improved monitoring to eliminate drug and alcohol use; and,
  - Training to reduce risk taking.

    (Advanced Vehicle Design and Technology, 2012)

The following sections present information on why each of the above topics are a problem for bus and coach drivers, as well as looking at ways in which these issues might be addressed.

Fatigue and Fatigue Management

Fatigue in commercial driving is a risk factor which is particularly relevant to long haul coach drivers. However, even short distance bus drivers can experience fatigue as a result of the stressful environment in which they operate.

- Three out of four coach drivers felt that fatigue adversely affected their driving.

    (J.K. Sluiter *et al*, 1999)

- Previous studies on 'city' bus drivers found that drivers have strong feelings of fatigue, tension and mental overload.

- Occupationally induced fatigue was found to be a substantial problem in coach drivers.

- The reported influence of fatigue, problems of sleep quality and symptoms of emotional exhaustion, raises expectations of increased risk of RTIs and safety hazards for coach drivers.

- The sub-population of express coach drivers who were questioned averaged 93 working hours per week during the high season, and since driving during night hours is normal practice in the long distance trips that these drivers perform, the risk of RTIs for these drivers is considered to be fairly high.

    (J.K. Sluiter *et al*, 1999)

While Fourie *et al*'s and the ETSC's reports discussed below relate to HGVs, they can still be relevant to coach drivers and give an indication of how fatigue can impact drivers in the commercial transport industry.

- Research suggests that driver fatigue is a significant factor in approximately 17 per cent of commercial transport RTIs.

- Peak levels of fatigue-related RTIs at night are often 10 times higher than daytime levels.

(ETSC, 2005)

- Driving is highly susceptible to fatigue because it involves many of the skills that are impaired by fatigue, such as vigilance.

- Unless remedial action (i.e. recovery sleep) is taken, the individual's state will decline still further which may lead to more pronounced effects on their driving performance.

- The inadequate sleep obtained by commercial drivers is widely considered to be a key determinant of fatigue in transport.

- The literature revealed that relying on Hours of Work limitations to provide protection from the adverse consequences of fatigue risk is increasingly being perceived as an overly simplistic strategy.

- The research proposes that an FRMS offers the most comprehensive approach to managing fatigue risks.

- Within an FRMS, fatigue is managed in a data-driven and flexible manner appropriate to the level of risk exposure and the nature of the operation.

(C. Fourie *et al,* 2010a)

The report summaries above illustrate that bus and coach drivers (as well as other commercial drivers) are commonly exposed to the risk of fatigue due to the long hours they work in an often stressful and repetitive role. Unless steps are taken to mitigate this risk, the chances of RTIs occurring can increase. This increase can be directly attributable to fatigue (such as falling asleep at the wheel) or as a knock on effect – misjudging speed or failing to see another vehicle due to tiredness.

Driver hours regulations are a legislative requirement within the commercial and passenger transport industries. These limit operator's working hours and driving hours, as well as regulating break length and placement within the working day/week. Hour restrictions vary based upon the kind of transport.

This has been the traditional method of controlling driver's hours and limiting fatigue. However, the following studies show that there may be additional methods/systems for preventing fatigue in commercial transport.

- The commercial transport managers interviewed as part of a fatigue risk management study were all convinced of the need to improve fatigue management in the transport industry. They felt that the human and financial costs currently associated with fatigue, particularly in the road transport industry, are unacceptably high.

- An FRMS is a scientifically-based data-driven system which manages employee fatigue in a flexible manner appropriate to the level of risk exposure and the nature of the operation. Driver hours regulations will form part of an FRMS, thus these systems provide extra fatigue reduction benefits over and above the standard regulations.

- An FRMS integrates management practices, beliefs and procedures used to manage the risks of fatigue. It provides tailored defences against fatigue-related risks through the use of objective thresholds specifically for local environments.

- Participants working in the road transport industry suggested that, to date, fatigue management has been too narrowly focused on long-haul HGV driving and that the risk associated with other sectors of the industry, for example vans, taxis and buses, deserves more attention.

- The literature review and interviews revealed considerable suppositional evidence to indicate that FRMS can benefit safety.

(C. Fourie *et al,* 2010b)

- Bus company managers identified operator training as a major countermeasure to bus driver fatigue.

- The researchers also identified rest and regular schedules as key features of any fatigue countermeasure program.

- Managers reported significant pressure from passengers to have bus drivers work for longer periods. They also reported that as many as 75 per cent of bus drivers also handle passenger luggage.

- There has been very little objective research conducted on bus drivers and this is particularly true when it comes to fatigue research.

(CTBSSP, 2005)

While these two reports demonstrate that there are additional methods (to be used in conjunction with driver time legislation) they also suggest that it is an area which would benefit from further research as the effectiveness of these measures does not appear to be very well understood or reported.

Violence

Violence is a very real problem for bus and coach drivers (particularly bus drivers on urban routes). While violence is not a direct road safety issue, exposure to and dealing with it, can have a significant impact on the driver's ability to safely operate on the road. The two UK studies below look at the different ways in which drivers may be exposed to violence during their work and the ways in which this can affect them.

- Violence and anti-social behaviour can take many forms, including verbal abuse and threats as well as spitting and physical assaults.

- Even minor cases can cause shock and stress, the effects of which may not appear until several weeks later. Severe cases can require hospital treatment and time off work.

(DfT, 2003)

- A number of key risks face bus drivers, such as carrying cash, road rage incidents, drunk or aggressive passengers, and youth/anti-social behaviour.

- These risk factors can manifest themselves in a number ways from assaults, to robberies, being threatened with weapons or being on the receiving end of vile behaviour.

- *First Leeds* bus company have trialled a number of different measures to address these problems ranging from diffusion techniques and interpersonal skills training to attack alarms and assault shields and CCTV

(HSE, 2012)

While violence is something that bus and coach drivers should not be exposed to during their working lives, unfortunately this does not seem to be the case and wherever possible bus operators should take steps to prevent this from occurring.

Health risks

As with violence, while this topic is not directly related to road safety, the ill health which might develop could have a significant impact on road safety e.g. a driver having a heart attack could result in significant injury to the bus/coach occupants as well as other road users. The three studies below indicate that the stressful environment and often restricted position that bus drivers are exposed to for long periods can have a detrimental effect upon their long term health.

- Bus driver's jobs can be characterised by highly frequent and often simultaneous task execution, performed with a constrained body posture alongside exposure to vibration and noise.

- Psychological stress is also caused by the responsibility for security and schedule.

- The resulting health impairments, intensified by problems of shiftwork, lead to a high percentage of absence and a low retirement age.

- For example, German bus drivers are typically rejected following legal health tests with a mean age of 50.1 years, often after less than 20 years of driving.

- Only 5 per cent of German bus drivers are allowed to continue to the usual retirement age of 63 years.

- Empirical findings suggest that the traffic situation, the work schedule and the driver workplace, in conjunction with the high demands for reliability, all have to be considered together as relevant factors contributing to the health status of the drivers.

(M. Gobel *et al*, 1998)

It is not only the sedentary nature of the job which can lead to health issues. The passengers can also cause a stressful environment for the driver, which over time can contribute to health issues.

- Trying to drive a bus whilst taking responsibility for the welfare of up to eighty young people, some of whom will be engaged in behaviour ranging from the high spirited (e.g. running up and down the stairs) to the wilfully life-threatening (e.g. interfering with the emergency exit), can put intolerable strain on staff.

(DfT, 2001)

- Dozens of studies conducted over the last four decades in cities on almost every continent show that bus drivers, when compared to workers in other jobs, are more likely to experience:

  o Death from heart and blood vessel disease;
  o Heart and blood vessel-related conditions such as chest pain and high blood pressure;
  o Digestive disorders; and,
  o Musculoskeletal problems, especially of the back, neck and shoulders.

- Bus drivers frequently report tension, mental overload, fatigue and sleeping problems.

- Bus drivers also have more frequent absences from work and of longer duration than workers in other occupations. A large proportion of the work absences are attributable to stress-related disorders such as digestive problems and anxiety.

- Stress is believed to play a significant role in causing two of the diseases (heart and blood vessel disease and digestive disorders) found in excess in bus drivers.

- Bus driving interferes with social support in two ways. The job itself is solitary with little chance for face-to-face contact between co-workers. The work schedule disrupts family and social life.

- How buses are designed and how work is scheduled may account for musculoskeletal problems associated with driving a bus.

(MFL Occupational Health Centre, 1998)

It is not possible to prevent the repetitive nature of bus driving but with better design the driver compartments may be improved which could help to prevent or at least delay the development of some of the health conditions mentioned above. This could result in a notable improvement in the driver's quality of life as well as reducing the risk of RTIs which might occur as a result of some conditions.

Alcohol abuse

Research on alcohol and substance abuse amongst drivers was only found in European studies, with no UK specific studies being identified on this topic. It is unclear whether this is due to lack of research or the fact that very little alcohol abuse occurs amongst commercial transport drivers in the UK. The research below acknowledges that the level of drink-driving amongst bus and coach drivers is low. However, this activity still has potential to have an impact on driver, passenger, and other road user safety.

- One potential cause of severe RTIs involving buses and HGVs is the abuse of alcohol by their drivers. This is particularly so in the case of buses, as a very high number of victims are likely to be involved.

- Some European countries and manufacturers particularly target the implementation of Ignition Interlock Devices (IIDs) in the bus and HGV sector in order to substantially reduce the number of alcohol-related RTIs.

(ETSC, 2005)

- In July 2009, over 38,000 coaches were checked by police forces in 17 countries: 55 bus and coach drivers were found to be above the legal alcohol limit, five were found under the effect of drugs and 106 did not hold a driving license, having previously been disqualified for offences. Drink-driving by coach drivers was thus only 0.15 per cent, far less than in the general driving population.

- Yet, alcohol related road RTIs in commercial transport result in more serious outcomes due to the vehicle RTI incompatibility caused by increased size and mass of commercial vehicles.

(ETSC, nd)

As already mentioned, alcohol does not appear to be a major problem for bus and coach drivers. However, given the significant impact that drinking could have amongst this group, in conjunction with the often stressful nature of their job (which could increase the likelihood of alcohol abuse), it becomes a topic that should not be completely ignored.

There are a number of ways in which drink driving can be prevented, which are outlined by the following reports.

- Hindering drink-driving in commercial transport could be achieved through actions in three main areas:
    - Regulations;
    - Awareness raising and education; and,
    - Enforcement of law.

(ETSC, nd)

- A Swedish trial placed an Ignition Interlock Device (IID) at a bus depot to allay driver concerns of testing in front of the public and suspicions by the public if the equipment is faulty etc.

- An Infra Red IID which used non-touch technology (no mouth piece to blow into) was also trialled.

- This equipment was found to be successful as it was as accurate as other breath devices at testing alcohol levels.

- Depot based IIDs were found to:
    - Have lower operating costs;
    - Be quicker; and,
    - Be more reliable compared to vehicle based IIDs.

- However, they only tested drivers at the start of their shifts - not throughout the course of the day.

(L. Holmkvist, 2012)

The examples presented by the ETSC (nd) study (relating to regulation, education and enforcement) are the predominant methods by which drink driving is prevented in the UK. During the research for this synthesis no evidence was found of IIDs being used by UK bus and coach operators. This may well be further evidence that drink driving is not an issue within the UK passenger transport industry. If this problem does not exist within the industry, then the widespread use of IIDs will not help to eradicate it, however it will act as an effective deterrent to drink driving and will also provide passengers and other drivers with reassurance that drink driving cannot occur. However, the cost of implementing this widespread use of IIDs would likely be very high.

Safety culture and risk

Different drivers can have markedly different attitudes to risk and safety when on the road. These different attitudes can create very different driving styles which can have an impact on the risk of RTIs. For example, aggressive drivers may be more likely to speed and make dangerous manoeuvres which can increase RTI risk.

Three US studies and one UK study reviewed safety and risk in relation to driving operations, along with the range of factors and behaviours which can influence them.

- Survey findings strongly support the notion that high-risk drivers are a real and significant problem and that individual differences in safety among drivers are enduring.

- Evidence suggests that individual differences in personality and performance predispose some people to increased RTI risk.

- Driver errors can be violations of rules, mistakes of judgment, inattention errors, or inexperience errors. Common driver errors resulting in RTIs include recognition errors and decision errors, or poor decision-making in dynamic traffic situations.

(CTBSSP, 2004)

In addition driver attitude, driver age and experience may also have an impact on RTI risk as Dorn and Wahlberg's study suggests.

- Bus drivers are a special group of professional drivers that differ markedly from car drivers in ways that are likely to affect their RTI risk:
  - Bus drivers already hold a car license before obtaining a bus license and also start driving a bus at a later age than novice car drivers.
  - They have the added pressure of responsibility for passengers' lives whilst driving large heavy vehicles, often in built up areas.
  - Organisational factors such as schedules are likely to exert a strong influence on their driving behaviour.

- The research found that as age increased there was also a very small increase in the risk of an RTI.

- For driver experience, there was a stronger initial increase in RTI risk for less experienced drivers.

- It therefore appears that lack of experience of driving a bus is more influential than age in its contribution to risk at first, but that age is still influential after a few years.

(L. Dorn and A. Wahlberg, 2008)

This suggests that attitude, experience and age are all factors which should be taken into account when planning safety training and awareness programs.

- Managers viewed safety as a top priority or at least equal to other major priorities, such as customer and operational concerns.

- Four factors were identified that best explained the motivations of safety managers' attitudes towards safety:
  - The financial impact of safety;
  - Internal awareness of safety;
  - Demand for safety; and,
  - Overall safety culture in the industry.

- These four factors can be considered as influences of safety managers' attitudes toward safety both internally and externally.

- This indicates that future investigations into creating and maintaining a positive safety climate and attitude may need to examine both the internal functioning of organisations as well as the industry as a whole.

- The result also suggests that internal awareness of safety can be reflective of the safety attitudes of managers.

- More specifically, this study indicates that safety manager attitudes toward safety are motivated by certain relationships between safety performance and the consequences of unsafe performance.

- Enhancing safety attitudes by emphasising this relationship will help establish a high safety culture.

<div align="right">(L.N. Boyle, 2010)</div>

- Fleet safety management approaches to preventing high-risk-driver–related RTIs revolve around the basic management functions of selection and hiring, performance evaluation, and driver safety management practices.

- The clearest advice to safety managers is, "Don't hire a problem" – which is understood to mean that it is best not to hire drivers who have a history of poor performance, drink/drug problems or who have been convicted for road rage/violent behaviour.

- Once drivers are hired, there are various ways to monitor their driving behaviours and modify their behaviour in ways that reduce risk:
    - Performance evaluation and feedback (perhaps enhanced by on-board safety monitoring of driver behaviour);
    - Training and counselling;
    - Performance incentives;
    - Behaviour-based safety;
    - Driver self-management; and,
    - Termination may be the ultimate solution when drivers are unmanageable from the safety perspective.

<div align="right">(CTBSSP, 2004)</div>

- Studies indicate that driving behaviours are a significant contributing factor of large HGV RTIs, and interventions aimed at increasing safe driving behaviours and reducing at-risk driving behaviours are likely to prevent many vehicle RTIs.

- Behaviour Based Safety (BBS) is a safety improvement approach which focuses on what people do, analyses why they do it, then applies a research supported intervention strategy to improve what people do.

- BBS provides robust positive results when applied in organizations seeking to reduce employee injuries due to at-risk behaviours.

- However, almost all prior BBS research has been applied in work settings where employees can systematically observe the safe versus at-risk behaviours of their co-workers (such as factories).

- HGV and bus drivers work alone in relative isolation and thus may require alternative BBS processes.

- Despite the widespread use and success of BBS in other industrial settings, systematic BBS programs have not been widely embraced by safety professionals in Commercial Motor Vehicle (CMV) operations.

- Uptake of BBS programs in CMV operations may be low due to the solitary nature of driving, the difficulty of capturing and documenting key safety-critical behaviours, and/or a general lack of fleet safety manager knowledge about BBS and its potential benefits.

- However, if these issues can be overcome, then the uptake and positive impacts from reductions in RTIs realised by BBS in CMV operations could be significant.

(CTBSSP, 2007)

A number of different approaches are available to improve safety and reduce the risk posed to (and by) bus and coach drivers. Further research would be useful in identifying which of the factors pose the biggest risk and which measures are most effective at addressing these issues.

Passenger relationships

The relationships that bus and coach drivers have with their passengers is an important one. Poor relationships with passengers can result in increased stress, distractions, or even violent behaviour, which can all have a negative effect on the driver's ability to operate the bus safely.

- Many bus-drivers are apprehensive about the school run, which may be the reason why the service they offer is reported as poor. As a result, schoolchildren, the future customer base of public transport, may be turned off bus travel before they have become economically active. This was the backdrop against which Crime Concern were commissioned to research, develop and undertake pilot training designed to improve driver skills in managing the situation.

- The research indicated that an approach to the problem based solely on training drivers had poor prospects for success. Driver behaviour was likely to be a significant factor, but so too were the perceptions school children had about acceptable behaviour on buses.

- Furthermore, even if the perception each group had of the other could be improved and relations put on a more positive footing, progress could be sabotaged without co-operation and support from schools, Parent Teacher Associations (PTAs), and bus companies themselves.

- So, in addition to the staff training pilot, an organisational 'best practice' checklist was designed to give guidance to schools, PTAs and bus companies. The checklist covered a variety of measures that these organisations could take to support the majority of drivers who take a professional approach to their work.

- In addition, a number of educational sessions were developed for use in primary and secondary schools, designed to improve young people's appreciation of the difficult and valuable job bus drivers do.

<div align="right">(Crime Concern and First Leeds Buses, 2001)</div>

Driver training, in conjunction with raising passenger awareness, is likely to be the most effective way to build good relationships between these groups and ensure that road safety is not compromised.

Speed limiting

Since 2001, speed limiters have been a legal requirement on all new vehicles carrying over 8 people. Older, but larger, passenger vehicles (over 10 tonnes) also require limiters. It is therefore recognised that controlling the speed of these passenger vehicles is an important consideration. The information below may be relevant to individuals/organisations interested in speed limiting older passenger vehicles under 10 tonnes.

- Organisations that used Speed Limiters (SL) saw benefits in terms of both safety and fuel economy, whereas those choosing not to use speed limiters cited concerns with car–HGV speed differentials.

- A written survey documented anecdotal evidence of large percentages of HGV drivers (with speed-governed lorries) exceeding posted speed limits in zones posted below the speed limiter set speed to "make up time."

- Overall, a positive picture emerges from speed limiter users who participated in the written survey. Fifty-six percent of respondents indicated speed limiters were either 'successful' or 'very successful' in reducing RTIs, and 64 per cent reported speed limiters were either 'successful' or 'very successful' in reducing speeding violations.

<div align="right">(CTBSSP, 2008)</div>

- Results from multiple analyses indicated a significant safety benefit for lorries equipped with an active SL.

- The cost of SL technology is negligible and is a standard feature on new lorries (owners only need to activate and set the SL).

- The positive findings in this study are consistent with the bulk of the literature on this topic indicating significant safety benefits associated with speed reduction which can be achieved through the implementation of SLs.

(US Dept of Trans – Federal Motor Carrier Safety Administration, 2012)

The above studies indicate that SL are effective at improving safety and reducing RTIs in larger vehicles, and should also be able to provide similar safety improvements if installed on older passenger vehicles under 10 tonnes.

How effective?

This section of the synthesis presents evidence to demonstrate how effective the various initiatives/measures can be at improving bus and coach driver safety.

As will be seen in the 'Gaps in research' section, while a wide variety of measures have been identified to address the different safety issues discussed in this synthesis, there is rather limited evidence available on how effective these measures are at reducing risk or improving safety.

Violence

The Health and Safety Executive lists a number of different measures that can be employed to prevent violence against bus drivers. Some of them aim to prevent the violence occurring while others help to protect the driver or improve the chances of the police catching the perpetrator.

- First Leeds bus company have trialled a number of different measures to address violence towards bus drivers which have all proved effective to varying degrees. These measures include:
  - CCTV;
  - Assault shields;
  - Diffusion techniques and interpersonal skills training;
  - Attack alarms; and,
  - Smart Water systems.

(HSE, 2012)

While the measures listed above can be effective in reducing violence against staff, no statistics have been identified which provide evidence on how effective (reductions in numbers/severity of attacks) these measures are.

Fatigue Management

Fatigue is a significant problem for the commercial transport industry and reducing the impact it has on driver errors and RTIs is an ongoing issue.

- Research proposes that an FRMS (Fatigue Risk Management System) offers the most comprehensive approach to managing fatigue risks.

(C. Fourie *et al,* 2010a)

- Participants in a study to review FRMS (predominantly operators and regulators within the commercial transport industry) were enthusiastic about FRMS and the possibility that they could improve the management of fatigue. They provided some evidence that FRMS has improved safety, for example reduced accident rates, as well as other benefits, such as improved staff morale and reduced absenteeism.

(C. Fourie *et al,* 2010b)

Driver's hours regulations are a well established method of reducing driver fatigue and RTIs. Approaches such as FRMS build upon these established methods with the aim of improving safety even further. However, as of yet, the effectiveness of these methods in relation to bus drivers does not appear to have been extensively researched or reported upon, resulting in a lack of evidence relating to the benefits they can potentially provide.

Health

There are a host of different ways in which bus operators are attempting to reduce the health impacts experienced by their drivers. Some of these are presented in a report by MFL Occupational Health Centre:

- Research supports a number of measures to reduce work hazards for bus drivers. Measures include:
    - Reducing traffic congestion (bus lanes, signal priority);
    - Reducing passenger inquiries (automated information systems);
    - Enhancing driver security (alarm systems, emergency procedures);
    - Reducing social isolation on the job (schedule breaks in central locations);
    - Reducing fatigue and interference with personal life (improve work schedules);
    - Improving social aspects of work (supportive style of leadership); and,
    - Improving ergonomic design of buses (seat design, steering wheel design).

<div align="right">(MFL Occupational Health Centre, 1998)</div>

These measures can be beneficial in reducing occupational health risks amongst bus and coach drivers, however, no statistics have been identified which provide evidence on their effectiveness.

Alcohol abuse

No evidence was identified that suggested drink driving was a significant problem amongst UK bus and coach drivers. However, if commercial passenger transport operators did decide to use them, Ignition Interlock Devices (IIDs) were found to be very effective at preventing drink driving and re-offending.

- IIDs eliminate drink driving virtually to zero once installed, but the positive effect on re-offending usually disappears completely after the lock is removed from the vehicle.

- Various assessments have shown that an alcohol interlock is more effective than driving licence suspension in preventing re-offending.

<div align="right">(ETSC, nd)</div>

Speed limiting

Speed limiters can provide significant safety improvements when installed on large vehicles.

- The RTI involvement rate for speed-limited lorries fell 26 per cent between 1993 (when mandated) and 2005.

(CTBSSP, 2008)

Gaps in the research

- The majority of bus related information relates to passengers. There is relatively limited research focussing on drivers and the risks/issues that face them.

- The fatigue management studies appear to be centred in the commercial transport industry which covers both buses and goods vehicles. Focusing this topic upon passenger transport would help to clarify the issues that bus and coach drivers face, as well as providing more data on the effectiveness of different measures to address them.

- While various measures to mitigate violence and health issues amongst drivers have been covered by a number of reports, there appears to have been very little research into the actual effectiveness of these measures.

- Studies into the reductions in RTIs achieved as a result of FRMS or driver time regulations may help to further develop these measures.

- Whilst not a significant problem in Europe, alcohol and substance abuse is still seen as an important consideration given the number of passengers for which a driver is responsible. More research into this area in a UK context would be beneficial.

References

Department for Transport research and statistics

Title: Reported Road Casualties Great Britain: 2011 Tables
Author / organisation: P. Kilbey, D. Wilson, O. Beg, G. Goodman, A. Bhagat (DfT) **Date:** 2012 **Format:** PDF and data tables (CSV format) **Link:** https://www.gov.uk/government/publications/reported-road-casualties-great-britain-annual-report-2011 **Free / priced:** Free
Objectives: Summary of vehicles involved in reported RTIs by severity and vehicle type and summary of contributory factors for RTIs in 2011.
Methodology: Reports from RTIs reported to the police. It is accepted that there is likely to be a level of under-reporting, however this remains the biggest single source of road casualty data in the UK. Not all RTIs are attended by police, and even when an accident is attended, it is not always possible to record a suitable contributory factor. However, this data remains one of the best sources of RTI contributory factors in GB. 'RAS20003: Vehicles involved in reported accidents by accident severity and vehicle type, Great Britain, 2011', 'RAS50005: Contributory factors, Vehicles in reported accidents by vehicle type, Great Britain, 2011', and 'RAS30010: Reported casualties by gender, road user type and severity, Great Britain, 2004-11'
Key Findings: - A total of 7,223 buses or coaches were involved in reported accidents in 2011.   872 buses or coaches were involved in Killed or Seriously Injured (KSI) RTIs.   6,351 buses or coaches were involved in Slight Injury RTIs.   - In those road accidents that were attended by police and in which a contributory factor was reported, 4,422 buses or coaches were involved.   2,942 contributory factors were assigned to buses or coaches at these attended RTIs (each accident can have more than one contributory factor). 2,204 buses or coaches had no contributory factor assigned.   - Of the contributory factors assigned to buses and coaches, 41 per cent could be attributed to driver error or reaction.   - In 2011, there were no reported fatalities amongst bus or coach drivers. The number of bus or coach drivers who were seriously injured was 15 and the number who were slightly injured was 474.   - In 2011, there were 5,688 bus or coach passenger casualties of all severities. Seven of these passengers were fatally injured, and 310 were seriously injured.
Themes: Accident numbers, Accident severity, Contributory factors.
Comments: The largest single source of GB data. Results are designated National Statistics.

Title: Reported Road Casualties Great Britain: 2013
Author / organisation: Department for Transport
Date: 2014
Format: PDF and data tables (CSV format)
Link: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359311/rrcgb-2013.pdf
Free / priced: Free
Objectives: Summary of vehicles involved in reported RTIs by severity and vehicle type and summary of contributory factors for RTIs in 2013.
Methodology: Reports from RTIs reported to the police. It is accepted that there is likely to be a level of under-reporting, however this remains the biggest single source of road casualty data in the UK. Not all RTIs are attended by police, and even when an accident is attended, it is not always possible to record a suitable contributory factor. However, this data remains one of the best sources of RTI contributory factors in GB.
Key Findings In 2013: • A total of 5,896 buses or coaches were involved in reported accident. • 767 buses or coaches were involved in Killed or Seriously Injured (KSI) RTIs. • 5,129 buses or coaches were involved in Slight Injury RTIs. • In those road accidents that were attended by police and in which a contributory factor was reported, 3,864 buses or coaches were involved. • 2,370 contributory factors were assigned to buses or coaches at these attended RTIs (each accident can have more than one contributory factor). 2,059 buses or coaches had no contributory factor assigned. • Of the contributory factors assigned to buses and coaches, 62 per cent could be attributed to driver error or reaction. • In 2013, 2 bus or coach drivers were killed, 20 were seriously injured and 382 were slightly injured. • 8 bus or coach passengers were killed, 312 were seriously injured, and 4,149 were slightly injured.
Themes: Accident numbers, Accident severity, Contributory factors.
Comments: The largest single source of GB data. Results are designated National Statistics.

Title: Reported Road Casualties Great Britain: 2014
Author / organisation: Department for Transport
Date: 2015   **Format:** PDF and data tables (CSV format)   **Link:**   https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463797/rrcgb-2014.pdf   **Free / priced:** Free
Objectives: Summary of vehicles involved in reported RTIs by severity and vehicle type and summary of contributory factors for RTIs in 2014.
Methodology: Reports from RTIs reported to the police. It is accepted that there is likely to be a level of under-reporting, however this remains the biggest single source of road casualty data in the UK. Not all RTIs are attended by police, and even when an accident is attended, it is not always possible to record a suitable contributory factor. However, this data remains one of the best sources of RTI contributory factors in GB.
Key Findings   In 2014:   - A total of 5,896 buses or coaches were involved in reported accident.   - Buses or coaches were involved in 61 fatal, 716 serious and 5,326 slight reported road accidents.   6,103 buses or coaches were involved in reported road accidents.   7 bus or coach users were killed, 293 were seriously injured and 4,898 were slightly injured in reported road accidents.   - All 7 of the deaths were bus or coach passengers, as were 272 of those seriously injured and 4,501 of those slightly injured.   - Of those seriously injured, 21 were bus or coach drivers, as were 397 of those slightly injured.   - There were 26 fatal, 208 serious and 788 slight reported road accidents involving a bus or coach and a pedestrian.   2,148 contributory factors were assigned to buses or coaches at these attended RTIs (each accident can have more than one contributory factor). 4,102 buses or coaches had no contributory factor assigned.   - Of the contributory factors assigned to buses and coaches, the most common were careless, reckless or in a hurry, failed to look properly, sudden braking and poor turn or manoeuvre.
Themes: Accident numbers, Accident severity, Contributory factors.
Comments: The largest single source of GB data. Results are designated National Statistics.

Title: Road Safety Research Report No. 110 – Fatigue Risk Management Systems: A Review of the Literature
Author / organisation: C. Fourie, A. Holmes, S. Bourgeois-Bougrine, C. Hilditch, and P. Jackson (Clockwork Research Ltd for DfT) **Date:** September 2010a **Format:** Pdf **Link:** http://assets.dft.gov.uk/publications/fatigue-risk-management-systems-a-review-of-the-literature-road-safety-research-report-110/rsrr110.pdf **Free / priced:** Free
Objectives: To review fatigue management strategies.
Methodology: The papers provide a detailed literature review of research on fatigue management systems.
Key Findings: - While not directly reviewing bus and coach RTIs where fatigue is the cause, the paper acknowledges that fatigue-related collisions are particularly prevalent among commercial vehicle drivers because of the extended amount of time they spend on the road, the long hours that are worked and shifts that start at various times of the day and night.   17 per cent of RTIs occurring on major trunk roads which resulted in injury or death were sleep-related (Flatley et al, 2004).   - Driving is highly susceptible to fatigue because it involves many of the skills that are impaired by fatigue, such as vigilance.   - Unless remedial action (i.e. recovery sleep) is taken, the individual's state will decline still further which may lead to more pronounced effects on their driving performance.   - A report from Germany in 1994 found that fatigue was the cause of 26 per cent of RTIs involving LGVs over 7.5 tonnes and 36 per cent of RTIs involving commercial vehicles of less than 7.5 tonnes.   - The inadequate sleep obtained by commercial drivers is widely considered to be a key determinant of fatigue in transport (Fatigue and Transport Working Party, undated).   - The literature revealed that relying on Hours of Work limitations to provide protection from the adverse consequences of fatigue risk is increasingly being perceived as an overly simplistic strategy.   - The research proposes that a fatigue risk management system offers the most comprehensive approach to managing fatigue risks.   - Within an FRMS, fatigue is managed in a data-driven and flexible manner appropriate to the level of risk exposure and the nature of the operation.
Themes: Fatigue risk, Fatigue management.
Comments: Commercial transport – relates to goods vehicles as well as buses and coaches.

Title: Road Safety Research Report No. 120 Interviews with Operators, Regulators and Researchers with Experience of Implementing Fatigue Risk Management Systems
Author / organisation: C. Fourie, A. Holmes, S. Bourgeois-Bougrine, C. Hilditch, and P. Jackson (Clockwork Research Ltd for DfT)   **Date:** September 2010b   **Format:** Pdf   **Link:** http://assets.dft.gov.uk/publications/research-and-statistical-reports/rsrr120.pdf   **Free / priced:** Free
Objectives: To conduct a worldwide review of Fatigue Risk Management Systems (FRMS).
Methodology: • Using the literature review and professional contacts, 88 individuals with potential knowledge or experience of FRMS were identified.   • A survey helped to establish that 67 of these people had sufficient practical knowledge of implementing FRMS, or new strategies for fatigue management, to be invited to participate in an interview. Fifty-nine (88 per cent) people agreed to be involved and were interviewed.
Key Findings: • The interview participants were all convinced of the need to improve fatigue management in the transport industry. They felt that the human and financial costs currently associated with fatigue, particularly in the road transport industry, are unacceptably high.   • An FRMS is a scientifically-based data-driven system which manages employee fatigue in a flexible manner appropriate to the level of risk exposure and the nature of the operation. FRMS can be used as an additional or alternative to prescriptive hours of work limitations.   • An FRMS integrates management practices, beliefs and procedures used to manage the risks of fatigue. It provides tailored defences against fatigue-related risks through the use of objective thresholds specifically for local environments.   • Most participants were enthusiastic about FRMS and the possibility that they could improve the management of fatigue. They provided some evidence that FRMS has improved safety, for example reduced accident rates, as well as other benefits, such as improved staff morale and reduced absenteeism.   • The only disadvantages of FRMS cited by more than one participant were the difficulties associated with changing regulatory approach and the perceived potential for FRMS to be abused by unscrupulous operators.   • Participants working in the road transport industry suggested that, to date, fatigue management has been too narrowly focused on long-haul HGV driving and that the risk associated with other sectors of the industry, for example vans, taxis and buses, deserves more attention.   • The emphasis reflects the high risk of serious injury and fatality associated with a RTI involving an LGV. However, it is likely that drivers of other vehicles, such as taxis, vans and buses, are also subject to fatigue. It is recommended that research is undertaken to determine the extent of this problem.   • The literature review and interviews revealed considerable suppositional evidence to indicate that FRMS can benefit safety.
Themes: Fatigue risk, Fatigue management.
Comments: Commercial transport – relates to goods vehicles, buses and coaches.

Title: Protecting Bus and Coach Crews A Practical Guide for Bus and Coach Operators and Staff	
Author / organisation: DfT **Date:** December 2003 **Format:** Pdf **Link:** http://webarchive.nationalarchives.gov.uk/20100512173431/http://www.dft.gov.uk/pgr/regional/buses/buscrime/coll_protectingbusandcoachcrewsa/ectingbusandcoachcrewsaq3537.pdf **Free / priced:** Free	

Objectives: This guide contains practical advice on how managers and staff can reduce the risk of violence, anti-social behaviour and criminal damage on buses and coaches, at bus stops and at bus and coach stations.

Methodology: Guidance document developed by the Safer Travel on Buses and Coaches Panel (STOP).

Key Findings:

- If you work in the bus and coach industry, you can't fail to be aware of the problem of violence and anti-social behaviour.
- The people most at risk are those on buses and coaches:
  - Drivers;
  - Conductors;
  - Inspectors and other officials; and
  - Passengers.
- Violence and anti-social behaviour can take many forms, including verbal abuse and threats as well as spitting and physical assaults.
- Even minor cases can cause shock and stress, the effects of which may not appear until several weeks later. Severe cases can require hospital treatment and time off work.
- Transport for London estimates that criminal damage caused to buses in London costs the industry over £10 million per year.
- Advice to drivers includes:
  - Keep calm and try to diffuse the situation;
  - Not to leave their cab unless they are sure it is safe to do so;
  - Attempt to get help by using equipment such as panic alarms or two way radios; and
  - Always report incidents in writing to management.
- Advice for bus operators includes:
  - Undertaking regular risk assessments;
  - Make sure all incidents are reported and recorded;
  - Take preventative measures such as training, simplified fair structures, CCTV, shields, two way radios etc;
  - Consult with staff; and
  - Act and monitor.

Themes: Violence and anti social behaviour, Bus drivers.

Comments: Very few useful statistics related to violence, but overall a good source of information on the measures and processes to help drivers and operators reduce the risk of violence.

Title: The School Run: A Training Programme for Bus Drivers Focusing on Conflict Resolution with School Pupils
Author / organisation: A DfT pilot study by Crime Concern and First Leeds Buses **Date:** 2001 **Format:** Pdf **Link:** http://webarchive.nationalarchives.gov.uk/20100512173431/http://www.dft.gov.uk/pgr/crime/srtp/choolruntrainingprogramm3007.pdf **Free / priced:** Free
Objectives: To develop a driver training programme which would help bus drivers to safely and effectively deal with the problems and stresses associated with the large numbers of school pupils using bus travel each day.
Methodology: An initial literature review of publically available information was undertaken followed by an extensive interview process which included interviewees from bus companies (managers, drivers and trainers), accident investigation departments, school pupils and staff.
Key Findings: • Historically the relationship between young people and bus personnel has been problematic. • Bus drivers see young people as a major source of stress and damage. Trying to drive a bus whilst taking responsibility for the welfare of up to eighty young people, some of whom will be engaged in behaviour ranging from the high spirited to the wilfully life-threatening, can put intolerable strain on staff. This strain is frequently compounded by drivers' perceptions that, not only are they powerless to take effective measures, but that disruptive children are aware of this. Anecdotal evidence would indicate a deteriorating situation. • Children, for their part, believe that their custom is not valued by the bus companies or their staff. Complaints from school children about poor quality buses, overcrowding, and surly service are frequent. They perceive the majority of bus-drivers to be unsympathetic. • Many bus-drivers dread the school run which may be the reason why the service they offer is reported as surly. As a result, schoolchildren, the future customer base of public transport, may be turned off bus travel before they have become economically active. This was the backdrop against which Crime Concern were commissioned to research, develop and pilot training designed to improve driver skills in managing the situation. • The research indicated that an approach to the problem based solely on training drivers had poor prospects for success. Driver behaviour was likely to be a significant factor, but so too were the perceptions schoolchildren had about acceptable behaviour on buses. • Furthermore, even if the perception each group had of the other could be improved and relations put on a more positive footing, progress could be sabotaged without co-operation and support from schools, PTAs/PTEs, and bus companies themselves. • So, in addition to the staff training pilot, an organisational 'best practice' checklist has been designed to give guidance to schools, bus companies and PTEs on measures they could take to support the majority of drivers who take a professional approach to their work.

• As a third prong to the solution, Crime Concern have outlined some educational sessions for use in primary and secondary schools designed to improve young people's appreciation of the difficult and valuable job bus-drivers do. • A workbook was designed for use on the pilot training Crime Concern carried out with Leeds First drivers. It was amended progressively following feedback from each of the pilot courses.
Themes: Driver distraction, Driver responsibilities.
Comments: Useful to demonstrate the distractions that face bus drivers as well as the views of a specific group of passengers.

Other works

Title: Ignition Interlock Device (IID) placed at a bus depot
Author / organisation: L. Holmkvist (The European Transport Safety Council) **Date:** May 2012 **Format:** Powerpoint Presentation **Link:** http://www.etsc.eu/documents/Boras_Public_Transport_Lars_Holmkvist.pdf **Free / priced:** Free
Objectives: To give an overview of the process, benefits and problems involved with installing and implementing an Ignition Interlock Device (IID) at a bus station in Sweden
Methodology: A summary of a pilot project undertaken in Sweden

Key Findings:
• An IID is a piece of equipment for testing the level of alcohol intoxication of an individual. They can be vehicle or site based and will prevent a vehicle being started if the test subjects level of intoxication is over a prescribed threshold.
• Placed the IID at the depot to allay driver concerns of testing in front of the public and suspicions by the public if the equipment is faulty etc.
• Centralises the process so reduces costs.
• Frequent calibration was needed – at least once a month. More reliable technology is required.
• An IR non touch tester was also trialled which was found to be successful
• Depot based IID were found to:
    o Have lower operating costs;
    o Be quicker; and,
    o More reliable.
• However, they only tested drivers at the start of their shifts – not throughout the course of the day.

Themes: IID, Ignition Interlock Device, Buses, Drink-driving.
Comments: Not clear if an issue in the UK, but still an important aspect of safety considerations.

Title: Research on the Safety Impacts of Speed Limiter Device Installations on Commercial Motor Vehicles: Phase II
Author / organisation: US Department of Transportation – Federal Motor Carrier Safety Administration **Date:** March 2012 **Format:** Pdf **Link:** http://www.intermotive.net/MISC/Speed-Limiters.pdf **Free / priced:** Free
Objectives: The purpose of Phase II was to identify and assess the impacts on a motor carrier implementing SL technology in fleet operations. The focus of the current study was to identify: • Potential safety benefits, and other benefits, afforded by SLs. • Best practices application.
Methodology: This task was accomplished by analyzing carrier-owned RTI data and driver responses. The various analyses conducted used data from more than 150,000 lorries that were involved in more than 28,000 RTIs.
Key Findings: • This literature review revealed that the most indicative results on the effectiveness of speed limiters are from the United Kingdom (U.K.). Here, the RTI involvement rate for speed-limited lorries fell 26 percent between 1993 (when mandated) and 2005. • Based on RTI data from several studies, speeding was one of the primary factors in motor vehicle RTIs; this risky behaviour was also compared to driving with a blood alcohol concentration (BAC) of 0.08 (Evans, 1991). • Results from multiple analyses indicated a profound safety benefit for lorries equipped with an active SL. • The cost of SL technology is negligible and is a standard feature on new lorries (owners only need to activate and set the SL). • The positive findings in this study were consistent with the bulk of the literature on this topic indicating significant safety benefits associated with speed reduction which can be achieved through the implementation of SLs. • Domain research on the potential downside of speed deviations among vehicles that could occur due to the interaction of SL equipped vehicles and those without SLs seems to be far outweighed by the significant safety benefits associated with a reduction in absolute speed afforded by SLs.
Themes: Speed limiters, Commercial vehicles.
Comments: While this study discusses commercial vehicles, the benefits offered by speed limiters are applicable to those buses and coaches not currently covered by UK speed limiter regulations.

Title: Vision Zero International
Author / organisation: US Trade Publication – Advanced Vehicle Design and Technology
Date: January 2012 (p 26)
Format: Online magazine/Webpage
Link: http://viewer.zmags.com/publication/32adbb28#/32adbb28/1
Free / priced: Free
Objectives: To provide the most up to date information on vehicle design and technology.
Methodology: Review of current practice.

Key Findings:
• As with all motor vehicles, RTIs involving buses and coaches can be caused by a number of factors such as:
    o Fatigue;
    o Distractions; and,
    o Drug or alcohol abuse.
• To address the root causes of RTIs the emphasis is on:
    o Detecting and reducing driver fatigue;
    o The elimination of driver distractions;
    o Improved monitoring to eliminate drug and alcohol use; and,
    o Training to reduce risk taking.
• In addition further accident prevention could be achieved through:
    o Development and implementing stability control, collision avoidance and lane wandering-warning systems (see the Crash Protection Synthesis)
• Other upgrades are also discussed such as:
    o Fire safety Improvements;
    o Structural strengthening;
    o Roll over protection; and,
    o Preventing ejection from windows.

Themes: Coach safety design, Coach safety improvements.
Comments: Discusses various improvements that could be made to bus safety but doesn't provide any examples of the magnitude of improvement that they can offer.

Title: Buses Involved In Fatal Accidents Factbook 2008
Author / organisation: A. Matteson, L. Jarossi, and J. Woodroofe, (Center for National Truck and Bus Statistics)   **Date:** April 2011   **Format:** Pdf   **Link:** http://deepblue.lib.umich.edu/bitstream/2027.42/84149/1/96746_A10.pdf   **Free / priced:** Free
Objectives: To use the Buses Involved in Fatal Accidents (BIFA) database to present aggregate statistics on buses involved in RTIs in 2008.
Methodology: The BIFA database was interrogated for 2008 statistics in order that four separate areas of review could be provided – Trends, Accident Conditions, Vehicle, and Driver. Each of these sections analysed the data with reference to the particular topic.
Key Findings: • The most relevant statistics relate to drivers and the human error factors which contributed to the incidents.   • Fifteen bus drivers were coded as inattentive, and two as drowsy or asleep at the time of the RTI.   • Drinking was reported in 1.7 per cent of the bus drivers.   • Overall, 9.5 per cent of bus drivers involved in a fatal RTI had a previous speeding conviction. Drivers of buses in the 'other' bus category had the highest percentage of previous speeding convictions, while transit bus drivers had the highest incidence of previous RTIs (fatal and nonfatal).   • Failure to yield was the most common driver factor (10.2 per cent), followed by careless/inattentive (5.1 per cent), and failure to keep in proper lane (4.1 per cent).
Themes: Fatal bus RTIs, Statistics.
Comments: The Driver section of the report provides some further evidence on some of the other issues discussed in this synthesis, such as drink-driving and fatigue.

Title: Safety Climate of Commercial Vehicle Operation	
Author / organisation: L.N. Boyle (University of IOWA for the Mid-America Transportation Center) **Date:** 2010 **Format:** Pdf **Link:** http://trid.trb.org/view/2010/M/1101706 **Free / priced:** Free	
Objectives: To investigate the various factors that affect the 'safety climate' of organisations within the good vehicle and motor coach industry.	
Methodology: Data from a survey distributed to safety managers was analyzed for this study. The survey questions were designed to assess manager's perceptions of safety and included questions on available incentive programs, investments in technology and safety certificate programs, as well as demographics of the safety department and the company as a whole.	
Key Findings: • The survey results showed that safety managers viewed safety as a top priority or at least equal to other major priorities, such as customer and operational concerns. • About two-thirds of the survey respondents reported that safety is integrated into driver screening, hiring, discipline, firing and also into compensation, benefits, and incentives. • Four factors were identified that best explained the motivations of safety managers attitudes towards safety. • The four factors include different aspects of safety managers' perceptions and considerations related to safety: the financial impact of safety, internal awareness of safety, demand for safety, and overall safety culture in the industry. • These four factors can be considered as influences of safety managers' attitudes toward safety both internally—the financial cost of safety, internal awareness of safety and demand for safety—and externally: that is, the overall safety culture in the industry. • This indicates that future investigations into creating and maintaining a positive safety climate and attitude may need to examine both the internal functioning of organizations as well as the industry as a whole. • The result also suggests that internal awareness of safety can be reflective of the safety attitudes of managers. • It is also possible that insurance costs will decrease as good safety performance is maintained, and safe companies may have a better ability to attract safer drivers. • More specifically, this study indicates that safety manager attitudes toward safety are motivated by certain relationships between safety performance and the consequences of unsafe performance. • Enhancing safety attitudes by emphasizing this relationship will help establish a high safety culture within the industry.	
Themes: Perception of safety, Safety climate, Commercial vehicles operators.	
Comments: Commercial transport – relates to goods vehicles as well as buses and coaches.	

Title: Analysis of Bus and Coach Passenger Casualties North East England 2006 - 2010
Author / organisation: P. Slater, and S. Shield (North East Regional Road Safety Resource) **Date:** December 2011 **Format:** Pdf **Link:** http://www.neroadsafety.org.uk/documents/32.%20Analysis%20of%20Bus%20and%20Coach%20Passenger%20Casualties%20in%20North%20East%20England,%202006%20-%202010.pdf **Free / priced:** Free
Objectives: To provide information and analysis on bus and coach passenger casualties in the North East between 2006 and 2010. This report is intended to assist road safety professionals in identifying the current trends in bus and coach passenger casualties. It also provides information on dates, times and areas where bus and coach passenger casualties are most likely to occur, along with details on the passenger's position and the bus or coach's movements at the time of the collision.
Methodology: The data used to produce this report is based on the Road Safety Resource's database of Stats 19 provided by Cleveland, Durham and Northumbria police forces. STATS 19 classifies a vehicle constructed and equipped to carry 17 or more seated passengers as a 'bus or coach'.
Key Findings: • Between 2006 and 2010 there have been 2,102 bus and coach passengers injured in collisions in the North East. Of this number, 1,998 were slightly injured, 101 were seriously injured and three were killed in these collisions. • Of these 2,656 casualties on buses and coaches, 2,102 were passengers, 369 were pedestrians hit by the vehicle and 185 were the driver. • During the period the number of casualties on buses and coaches has been steadily increasing, while over the same time the number of total casualties has been falling. • The most at risk age groups for casualties on buses and coaches are the under 30s and the over 50s, and passengers over 60 tend to suffer more severe injures. • Over the day, child (0-15) and adult (16-59) casualties tend to peak at school opening and closing times, while bus pass aged adults (60+) generally seem to be injured in collisions between 09:00 and 14:59. • The main contributory factor for buses and coaches involved in collisions is the bus or coach driver suddenly braking.
Themes: Bus and coach casualties.
Comments: Highlights the numbers and severity of injuries which occur on inner city buses.

Title: Commercial Truck and Bus Safety Synthesis 16 Safety Impacts of Speed Limiter Device Installations on Commercial Trucks and Buses
Author / organisation: Commercial Truck and Bus Safety Synthesis Program (CTBSSP)Transportation Research Board **Date:** 2008 **Format:** Pdf. **Link:** http://onlinepubs.trb.org/onlinepubs/ctbssp/ctbssp_syn_16.pdf **Free / priced:** Free
Objectives: The objectives of this synthesis are to document current knowledge and state of practice for speed limiters in commercial vehicle operations and to survey HGV and intercity and charter bus carriers who have experience in using speed limiters regarding perceived benefits and/or drawbacks.
Methodology: The scope of the project encompasses data and analyses that assess the safety efficacy of speed limiters for commercial motor vehicles in Australia, Europe, and North America. A survey of fleet safety managers in the US was also undertaken as part of the study.
Key Findings: • There is adequate literature on the role of large-HGV speed in terms of RTI severity, but less empirical data relating to the use of speed limiters to meaningful reductions in total RTIs because the percentage of RTIs that occur above 65 mph is relatively small. • Published studies indicate that both travelling above the posted speed limit and speed variance among vehicles increase RTI exposure. • The Study Team found little in the way of published data that addresses the safety impacts of speed limiters on commercial motor vehicles. • The most definitive results on the effectiveness of speed limiters comes from the UK, which showed that the RTI involvement rate for speed-limited heavy lorries fell 26 per cent between 1993 (when mandated) and 2005. • Given the paucity of published objective results, the experiences of fleet safety managers and owner–operators are the best available sources of information. • Two opposing views existed amongst fleet manager s with regards to the limiters - those carriers. • Using speed limiters saw benefits in terms of both safety and fuel economy, whereas those choosing not to use speed limiters cited concerns with car–HGV speed differential. • The written survey documented anecdotal evidence of large percentages of HGV drivers (with speed-governed lorries) exceeding posted speed limits in zones posted below the speed limiter set speed to "make up time". • Overall, a positive picture emerges from speed limiter users who participated in the written survey. Fifty-six percent of respondents indicated speed limiters were either 'successful' or 'very successful' in reducing RTIs, and 64 per cent reported speed limiters were either 'successful' or 'very successful' in reducing speeding violations. • In summary, these results provide strong anecdotal evidence that speed limiters were beneficial to fleet operations; however, the results suggest cost reductions associated with fleet operations and high-severity RTIs were greater than for a reduction in the frequency of large HGV RTIs.
Themes: Speed limiters, Commercial vehicles.
Comments: Although carried out in the US this study shows some significant benefits that can be provided by the use of speed limiters.

Title: Work Related Road Safety: An Analysis Based on U.K. Bus Driver Performance
Author / organisation: L. Dorn, and A. Wahlberg (Risk Analysis Vol 28) **Date:** 2008 **Format:** Pdf **Link:** Available through www.ingentaconnect.com http://www.ingentaconnect.com/search/article?option1=tka&value1=work+related+road+safety&pageSize=10&index=7 **Free / priced:** Priced
Objectives: To review age and experience as accident predictors amongst bus drivers and to consider methodological approaches to understanding.
Methodology: Driver and RTI data was provided by a major UK bus company. These data were analysed in various ways to assess the impact which age and experience can have on RTI risk.
Key Findings: - Many organisations are concerned about the frequency with which their employees are involved in road traffic incidents, but there is, in comparison to car drivers, few published data to guide company policy and professional driver training.   - Bus drivers are a special group of professional drivers that differ markedly from car drivers in ways that are likely to affect their RTI risk: - Bus drivers already hold a car license before obtaining a bus license and also start driving a bus at a later age than novice car drivers;   - They have the added pressure of responsibility for passenger's lives while driving large heavy vehicles often in built up areas; and   - Organisational factors such as schedules are likely to exert a strong influence on their driving behaviour.   - The main findings suggest that, overall, there was an initial negative, then thereafter a weak positive effect of age on bus driver RTIs.   - For driver experience, there was a stronger initial, negative effect on RTI risk.   - It therefore appears that lack of experience of driving a bus is more influential than age in its contribution to risk at first, but after 2 or 3 years the effect is small.
Themes: Bus/Coach RTI risk, Age and experience.
Comments: UK based study on basic risk factors for bus drivers – useful angle.

Title: Commercial Truck and Bus Safety Synthesis 11 Impact of Behaviour-Based Safety Techniques on Commercial Motor Vehicle Drivers
Author / organisation: Commercial Truck and Bus Safety Synthesis Program (CTBSSP)Transportation Research Board
Date: 2007 **Format:** Pdf **Link:** http://onlinepubs.trb.org/onlinepubs/ctbssp/ctbssp_syn_11.pdf **Free / priced:** Free
Objectives: This synthesis documents current information on various Behaviour-Based Safety (BBS) strategies to increase safety-related and decrease at-risk driving behaviours of commercial motor vehicle (CMV) drivers.
Methodology: This report includes an extensive literature review and case study information about innovative and successful BBS practices in work settings. A survey of motor carrier safety managers provides information on current behavioural safety management practices in commercial motor vehicle transport, including manager assessments of effectiveness. As part of the study, the researchers also held two focus groups with fleet safety managers.
Key Findings: • Studies indicate that driving behaviours are a significant contributing factor of large HGV RTIs, and interventions aimed at increasing safe driving behaviours and reducing at-risk driving behaviours are likely to prevent many vehicle RTIs. • BBS provides robust positive results when applied in organizations seeking to reduce employee injuries due to at-risk behaviours. However, almost all prior BBS research has been applied in work settings where employees can systematically observe the safe versus at-risk behaviours of their co-workers. HGV and bus drivers work alone in relative isolation and thus may require alternative BBS processes. • Despite the widespread use and success of BBS in other industrial settings, systematic BBS programs have not been widely embraced by safety professionals in CMV operations. • This synthesis shows that respondents indicated widespread use of specific BBS techniques but little use of more comprehensive BBS programs. • This lack of comprehensive BBS programs may be due to the solitary nature of driving, the difficulty of capturing and documenting key safety-critical behaviours, and/or a general lack of fleet safety manager knowledge about BBS and its potential benefits. • Clearly, a significant need is to develop a set of accepted practices and guidelines for implementing and using BBS techniques in CMV operations.
Themes: Driver behaviour, Behaviour based safety.
Comments: Backs up the papers which relate to the more general commercial transport to show that fatigue is also an issue for coach drivers.

Title: ETSC Fact Sheet No 7: The Safety of Heavy Duty Vehicles
Author / organisation: European Transport Safety Council **Date:** September 2005 **Format:** Pdf **Link:** http://www.etsc.eu/documents/FS_HDV.pdf **Free / priced:** Free
Objectives: To provide basic facts on the various initiatives and their benefits, which have been developed and implemented within the EU.
Methodology: A basic summary of a number of different pieces of research.
Key Findings: • Because of their sheer mass, heavy commercial vehicles involved in multiple vehicle RTIs cause very high rates of death and injury to other road users. • Speed control of buses and lorries is therefore a vital aspect of road safety. • Another cause of severe RTIs by bus and HGV drivers is the abuse of alcohol by them. Particularly in the case of a bus, a very high number of victims are likely to be involved. • Some European countries and manufacturers particularly target the implementation of alcohol interlocks (or alcolocks) in the bus and HGV sector in order to substantially reduce the number of alcohol-related RTIs. • In the case of buses, all passengers are more exposed to the risk of injury if unbuckled. • Seat belts in heavy duty vehicles are hence intended both at drivers and passengers to reduce the probability of injury to them and to make the injuries which occur at least less severe. • Research suggests that driver fatigue is a significant factor in approximately 20 per cent of commercial transport RTIs. • Peak levels of fatigue-related RTIs at night are often 10 times higher than daytime levels. • Every year a large number of vulnerable road users are killed or severely injured when lorries turn right. The main cause of these RTIs is the bad visibility field of the HGV driver on the right side of the vehicle. • Lorries with a gross weight over 7.5 tonnes have to be equipped with two mirrors outside on both sides of the vehicle, to recognise bicycle riders or pedestrians. • Based on real accident investigations it became apparent that the view out of lorries was still restricted. An additional EU Directive was released to improve vulnerable road users safety by upgrading the performance of rear view mirrors. • Due to the size and mass of heavy good vehicles, the problem of compatibility with other road users is a serious matter. • EU requirements have been introduced mandating front, rear and side underrun protection for lorries with a gross weight over 3.5 tonnes. • The current standards can however be largely improved. Research has shown that energy absorbing front underrun protection systems could save more than 1,000 fatalities per year, improved rear underrun protection systems could save a third of related fatalities per year and improved side underrun protection systems could save 45 per cent of related vulnerable road users fatalities per year.
Themes: Large vehicle safety.
Comments: Commercial transport – relates to goods vehicles as well as buses and coaches.

Title: Commercial Truck and Bus Safety Synthesis 7 Motorcoach Industry Hours of Service and Fatigue Management Techniques	

Author / organisation: Commercial Truck and Bus Safety Synthesis Program (CTBSSP)Transportation Research Board
Date: 2005
Format: Pdf. **Link:** http://trb.org/publications/ctbssp/ctbssp_syn_7.pdf
Free / priced: Free

Objectives:

- The primary objective of this research is to identify and document the fatigue effects of the extended workday that typifies motorcoach operations.
- The researchers also sought to identify any techniques that motorcoach managers, front-line employees, and drivers use to reduce fatigue-related incidences resulting from the irregular on-duty conditions facing the operator.
- A final objective is to identify any current or on-the-horizon technologies that may be appropriate for motorcoach operations to offset the effects of the extended workday and fatigue-inducing environment.

Methodology: The scope of the study included a literature review complemented by a survey of selected motorcoach bus companies, industry associations, insurers of motorcoach companies, state driver licensing agencies, private driving schools, and other organizations.

Key Findings:

- Managers surveyed for this and other studies reported very few bus RTIs associated with bus operator fatigue. The research personnel responding to the survey believe that bus operator fatigue may be a significant contributor to over-the-road safety incidents.
- However, the paper suggests that there is little statistical evidence to support this belief. Bus company managers identified operator training as a major countermeasure to bus operator fatigue.
- The researchers also identified rest and regular schedules as key features of any fatigue countermeasure program.
- Managers reported significant pressure from passengers to have bus drivers work for longer periods. They also reported that as many as 75 per cent of bus drivers also handle passenger luggage.
- There is no evidence that over-the-road bus drivers are any more susceptible to fatigue than other commercial drivers or other transportation drivers.
- There has been very little objective research conducted on over-the-road bus drivers and this is particularly true when it comes to fatigue research.
- Fatigue countermeasures that work for over-the-road HGV drivers should work for over-the-road bus drivers as well. Both bus and HGV drivers drive large vehicles on long, over-the-road routes.
- There is no evidence that bus and HGV drivers are drawn from different workforce populations; they are also subject to the same work related pressures, schedules, and challenges.
- The effects that passengers have on either combating or amplifying fatigue in bus drivers have not been well documented.

Themes: Coach drivers, Fatigue management.

Comments: The paper suggests that fatigue related crashes amongst motorcoach drivers are very rare, but also highlights the fact that a very limited amount of research has been carried out in this area.

Title: Commercial Truck and Bus Safety Synthesis 4 Individual Differences and the 'High-Risk' Commercial Driver
Author / organisation: Commercial Truck and Bus Safety Synthesis Program (CTBSSP)Transportation Research Board **Date:** 2004 **Format:** Pdf **Link:** http://onlinepubs.trb.org/onlinepubs/ctbssp/ctbssp_syn_4.pdf **Free / priced:** Free
Objectives: For each topic, the project objectives are: • To locate and assemble documented information; • To learn what practices have been used for solving or alleviating problems; • To identify relevant, ongoing research; • To learn what problems remain largely unsolved; and • To organize, evaluate, and document the useful information that is acquired.
Methodology: Literature reviews formed part of the work in this synthesis but the predominant source of data was from surveys of safety managers and other experts in the industry.

Key Findings:
• Survey findings strongly support the notion that high-risk drivers are a real and significant problem and that individual differences in safety among drivers are enduring
• Large individual differences have been seen in the rate of driver involvement in traffic 'near-miss' incidents, and 12 per cent of the drivers in the study were associated with 38 per cent of the incidents.
• Evidence suggests that individual differences in personality and performance predispose some people to increased RTI risk.
• Driver errors can be violations of rules, mistakes of judgment, inattention errors, or inexperience errors. Common driver errors resulting in RTIs include recognition errors and decision errors, or poor decision-making in dynamic traffic situations.
• Fleet safety management approaches to preventing high-risk-driver–related RTIs revolve around the basic management functions of selection and hiring, performance evaluation, and driver safety management practices.
• The clearest advice to safety managers is, "Don't hire a problem."
• Once drivers are hired, there are various ways to monitor their driving behaviours and modify their behaviour in ways that reduce risk:
   o Performance evaluation and feedback (perhaps enhanced by on-board safety monitoring of driver behaviour);
   o Training and counselling, performance incentives;
   o Behaviour-based safety; and
   o Driver self-management are among the methods described.
• Termination may be the ultimate solution when drivers are unmanageable from the safety perspective.

Themes: High-risk drivers, Safety management.
Comments: High-risk drivers present a problem in all commercial transport operations. Therefore identification and appropriate management are important aspects of safety within bus and coach companies.

Title: Work-Related Violence Case Studies: Public Transport - Bus drivers
Author / organisation: Health and Safety Executive
Date: Dec 2003   **Format:** website   **Link:** http://www.hse.gov.uk/violence/hslcasestudies/first.htm   **Free / priced:** Free
Objectives: To provide a summary of the risks to drivers along with successful measures that have been implemented to address them.
Methodology: A case study of First Leeds bus company was carried out to review the three year programme of violence prevention which they have implemented.

Key Findings:
 • A number of key risks face bus drivers such as carrying cash, road rage incidents, drunk or aggressive passengers and youth/anti-social behaviour.
 • These risk factors can manifest themselves in a number ways from straight out assaults, to robberies, being threatened with weapons or being on the receiving end of vile behaviour.
 • Incidents such as those listed above can have a wide ranging consequences not only the drivers themselves but also on the companies they work for as well as passengers on the bus.
 • Consequences can include:
    o Physical injury;
    o Stress and fear which have a cumulative effect on health;
    o Lost time and production because of sickness absence;
    o Demoralisation and staff losses;
    o A negative effect on recruitment because people are put off when they hear about the problems;
    o Financial loss through compensation claims – although this is mitigated by a company-specific sick pay scheme.
 • First Leeds bus company have trialled a number of different measures to address these problems some have been successful while others have not.
 • Successful measures include:
 • **Training and techniques:**
    o Diffusion techniques and interpersonal skills;
    o Liaison with police; and
    o Reporting incidents.
 • **Work Environment and equipment:**
    o Attack alarms;
    o Assault screens; and
    o CCTV.
 • While there have been costs associated with these measures, there have also been significant benefits such as declining assault rates, fewer compensation claims and improved morale.

Themes: Bus driver personal risks, Mitigation measures.
Comments: A useful summary of one of the main problems facing inner city bus drivers.

Title: The influence of work characteristics on the need for recovery and experienced health: a study on coach drivers.
Author / organisation: J.K. Sluiter, A.J. Van Der Beek, and M.H.W. Frings-Dresen (Ergonomics Vol 42) **Date:** 1999 **Format:** Pdf **Link:** Available through www.ingentaconnect.com **Free / priced:** Priced
Objectives: The work has three objectives – 1) To describe the work characteristics and job context of coach drivers in relation to occupationally induced fatigue. 2) To find out if high job demands and low job control are predictors of the perceived load at the end of the day. 3) To find out whether this perceived load and need for recovery are predictors of health complaints.
Methodology: The research is based on a questionnaire sent to 750 Dutch coach drivers.
Key Findings: - Exposure to occupational risk factors has often been demonstrated to be related to adverse reactions of short or long term psychological strain.   - These complaints have been reported most frequently when the psychological demands of the job are high and the worker's decision latitude is low.   - Signs of fatigue are mostly experienced during or after a day of work, which need not be a problem if enough time to recover is offered in between periods of work.   - Therefore, time seems to be the crucial variable in recovery from occupationally exerted efforts.   - Repeated insufficient recovery from work related fatigue however is seen as the take off of a vicious cycle requiring extra effort and accumulating fatigue which can ultimately lead to a breakdown in performance.   - Previous studies on city bus drivers found that drivers have strong feelings of fatigue, tension and mental overload.   - Occupationally induced fatigue was found to be a substantial problem in coach drivers, although it was found to be less of a personal problem.   - Three out of four coach drivers felt that fatigue adversely affected their driving.   - One third of drivers in the study reported mental overload as cause for their sense of being unable to make the next trip planned for them.   - This corresponds to the fact that mental overload was reported as one of the main health problems of city bus drivers.   - The reported influence of fatigue, problems of sleep quality and symptoms of emotional exhaustion, raises expectations of increased risk of RTIs and safety hazards for the coach drivers.   - The sub-population of express coach drivers in this study averaged 93 working hours per week during the high season, and since driving during night hours is normal practice in the long distance trips that these drivers perform, the risk of RTIs for these drivers is considered to be fairly high.   - Need for recovery proved to be a powerful predictor of experienced health complaints in coach drivers but further study is required to find out which work-rest ratios are optimal to prevent occupationally induced problems.
Themes: Bus/Coach driver fatigue, Recovery, Health Problems.
Comments: Dutch study but very relevant to the synthesis due to the focus on coach drivers.

Title: Stress and strain of short haul bus drivers: psychophysiology as a design oriented method for analysis	
Author / organisation: M. Gobel, J. Springer, and J. Scherff (Ergonomics Vol 41)	
Date: 1998	
Format: Pdf	
Link: Available through www.ingentaconnect.com http://www.ingentaconnect.com/search/article?option1=tka&value1=stress+and+strain+of+short+haul&pageSize=10&index=1	
Free / priced: Priced	

Objectives: To design a new driver work space that meets the specific ergonomic requirements of the driver in order to minimise their workload.

Methodology: Task analysis using video cameras was used to review the different actions and of the drivers as well as the vehicle and traffic situation outside of the cab. Strain analysis was also undertaken for these tasks to assess their physiological impact on the drivers.

Key Findings:

- Bus driver's jobs can be characterised by highly frequent and often simultaneous task execution, performed with a constrained body posture alongside exposure to vibration and noise.
- Psychological stress is also caused by the responsibility for security and schedule.
- The resulting health impairments, intensified by problems of shiftwork, lead to a high percentage of absence and a low retirement age.
- For example, German drivers are typically rejected following legal health tests with a mean age of 50.1 years, after less than 20 years of driving.
- Only 5 per cent of drivers are allowed to continue to the usual retirement age of 63 years.
- Empirical findings suggest that the traffic situation, the work schedule and the driver workplace in conjunction with the high demands for reliability have to be considered altogether as relevant factors contributing to the health status of the drivers.
- The research concluded that the application of psychophysiological methods as a scientific basis for the design process enabled the identification of important facts that would not be obtained from questionnaires alone.

Themes: Bus/Coach driver stress, Task and stress analysis.

Comments: A good study to show some of the stresses which bus and coach drivers are exposed to and gives an indication of the impact that this can have on their careers.

Title: Health and Safety Hazards for City Bus Drivers
Author / organisation: MFL Occupational Health Centre **Date:** 1998 **Format:** Webpage **Link:** http://www.mflohc.mb.ca/fact_sheets_folder/bus_drivers.html **Free / priced:** Free
Objectives: To summarise some of the health and safety issues facing bus drivers and provide some solutions to how these risks can be reduced.
Methodology: Literature review of existing work.
Key Findings: - Dozens of studies conducted over the last four decades in cities on almost every continent show that bus drivers, when compared to workers in other jobs, are more likely to experience: - Death from heart and blood vessel disease;   - Heart and blood vessel-related conditions such as chest pain and high blood pressure;   - Digestive disorders; and   - Musculoskeletal problems, especially of the back, neck and shoulders.   - Bus drivers frequently report tension, mental overload, fatigue and sleeping problems.   - Bus drivers also have more frequent absences from work and of longer duration than workers in other occupations. A large proportion of the work absences are attributable to stress-related disorders such as digestive problems and anxiety.   - Stress is believed to play a significant role in causing two of the diseases (heart and blood vessel disease and digestive disorders) found in excess in bus drivers.   - Typically, stressful jobs are those which have high psychological demands and little decision-making control, in combination with low social support on the job.   - Bus driving interferes with social support in two ways. The job itself is solitary with little chance for face-to-face contact between co-workers. The work schedule disrupts family and social life.   - How buses are designed and how work is scheduled may account for musculoskeletal problems associated with driving a bus.   - Research supports a number of measures to reduce work hazards for bus drivers. Measures include: - Reduce traffic congestion (bus lanes, signal priority);   - Reduce passenger inquiries (automated information systems);   - Enhance driver security (alarm systems, emergency procedures);   - Reduce social isolation on the job (schedule breaks in central locations);   - Reduce fatigue and interference with personal life (improve work schedules);   - Improve social aspects of work (supportive style of leadership); and   - Improve ergonomic design of buses (seat design, steering wheel design).
Themes: Bus driver health.
Comments: Although from the US and a slightly older source of data, the topics discussed are still very relevant to UK bus drivers.

Title: Drink-driving in commercial transport
Author / organisation: The European Transport Safety Council   **Date:** [no date]   **Format:** Pdf   **Link:**   www.etsc.eu/documents/DrinkDriving%20in%20CommercialTransport%20ETSC.pdf   **Free / priced:** Free
Objectives: To provide an overview of how drink-driving could be effectively tackled in commercial transport through various regulations and initiatives.
Methodology: The report reviewed current research, technology and legislation across Europe that is being used or could be used to prevent drink-driving.

Key Findings:
 • In Europe, at least 20 per cent of all road deaths in Europe are alcohol related whereas about only 1 per cent of all kilometres driven in Europe are driven by drivers with 0.5 g/l alcohol in their blood or more.
 • In July 2009, over 38,000 coaches were checked out by police forces in 17 countries: 55 bus and coach drivers were found to be above the legal limit, five were found under the effect of drugs and 106 did not hold a driving license, having previously been disqualified for offences. Drink-driving by coach drivers is thus as high as 0.15 per cent only, far less than in the general driving population.
 • Yet, alcohol related road RTIs in commercial transport result in more serious outcomes due to the vehicle RTI incompatibility caused by increased size and mass of commercial vehicles.
 • Hindering drink-driving in commercial transport could be achieved through actions in three main areas:
     o Regulations;
     o Awareness raising and education; and
     o Enforcement of law.
 • It appears that there is no one-fits-all solution to tackle drink-driving in commercial transport and that current technologies such as alcohol interlocks do not represent an end in themselves to solve the problem.
 • In the Commission Communication on an EU alcohol strategy the Commission invites the Member States to even consider a zero BAC limit for young and novice drivers and drivers of public transports and dangerous goods.
 • Consistent and visible enforcement has been shown to be a powerful deterrent to drink-driving. Enforcement methods which have proven effective include breath testing (random or where drink-driving is suspected), sobriety checkpoints, police patrols, and officer training.
 • A time series of roadside surveys in the Netherlands covering a 30-year period showed a high correlation between enforcement and drink-driving levels. During the whole period, each doubling of the enforcement level resulted in a substantial reduction (by approximately 25 per cent) of drink-driving.
 • Alcohol interlocks eliminate drink-driving virtually to zero once installed, but the positive effect on recidivism usually disappears completely after the lock is removed from the vehicle.
 • Various assessments have shown that an alcohol interlock is more effective than driving licence suspension in preventing recidivism.

Themes: Drink-driving, Commercial vehicles, Preventative measures.
Comments: Commercial transport – relates to goods vehicles, buses and coaches.

Title: Bus Collisions: Analysis of collision data covering the 10 year period 2000-2009
Author / organisation: Sheffield City Council **Date:** [no date] **Format:** Webpage **Link:** http://www.roadsafetyknowledgecentre.org.uk/issues/driving-for-work/knowledge/419.html
Free / priced: Free
Objectives: To provide a summary of bus collision statistics for Sheffield from 200-2009.
Methodology: A literature review of RTI statistics in Sheffield.
Key Findings: • In the 10 year period covering 2000-2009 there were 2,703 collisions involving a bus, 12 per cent of all collisions in Sheffield. 11 per cent of these were KSI, 9 per cent of all KSI collisions. • The number of slight bus collisions is falling in-line with other types of collisions; however the number of KSI collisions is not. • Collisions involving a bus make up 12 per cent of all collisions in Sheffield and 9 per cent of KSI collisions. • Buses account for only 3 per cent of traffic on roads in Sheffield, yet bus passengers make up 24 per cent of all passenger casualties. • 86 per cent of collisions take place between 8am and 6pm on a weekday, peaking between 3pm and 4pm. There is more than average on a Friday. • 40 per cent of KSI collisions involving a bus passenger being injured were caused by heavy braking.
Themes: Bus collision data, Statistics.