

# **MEANS OF ESCAPE IN THE EVENT OF BUS/COACH FIRES**

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## **ABSTRACT – Means of Escape in the Event of Bus/Coach Fires**

Fires in buses/coaches are a risk to passengers and a risk to an industry that wants to promote safety for their passengers. Reports from tragic incidents that have resulted in fatalities indicate delays in evacuation and/or inadequate means for passengers to escape.

This presentation would explore the fundamental principles of means of escape as applied to bus/coach travel. It will look at exit design and position and the challenges faced by manufacturers and operators as they look to combine functionality with escape principles. It will concentrate on transport used in longer journeys where access/egress are not a frequent feature but comfort and luggage capacity are.

The presentation will consider the factors that impact on fire development and, therefore, the time available for escape. It will consider passenger behaviour and will look at the need to take into account the nature of the vehicle occupancy. In particular, it will look at evacuation involving passengers with limited mobility or other factors that may lengthen evacuation times. Safety critical information for passengers will be examined and how that information may be shared.

Finally it will examine the role of the ‘responsible person’, usually the driver, in initiating and guiding evacuation. This will emphasise the importance of driver training.

**Keywords:** means of escape, fire development, evacuation, vehicle occupancy

# MEANS OF ESCAPE IN THE EVENT OF BUS/COACH FIRES

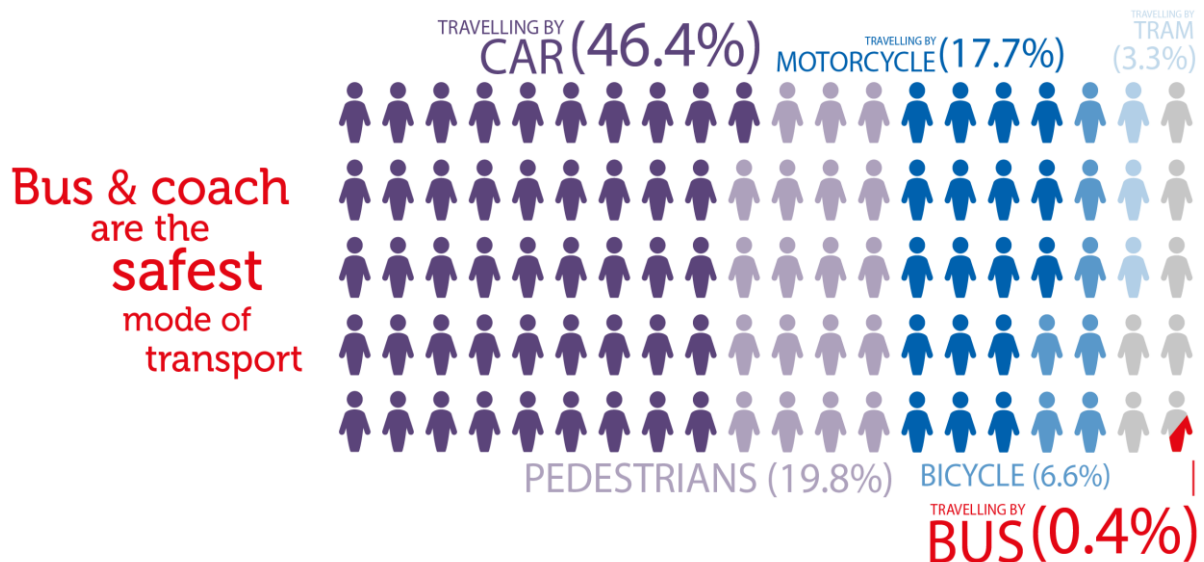
## INTRODUCTION

Fires in buses/coaches are a risk to passengers and a risk to an industry that wants to promote safety for their passengers. Reports from tragic incidents that have resulted in fatalities indicate delays in evacuation and/or inadequate means for passengers to escape.

## BACKGROUND

To the credit of the bus/coach industry, this form of travel is widely known to be relatively safe[1]

### Road fatalities in the EU by transport mode



Yet a fire in a bus attracts attention that can be damaging to the reputation of the industry and is regarded differently by the public. For instance, a car accident involving a family on the way to school is reported as a car accident; a bus carrying children to school would be reported as a 'school bus' accident and viewed from the viewpoint that the care of children had been handed to a bus company and somehow they had failed.



An additional factor that sets apart fires in bus/coaches is that it can often involve a larger number of people/victims and inevitable attracts more attention. A fire occurring in a 'sleeping bus' near Hanover, northern Germany that killed 20 elderly people received widespread coverage and still features high in internet search engines.

### **Bus fire in southern India leaves 42 dead, 30 October 2013**

At least 42 people have died after the luxury bus they were travelling in caught fire in India's southern state of Andhra Pradesh, police said. The bus, carrying more than 50 passengers, was travelling from Bangalore city to Hyderabad, Andhra Pradesh's capital, when the incident happened early on Wednesday. Seven people, including the driver, managed to escape the blaze

Similarly, a bus fire in southern India that killed 42 people received international coverage including from the BBC[1].

A worrying feature of the accidents referred to above and many others reported around the world is the reference to difficulties experienced by passengers in escaping the blaze and the speed with which a fire developed. For instance, one quote in a news feed[2] '*Some of the victims had difficulty walking and were unable to escape in time, the tour company said*'; in another fire[3] it was reported that '*A group of schoolchildren had a miraculous escape when they were evacuated from a bus minutes before it burst into a raging fireball*'. There is a recurring message of rapid fire spread and difficulty escaping. It is timely, therefore, to consider the principles of Means of Escape and how they can be applied to bus/coach transport.

## **MEANS OF ESCAPE PRINCIPLES**

An old established principle of escape is that people should be able to escape from fire *by their own unaided efforts and without being placed at hazard whilst doing so*[4]. A similar definition can be given as *occupants should be able to reach a place of safety, unharmed, in the event of a fire occurring*[5]. The emphasis in these and other definitions is being able to travel away from a fire and reach a place of safety - in terms of bus/coach you would expect this to be away from the vehicle - usually by their own means. To achieve this outcome, needs a number of components.

### **Exit Provision**

In considering the position of exits, other than in a small vehicle, it is reasonable to expect that a fire or other emergency may render an exit unavailable. Exits must be true 'alternatives' and not capable of being rendered unusable by the same event. They should also be accessible without undue difficulty, easy to operate and negotiate and well marked. The remaining exit(s), therefore, must be sufficient to allow all the passengers to leave before the environment within the passenger compartment becomes untenable. Such provision must also be mindful of the varied nature of passengers whether it be the very young (school bus for instance) or the elderly and infirm.

## Access v Egress

This is an area where there can be differences between buses designed to be used for urban routes where there are expected to be multiple stops for passengers to board or leave. By design, these buses are more likely to have ample exits designed to maximise the flow of passengers on and off the bus including features such as ramps and lowered suspension. Intrinsically these designs will offer more effective exit provision in the event of fire. One qualification, however, is that in some emerging economies they do not have the luxury of different buses for different purposes/locations so some of these design benefits may not be realised.



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With regard to buses designed for inter-city type travel or touring, the design emphasis is on passenger comfort, passenger numbers and luggage capacity. We see, therefore, designs that have limited entrance/exits in 'normal' use and rely on emergency exits in the event of an emergency. We also see luggage stored at a low level on a bus with the passenger compartment situated above the luggage. This often means emergency exits are at window level up to 2m above ground level creating a potential hazard to escaping passengers and a daunting 'leap of faith'.



In some cases vehicles are designed for overnight travel and known as sleeping coaches. This produces another challenge for designers as passengers are provided with reclining chairs or beds where space is at a premium. Provision should still be made for evacuation in an emergency with sufficient exits that are easily available. There is likely to be a need to factor in more time for escape if it is expected the reaction time of passengers will be delayed.



## ESCAPE TIME

A simple concept exists to base the time needed for escape[6]. This is based on a relationship between *Critical Time* and *Reaction Time*. *Critical Time* is the time available before a compartment becomes intolerable due to the effects of fire and smoke and *Reaction Time* is the time taken for passengers to react to the fire and reach a place of safety. Means of Escape should be designed so that the *Reaction Time* is less than the *Critical Time*.

Designers and operators can look at both elements of this 'Time equation' to increase the safety of passengers. For instance, whilst measures to mitigate a fire and reduce fire development can increase the *Critical Time* improving the size, position and accessibility of exits can reduce *Reaction Time*.

## Fire Development

A primary means of reducing fire risk is to have quality design and manufacture to minimise the likelihood of fire. Similarly, modern engine fire suppression systems can minimise the impact of fires in these areas. In terms of means of escape, however, reducing fire development is an important consideration as it increases escape times.

Images of bus fires are very revealing. There are many examples of bus fires that are attributed to such things as electrical causes yet show a bus totally consumed in fire. On examination, it can be seen that the area responsible for fire development is the passenger compartment and the item on fire is the soft furnishings such as seat upholstery. aircraft, for, instance, this would be unacceptable as seats have to be able to pass simple functional fire tests that reduce their ignitability and their ability to develop a fire.



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## Passenger Behaviour

It is known that there is a tendency for people escaping from a fire to instinctively head for the exit by which they entered – the familiar route. For people to consider alternative exits requires knowledge and understanding on their part and can be encouraged by the action of a 'responsible person'.

A useful comparison is to think of the standard information given to passengers before every air flight which gives a thorough overview of evacuation procedures and identifies alternative exits. An alternative means of providing such information in other forms of transport is beginning to emerge through the use of technology on TV screens that, with the use of standard symbols, can be an effective way of giving information. Emergency evacuation information should be given a higher priority.

## Passenger Mobility

Passengers come with varying degrees of mobility and ability to evacuate quickly. Anecdotally, this author expected the age profile of coach users to be older but this would be too sweeping a generalisation. For instance, a report commissioned by the EU[7] said *‘The results show a significant difference between the Member States: users in Greece and Spain tend to be young, whereas in the UK and Sweden users tend to be older. In the UK, users of occasional coach services tend to be much older than users of regular services, whereas the reverse is true in Sweden. This may indicate that school tours account for a significant proportion of occasional trips in Sweden’*. This shows the challenges faced by coach operators who have to plan for passengers of all ages, sizes and mobility levels.

Bus/coach designers must plan for likely occupancy and their ability to negotiate exits. It is perhaps only on bus/coaches where it is common to see emergency exits reached via breaking/removing windows having first negotiated seating before facing a significant drop to the ground!



## THE ‘RESPONSIBLE PERSON’

Mentioned above has been the role of what could be called the ‘Responsible Person’ – normally the driver. If a parallel is drawn with aircraft safety, one provider[8] says *‘The primary responsibility of the cabin crew during an evacuation is to direct passengers to evacuate the aircraft using all of the usable exits’* and recognises that *‘An assertive cabin crew that uses short, clear commands will have an immediate impact on the rapidity of the cabin evacuation’*. These principles can be applied to drivers.

A driver should be trained and regularly assessed as to their competency in emergency evacuation. It should be recognised that their action in the early stages of an emergency can have a significant bearing on the outcome. Recognising early on that an evacuation should be initiated will save valuable time. Similarly, a driver can give guidance, direction and confidence to passengers enabling a swift evacuation.

## CONCLUSION

The risk from fire in buses/coaches can be reduced by design and active fire suppression systems. Adequate provision needs to be made for escape that takes account of passenger characteristics and behaviour enhanced by proper driver training.

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## Reference List

1. *EU Care Database* 2011
2. *BBC News India* October 2013
3. *BBC News Europe* November 2008
4. *The Leader NWN Media* May 2012
5. Marchant, E.W. 1972, *A Complete Guide to Fires and Buildings*
6. Shields, T. J. Silcock, G.W.H. 1987, *Buildings and Fire*
7. Marchant, E.W. 1972, *A Complete Guide to Fires and Buildings*
8. *European Commission, Study of passenger transport by coach*, Final Report, June 2009
9. Airbus, *Flight Operation Briefing Notes*, Cabin Operations, November 2006

## THE AUTHOR

Mike Hagen is a founding member and Managing Director of Fire Safety Platform. Mike worked for more than 33 years in the Fire and Rescue Service in the UK. For 9 years he was Deputy Chief in the Metropolitan area of Merseyside (a region that includes the city of Liverpool) and led the change in focus for the fire service that saw them apply the same skill and energy to community fire safety as they did to the all-important emergency response. The core of the philosophy was that a fire service has unique access to those most vulnerable to fire by virtue of the position of trust a firefighter has in local communities; they can visit people in the home to help apply simple measures to reduce risk.

This ground-breaking work in community fire safety led to him being invited by fellow fire professionals to speak of his experiences and the lessons learned in many venues across Europe and further afield. Meeting others who are committed to fire safety has helped Mike create a wide fire network on which the Fire Safety Platform is built. Through this network he has become a safety expert panel member of Busworld an organisation that promotes bus and coach travel.

Mike has a first class degree in fire engineering and is a Chartered Engineer; he is a Companion Fellow of the Institute of Fire Engineers where he has been a member for over 30 years.

Mike is also passionate about the people and mountains of the Himalayas. He is chair of the trustees who run a small charity called Classrooms in the Clouds that is dedicated to working with local communities to improve the education chances for children in the very poor country of Nepal. He regularly visits the area and enjoys trekking through the mountains. Mike is married to Sarah and has 3 grown up children.

*The Fire Safety Platform is a non-profit association with a mission to reduce the risk from fire. It is an independent body that does not support any individual fire safety product, technology or commercial organisation. Support is welcome from all individuals and organisations concerned with fire safety. Currently, the Platform receives financial support from Albemarle, Busworld, Chemtura, the European Flame Retardants Association (EFRA), ICL Industrial Products and Sprue Safety Products. Burson-Marsteller Brussels acts as the secretariat to the Fire Safety Platform*