Road safety factsheet: Airbags

March 2024

In 2022, 74,379 people were killed or injured while travelling in cars, and 51,623 (69%) of these were the driver[1].

Number of car occupant casualties in 2022, by severity[1]

	Drivers	Passengers	Total
Killed	543	245	788
Seriously Injured	7,127	3,584	10,711
Slightly Injured	43,953	18,927	62,880
All	51,623	22,756	74,379

Seatbelts have proved to be very effective in reducing the severity of injuries in the event of collisions. However, in frontal collisions, car occupants are still injured by being thrown onto unpadded parts of the car interior such as the steering wheel and the dashboard. Therefore, in recent years, airbags have been introduced to provide further protection. However, it must always be remembered that airbags are an addition rather than an alternative to seatbelts.

How airbags work

Airbags inflate rapidly (and then immediately deflate), cushioning the occupants and preventing or reducing the level of contact with the steering wheel or dashboard.

They need to inflate at an extremely fast rate to be fully inflated by the time a person's body begins to move in reaction to a collision. The bigger the airbag, the faster it must inflate. Typically, European airbags hold 35 litres of gas propellant and fully inflate within 25 milliseconds, which means that they have to expand at anything up to 160mph. American airbags, usually holding 60 litres of gas, have to inflate even faster. The area of space within the car taken up by the airbag as it inflates is known as the 'airbag deployment zone'. Sensors within the vehicle monitor the direction and severity of an impact and deploy the airbag if the severity and direction warrants it. The impact should be greater than 20mph, and in a frontal direction for the airbags to deploy. Rear

[1] Department for Transport (2023) 'Table RAS0201: Reported road collisions, vehicles and casualties for GB: Road user type, numbers and rates, https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain#road-user-type-ras02 – accessed March 2024

end shunts should not deploy the airbag. As the airbag module fires, it and the gas it generates are hot, so car occupants may suffer minor burns.

The effectiveness of airbags

When airbags were first introduced in the United Kingdom and Europe, the only research on their effectiveness came from the United States of America. These studies looked at the bigger airbags used in America which were designed to protect a driver not wearing a seatbelt. These airbags inflate very fast and have caused some fatalities. The National Highway Traffic Administration in the United States estimates that from 1987 to 2015, frontal airbags saved 44,869 lives[2].

Airbags are now much more common in European vehicles and research on their effectiveness is now available. However, a lot of this research is focussed on the development of smart airbags and is looking at cases where injury has taken place.

Studies indicate that there may be a correlation between height, weight and driver injuries from airbags. Shorter (under 160cms) and lighter (under 55kgs) drivers who sit closer to the steering wheel are more likely to suffer more injuries from airbags.

A review of driver airbag deployments in Europe and Japan[3] found that there was some evidence to suggest that unrestrained drivers in frontal impacts are more likely to sustain greater severity of injuries from an airbag. However, this must be seen in relation to the severity of injuries that would be sustained by an unbelted driver in a vehicle without an airbag. It reinforces the need to use airbags with seatbelts.

Common concerns with airbags

Rearward facing child seats

A rearward-facing child seat **must not** be used on the front passenger seat with an active passenger side airbag, because the child seat would be within the airbag deployment zone. If the airbag is triggered, it will hit the child seat with considerable force and accelerate both it and the child towards the rear of the vehicle.

Forward facing child seats

There is some indication that even with forward-facing child seats, airbags could impinge on the restrained child, if the car seat is positioned too far forwards or the child seat is not securely fitted.

[2] NHTSA (undated) 'Air Bags' https://www.nhtsa.gov/equipment/air-bags - accessed July 2023

[3] Morris et al (1996) 'A Review of Driver Airbag Deployments in Europe and Japan to Date', *Proceedings of the Fifteenth International Technical Conference on the Enhanced Safety of Vehicles.*

To prevent this, fit the child seat securely, outside the deployment zone of the airbag. Either fit them in the back of the car if this means that they are clear of any side impact bags, or if the seat must be fitted in the front, ensure that the car seat is as far back as possible, and stays there, and that this takes the child and seat out of the deployment zone. The car manufacturer will be able provide information on the extent of the deployment zone.

Pregnant women

Concerns have been expressed regarding the potential harm airbags may cause to unborn children. As a precaution, pregnant women should have the car seat positioned as far back as possible, to take them out of the deployment zone.

Driver positioning

Airbags are designed to operate with drivers and passengers in the optimum position. If drivers and passengers are not, they can be injured if the airbag deploys.

Nothing should impede the deployment of the airbag. For example, if the occupant's arm gets is in the deployment zone, injury can occur. Drivers should ensure that they use the "ten to two" or the "quarter to three" position with their hands on the wheel because if they have their arm across the wheel when the airbag fires, the force of the airbag is likely to break the limb.

Hearing loss

Another issue, which has been raised around airbags, is that hearing loss may occur as a result of air bag inflation in low-speed crashes. A study[4] exploring hearing loss and airbag deployment concluded that this is an infrequent occurrence. However with more airbags in smaller cars, the occurrence may become more common with trauma being caused both by the increased pressure within the vehicle and the noise of the airbag firing. This is an issue which will require further investigation as more data becomes available.

Shorter, lighter drivers

Research shows that shorter lighter drivers under 55kgs and 160cm tall are at greater risk of being hurt by an airbag. Smaller drivers will normally move their seat closer to the steering wheel to control pedals, and hence, are closer to the airbag deployment zone. Therefore, it is possible that they would be hit by the airbag while it is inflating. Other factors that may increase the risk are pre-collision braking, slack seatbelts and/or seatbelt stretch. Shorter, lighter drivers should therefore ensure their seatbelt is in good condition and that it is holding them firmly in position and that their seating position takes them out of the deployment zone for the airbag.

Drivers with disabilities

TRL carried out research for the then Department of the Environment, Transport and the Regions (DETR) to investigate the effects of airbags on steering devices for disabled drivers attached to the rim of the wheel of a car, because concerns had been raised that such devices could cause injury when the airbag fired. The

[4] Huelke et al. (1999) 'Hearing Loss and automobile airbag deployment' *Accident Analysis and Prevention,* 31:789-792

adaptations tested, "a steering spinner", "a steering spinner with infrared unit and a "tetraplegic grip" allowed the airbag to inflate fully without damage to either the device or the user. However, steering devices with a fixing bar which crosses the centre of the steering wheel should not be used with an airbag. If a driver's stature or disability requires them to sit within the deployment zone or they need to place their arm across the wheel to steer, then the use of an airbag may be contra indicated.

A number of motor manufacturers have developed 'smart' airbag systems, which, can detect seat and driver position and alter the performance of the airbag accordingly. Some vehicles also have 'restricted' smart airbags, which only inflate if sensors indicate that a person is sitting in the seat.

However, in exceptional circumstances, it might be necessary to consider disabling the driver's airbag due to the extreme closeness of the driver to the steering wheel, but this must be a last resort when all other adaptations have been considered. The airbag should be reconnected before the car is eventually sold. You should inform your insurance company and display a sign in the vehicle that the driver's airbag has been disabled. The vehicle will not fail the MOT if the airbag has been professionally disarmed including the warning lamp.

Conclusion and Advice

Airbags are an effective secondary safety measure that reduces the risk of injury for vehicle occupants, in more severe collisions. RoSPA supports the fitment of airbags in vehicles if they are used in conjunction with - but not in place of - seatbelts.

Some problems with airbags have been identified, although many of these relate to American airbags. UK car users can avoid such problems by the following the below advice:

- Seatbelts should always be worn properly and should be adjusted to be as tight as possible across the body. Drivers and front seat passengers should ensure that as far as possible they are sitting squarely in their seat
- Rearward-facing child seats **must not** be placed on the front passenger seat if a passenger airbag is active
- If a rearward-facing child seat must be used, the passenger airbag must be deactivated first
- A forward-facing child seat should only be used in the front seat if it can be positioned so the child is out of the deployment zone of the airbag
- The driver's seat should be positioned as far back as possible while ensuring that the driver can safely and comfortably operate all of the vehicle's controls.
- Drivers should always use the ten-to-two or quarter-to-three hand position on the wheel, when driving. If the airbag fires with their arm across the wheel, the impact could break the arm.
- Airbags should be replaced if they deploy and most manufacturers recommend replacement of unused airbags after 10 years. Check and follow the manufacturer's guidance.
- Clear guidance from manufacturers, vehicle dealerships and garages should be available, and where the use of an airbag is contra indicated for safety reasons, it should be easy to have them disabled.