

# Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants

## Abstract

Data from in-depth accident investigation studies and police fatal accident files were used to calculate the relationship between impact speed and risk of fatal injury for both pedestrians and car occupants in road traffic collisions. Using the same method, results from other studies were compared to determine how much the relationship varies across countries and over time.

It was found that, for pedestrians in impacts with the front of cars, the risk of fatality increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly (between 3.5 and 5.5 times from 30 mph to 40 mph).

## Findings

This study explored the relationship between speed and the risk of being killed for three groups of casualties in road traffic collisions: pedestrians hit by the front of cars, belted car drivers involved in a frontal impact with another car, and belted car drivers in side impacts with another car.

In each case, in-depth accident data for Great Britain collected over the period 2000–09 were used. For pedestrian impacts, data from two other datasets were analysed in the same way for comparison (for Great Britain in the 1970s and for Germany from 1999 to 2007).

- The three pedestrian datasets studied show a similar pattern in fatality risk. The risk increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly – the increase is between 3.5 and 5.5 times from 30 mph to 40 mph.
- Based on in-depth data from Great Britain for 2000–09, the risk of pedestrian fatality is estimated to be approximately 1% at an impact speed of 20 mph, 7% at 30 mph and 31% at 40 mph. These are estimates which are subject to margins of error, but the pattern shown is consistent with similar analyses of other datasets.
- The risk of fatality is generally higher for the dataset from the 1970s, indicating that the risk of pedestrian fatality has reduced over the last 30 years.
- Generally, it appears that the risk of pedestrian fatality is similar for children and adults, but higher for elderly pedestrians.
- Even though the risk of pedestrians being killed at 30 mph is relatively low, approximately half of pedestrian fatalities occur at this impact speed or below, because of the relatively large number of pedestrian accidents at lower speeds.
- The risk of a belted car driver being killed in an impact with another car is much higher in a side impact than in a frontal impact with the same change of velocity.

## Background

There are many variables in a road traffic accident that will affect the injury severity of the casualties involved, including factors relating to the casualty, vehicle and wider environment.

One of the most widely studied variables is speed. For pedestrians, this is measured in terms of the speed of the colliding vehicle at the point of impact. For vehicle-on-vehicle impacts, the change in velocity of the vehicles involved is generally accepted as the measure of speed that is most closely linked to injury severity.

This study investigated the relationship between speed and fatal injury, for both pedestrians and car occupants. The risk of fatality with impact speed (for pedestrians) and change in velocity (for seat-belted car drivers) was calculated using a logistic regression method, applied to data from three sources of in-depth accident data in Great Britain: the On The Spot project, police fatal accident files, and the Co-operative Crash Injury Study.

Data from the in-depth studies were weighted to the number of casualties occurring nationally, to ensure that the results are representative in terms of severity level.

The same method was applied to two other important sources of pedestrian accident data: data collected by Ashton and Mackay in Birmingham in the 1970s, and data from the German In-Depth Accident Study (GIDAS). Using the same method on these different datasets means that the results can be directly compared.

Risk curves were plotted for each dataset, showing how the risk of fatality increases as speed increases, and confidence intervals around the estimated relationship are presented. In some cases, results should be treated with caution because of the relatively small sample sizes involved.

## Conclusions

It was found that, for pedestrians in impacts with the front of cars, the risk of fatality increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly (between 3.5 and 5.5 times from 30 mph to 40 mph).

The risk of a belted car driver being killed in an impact with another car is much higher in a side impact than in a frontal impact.

## About the project

Data from the On The Spot (OTS) project and Co-operative Crash Injury Study (CCIS) were used to investigate the relationship between speed and fatal injury. These are in-depth collision investigation studies that contain a large amount of detail for each accident, including information collected at the scene and collision reconstructions (OTS) and data collected from vehicle inspections at recovery garages and car occupant injuries (CCIS).

## Further information

The full report, **Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants**, by D.C. Richards (TRL), is published by the Department for Transport (ISBN 978 1 84864 092 4, free web download, [www.dft.gov.uk/pgr/roadsafety/research/rsrr](http://www.dft.gov.uk/pgr/roadsafety/research/rsrr)).

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