

Synthesis title: Adult pedestrians

Observatory main category: Pedestrians

Other relevant syntheses to be consulted:

- Safe Route Planning (Pedestrians)
- Pedestrian (Roads)

Keywords:

- Adults; Pedestrians, Education.

Key facts

- There were 17,552 adult pedestrian casualties in Great Britain in 2016, of which 414 were fatalities.
- The number of casualties amongst adult pedestrians tends to decrease with age: for example in 2016 there were 1,938 pedestrian casualties aged 20 to 24 years old and 1,252 pedestrian casualties aged 50 to 54.
- Adult pedestrian casualties in Great Britain are predominantly male. From the 2011 to 2015 average 57 per cent of pedestrian casualties aged 16 to 59 were male; in 2016 it stood at 56 per cent.
- Failing to look properly is by far the most frequently reported contributory factor allocated to pedestrians in casualty RTIs.

(RRCGB, DfT, 2017)

- There exists a well established link between road casualties and deprivation. Amongst adult pedestrians, studies have shown a ratio of 4:1 between numbers of casualties in the most deprived compared to the least deprived locations.

(N .Christie *et al.*, 2010)

- The risk of RTI involvement amongst pedestrians increases significantly when blood alcohol concentrations are above 100-150 mg/100ml, according to a study carried out in the West Midlands, UK.

(DfT, 2001)

Summary

For the purposes of this synthesis adult pedestrians are defined as those aged 16 to 59, which is the age range commonly used to describe adults in the '*Reported road casualties Great Britain*' reports. Where some authors of other research have used different age bands, these are clearly stated.

Pedestrians face specific road safety problems:

- Vulnerability – pedestrians lack physical protection, sub-groups such as older pedestrians may be especially frail;
- Conspicuity – pedestrians are small compared to vehicles;
- Effort – pedestrians are self-propelled and effort associated with making a detour results in direct desire lines; and,
- Distraction – pedestrians are often also engaged in other activities.

Accident statistics show that two thirds of adult pedestrian casualties in Great Britain are male. However, there are very few pedestrian safety educational campaigns aimed at adults and almost no research into how such programmes impact casualties.

Visibility, impairment and distraction are typical contributory factors. It has been found that lighting road crossings (to increase visibility) tends to reduce casualties, and that the casualty risk for pedestrians increases significantly when their blood alcohol concentration exceeds 150mg/100ml. Less is known about distraction, although one North American study found that more drivers yielded to a visibly inattentive pedestrian than to a visibly attentive one.

The United Kingdom has few laws for pedestrians; most obviously there are no laws to prevent crossing the road except at crossing points (i.e. jaywalking). For this reason, there is limited scope for pedestrian enforcement. Studies are cited in which police presence has improved driver and pedestrian behaviour at crossings; however one such study was carried out in 1968 and relevance today is likely to be limited.

Given the lack of legal framework, pedestrians in the UK cross the road according to their own convenience when they identify gaps in traffic (i.e. regardless of the status of a red or green man). Many adults are capable of crossing the road safely regardless of signals – studies have not been able to link 'red man compliance' with accident rates.

Effective engineering interventions include: signalised crossings (Puffin), pedestrian guard rails, advanced stop lines, central refuges, kerb extensions and pavements on both sides of the road. There is a large body of research concerning crossing design which, for example, has resulted in the improvements to Pelican crossings which have developed into the Puffin design.

A programme of countermeasures combining education, enforcement and engineering treatments has demonstrated safety improvements. In Miami-Dade County, Florida four high pedestrian risk RTI zones were identified and local knowledge utilised to apply a suitable blend of counter measures.

Vehicle design has advanced to the benefit of pedestrian safety.

Innovations such as active bonnets are designed to reduce injury in the event of a pedestrian being struck. However, there is a perceived risk to pedestrians from the very low noise levels of hybrid / electric vehicles – a UK study found that although these vehicles tend to be involved in fewer RTIs overall, relatively more of the RTIs that do occur involve hitting a pedestrian.

Methodology

For the purposes of this synthesis adult pedestrians are defined as those aged 16 to 59, which is the age range commonly used to describe adults in the '*Reported road casualties Great Britain*' reports. Where some authors of other research have used different age bands, these are clearly stated.

This synthesis was compiled during July 2012. 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>.

The steps taken to produce this synthesis are outlined below:

- **Identification of relevant research** – searches were carried out on pre-defined research (and data) repositories. As part of the initial search some additional information sources were also consulted, which included <http://www.ite.org>, <http://www.ingentaconnect.com> and <http://www.vtpi.org>. Search terms used to identify relevant papers included but were not limited to:
 - 'Pedestrian safety';
 - 'Pedestrian casualty'; and,
 - 'Pedestrian education'.

A total of 52 pieces of relevant research were identified. Of these, 31 pieces of research originate from the UK.

- **Initial review of research** – primarily involved sorting the 51 pieces of research, based on key criteria, to ensure that the most relevant and effective items went forward for inclusion in this synthesis. Key criteria included:
 - Subject age group - there has been a conscious effort to focus on work relevant to 16 to 59 year olds and not to duplicate research included in other pedestrian syntheses (child, teenager, older), so far as possible.
 - Relevance – whether the research has adequate focus on adult pedestrians and countermeasures or challenges relevant to this group.
 - Provenance – whether the research is relevant to adult pedestrians, road safety professionals or road safety policies in the UK.
 - Age of research – whether the research has been published within the last 10 years (exceptions are made for noteworthy items which are older).

- Effectiveness – whether the research credibly proves (or disproves) the effectiveness of particular interventions to improve road safety for adult pedestrians.

Following the initial review, 24 pieces of research were taken forward to form the basis for this synthesis.

- **Detailed review of research** – key facts, figures and findings were extracted from the identified 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.
- **Review** – the draft synthesis was subjected to extensive review by a subject matter expert, proof reader and an independent Evidence Review Panel appointed by the DfT.

Much of the research does not explicitly disaggregate main results into applicable pedestrian age bands. Hence the default position for this synthesis is that generally stated findings without age-related qualifiers are taken as broadly applicable to adult pedestrians.

A proportion of the research taken forward in this synthesis derives from outside of the UK. These have been included where they are relevant to UK road safety, and in particular where the effectiveness (or otherwise) of interventions has been evidenced or measured.

Please note that the terms Great Britain and UK have been reproduced in this synthesis as they have been used in the associated references.

Key statistics

This section collates key statistics relating to adult pedestrians.

Demographics

- There were 12,674 adult pedestrian casualties in Great Britain in 2011, of which 222 were fatalities.

(DfT, 2012)

- The number of casualties amongst adult pedestrians tends to decrease with age: for example in 2010 there were 2,361 pedestrian casualties aged 20 to 24 years old and 1,032 pedestrian casualties aged 50 to 54.
- Adult pedestrian casualties in Great Britain are predominantly male. From the 1994 to 1998 average 66.8 per cent of pedestrian casualties aged 16 to 59 were male; in 2010 it stood at 66.2 per cent.

(P. Kilbey *et al.*, 2011)

More recent statistics are available in [Reported Road Casualties Great Britain 2016](#).

Trends

Pedestrian RTIs may be grouped by trend, some of the most pertinent of which are detailed here. Regarding RTI involvement:

- There exists a well established link between road casualties and deprivation. Amongst adult pedestrians, studies have shown a ratio of 4:1 between numbers of casualties in the most deprived compared to the least deprived locations.

(N. Christie *et al.*, 2010)

Regarding potential contributory factors, prevalent pedestrian characteristics include distraction and impairment:

- Failing to look properly is by far the most frequently reported contributory factor allocated to pedestrians in casualty RTIs (allocated in 10 per cent of RTIs in 2010).

(P. Kilbey *et al.*, 2011)

- A North American study on distracted road users considered conflicts between drivers and pedestrians when the latter attempt to use a crosswalk. It found that 21.3 per cent of manoeuvres resulted in conflicts when the pedestrian displayed attentive behaviour but only 16.8 per cent resulted in conflicts when the pedestrian displayed visibly distracted behaviour. This may be partially explained by observations that 57.4 per cent of drivers yielded to the attentive pedestrians and 80 per cent yielded to the visibly distracted pedestrians.

(R. Brumfield and S. Pulugurtha, 2011)

- There is a problem with alcohol involvement and pedestrian casualties. Studying pedestrian fatalities from single vehicle RTIs in North America in 2001, it was found that 33 per cent of pedestrians were intoxicated (compared to 14 per cent of drivers).

(S. Umesh, 2003)

- The risk of RTI involvement amongst pedestrians increases significantly when blood alcohol concentrations above 100-150 mg/100ml, according to a study carried out in the West Midlands, UK.

(DfT, 2001)

- In Great Britain in 2009, 4.7 per cent of drink drive RTIs involved one or more pedestrian.

(P. Kilbey *et al.*, 2011)

Visibility of pedestrians is also a significant factor:

- Pedestrian fatalities are more prevalent in the dark. Studying pedestrian fatalities from over 18,000 single vehicle RTIs in North America between 1998 and 2001, it was found that 63.3 per cent occurred in dark or dark but lit conditions.

(S. Umesh, 2003)

- However, pedestrian RTIs are more prevalent in daylight when all severities are taken into account. Considering 70,000 pedestrian RTIs in North America between 1995 and 1998, it was found that 63.5 per cent occurred in daylight.

(M. daSilva *et al.*, 2003)

Road traffic incident characteristics

A number of studies consider the behaviour of vehicles in the event of a pedestrian RTI:

- A study of pedestrian RTIs in North America in 1995-98 considered the intended manoeuvres of involved vehicles:
 - Straight line 76.3 per cent;
 - Turning 15.4 per cent;
 - Reversing 2.5 per cent; and,
 - Other 5.8 per cent.

(M. daSilva *et al.*, 2003)

- Vehicle speed at impact is known to be linked to pedestrian fatality risk. Up to an impact speed of around 30 mph the risk increases slowly. Above 30 mph the risk increases rapidly – there is a 3.5 to 5.5 times increase in fatality risk from 30 mph to 40 mph impact speeds.

(D. Richards, 2010)

Locations

Pedestrian safety is also dependent on the characteristics of the carriageway, or on the crossing facilities provided:

- A study of pedestrian fatalities in North America showed that over three quarters of single vehicle RTIs occurred away from intersections.
(S. Umesh, 2003)
- In the UK in 2010 casualties amongst pedestrians aged 16 to 59 most commonly occurred when:
 - Crossing the road further than 50m from a crossing (42.5 per cent);
 - In the carriageway not crossing (15.3 per cent);
 - On a pedestrian crossing (13.3 per cent); and,
 - On the footway or verge (11.8 per cent).(P. Kilbey *et al.*, 2011)
- In the UK between 1993 and 2006, most pedestrian RTIs (around 75 per cent) happened where there were no pedestrian crossing physical facilities. Where RTIs did occur at pedestrian crossing facilities the distribution was as follows:
 - Pelican crossings [although not explicit in the research, it is assumed that this also includes Puffin and Toucan crossings] 39 per cent;
 - Traffic signal junction 30 per cent;
 - Zebra crossing 20 per cent; and,
 - Central refuge 10 per cent.

(K. Alnaqbi, 2009)

Research findings

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

Findings are presented according to the 'three Es' of road safety; Education, Engineering and Enforcement.

Education

- There are very few education interventions aimed at adult pedestrians, and no empirical assessment of their effect on pedestrian casualties.
(A. Martin, 2006)
- An initiative in the Spanish city of Ourense administered pedestrian safety education using volunteers; figureheads of the local community were ambassadors for visibly safe behaviour. The campaign also distributed reflective clothing for pedestrian use at night. Anecdotally, safety benefits are claimed, although statistics to support these are not given.

(M. Cid and A. Ferro, 2008)

Engineering - Vehicle design

- When comparing relative rates, proportionally more hybrid / electric vehicles hit a pedestrian than conventionally powered vehicles. Note that this may be attributable to greater hybrid / electric vehicle use in urban areas.

(P. Morgan *et al.*, 2011)

Engineering - Pedestrian conspicuity

- Lighting at pedestrian crossings typically reduces RTIs during hours of darkness. However, of the cited supporting studies, the latest was carried out in 1978.

(A. Martin, 2006)

Engineering - Highway design

- A virtual reality trial found that pedestrians tend to use distance between vehicles as a guide to determining safe crossing gaps. They do not necessarily take full account of vehicle speed. This should be taken into account in highway and sight line design.

(G. Simpson *et al.*, 2003)

- At signalised pedestrian crossings it is assumed that longer pedestrian waiting times lead to more pedestrians crossing on red, which may increase RTIs. However, while more pedestrians cross on red when waiting times are longer there is little evidence that this actually results in increased pedestrian casualties. Further, some authors have found no relationship between non-compliance and cycle time.
- Raised crossings have been shown in studies to reduce vehicle speeds and increase vehicles yielding to pedestrians. However, these interventions are sensitive to their physical environment and use should take account of, for example, sight lines and gradients.
- Pedestrian guard rails are typically (although not universally) thought to reduce pedestrian conflict and RTIs. However, they may also prompt risky behaviours in pedestrians determined to cross.
- Countdown timers at signalised crossings (counting down either time until pedestrian green phase, or time remaining to cross on green) typically reduce the number of pedestrians crossing on red. Timer use is only possible where time to cross or time of crossing phases can be predicted. Puffin crossings in the UK, which detect vehicle and pedestrians and can alter timings accordingly, are not readily compatible with timers.

(A. Martin, 2006)

- A meta-analysis of studies relating to count down timers found that these improved pedestrian compliance: more pedestrians crossed during 'walk' and more waited during 'don't walk'. Note that the studies were carried out in North America, where jaywalking laws exist so findings may not be directly applicable to the UK.

(J. Kennedy and B. Sexton, 2009)

- Apparent strategies to increase compliance at signalised crossings are to switch to the green man as soon as possible after the demand is made, to reduce the cycle time or to increase the proportion of the cycle that can be used by pedestrians. However trials have shown that whilst these approaches reduce waiting times, they do not increase compliance. The ultimate conclusion is that pedestrians cross according to their own convenience when they identify gaps in traffic, and that many adults are capable of doing so safely.

(J. Kennedy *et al.*, 2009)

- Shared Space schemes in the UK have no more casualties or injury frequency than other layouts, according to available evidence. However, evidence is not entirely consistent and better understanding of vehicle and pedestrian flows are required to predict risk exposure.

(S. Reid *et al.*, 2009)

Enforcement

- Great Britain has few laws for pedestrians (most obviously there are no laws to prevent crossing the road except at crossing points, i.e. jaywalking). For this reason, there is limited scope for pedestrian enforcement. Studies are cited in which police presence has improved driver and pedestrian behaviour at crossings; however much of the research is old and driver and pedestrian behaviours may have modified in the intervening decades.

(A. Martin, 2006)

How effective?

- Reducing vehicle speeds through use of 20 mph zones and physical traffic calming measures has been shown to reduce pedestrian RTIs. Their frequency of occurrence was reduced by as much as 63 per cent in one 1990s UK study.

(D. Webster and A. Mackie, 1996)

- Vehicle design has progressed to reduce injury risk to pedestrians. Euro NCAP crash testing now includes pedestrian safety ratings for new cars to include bumper design which minimises lower leg injury, and active bonnets which deploy to reduce injuries associated with strikes by cars with low bonnet lines. The deformation allowed by active bonnets absorbs energy and can reduce the risk of head injury by up to 30 per cent.

(M. Avery and A. Weekes, nd)

- A UK study is reported where pedestrians were given default green and vehicles stopped before being detected. This was trialled between 1993 and 1996 at two sites with high vehicle and pedestrian flows. The scheme reduced injuries between 36 per cent (including a 67 per cent drop in child RTIs). It is thought that the site specifics of both high vehicle and pedestrian flows were significant factors in successful application.
- Advanced stop lines (i.e. moving the stop line back from the crossing) have been shown in a Canadian study to reduce pedestrian – vehicle conflict from 16.8 per cent to 4.3 per cent. A study in London found that advanced stop lines significantly reduced the number of encroaching vehicles going into the pedestrian crossing.

(A. Martin, 2006)

- Puffin crossings bring pedestrian safety benefits compared to Pelican crossings. A UK study showed that personal injury RTI frequencies were reduced by 24 per cent for all pedestrian RTIs.

(A. Maxwell *et al.*, 2011)

- A cited Swedish study found that road surface condition was a factor in 78 per cent of incidents involving injured pedestrians but not involving a motor vehicle. Similarly, 70 per cent of pedestrian injuries were found to occur in winter.

(ETSC, 1999)

- Providing raised medians or refuge areas at unmarked crosswalk locations can reduce pedestrian RTIs by 39 per cent. At marked crosswalks, these countermeasures have resulted in even higher reductions (46 per cent).
- Providing walkways that are separated from the travel lanes can help to prevent up to 88 per cent of RTIs involving pedestrians walking along (not crossing) roadways. Roadways without sidewalks are more than twice as likely to have pedestrian RTIs as locations with sidewalks on both sides of the street.

(J. Bartlett *et al.*, 2012)

- A programme of countermeasures combining education, enforcement and engineering treatments has demonstrated safety improvements. In Miami-Dade County (Florida) four high pedestrian risk RTI zones were identified and local knowledge utilised to apply a suitable blend of counter measures. At the peak of countermeasure use, the programme reduced county wide pedestrian RTI rates by 8.5 and 13.3 per cent (depending on control group comparison). Due to over-lapping counter measures it was not possible to attribute success to individual interventions.

(C. Zegeer *et al.*, 2008)

Gaps in the research

- Considering pedestrian (and cyclist) safety across the EU in 1999, the ETSC identified gaps in knowledge, including:
 - Understanding the safety implications of large increases in walking;
 - Quantifying casualties from walking without involvement of a motor vehicle; and,
 - Monitoring the effectiveness of education on pedestrian safety.

(ETSC, 1999)

- Most research into pedestrians at crossings considers behaviour and compliance, rather than safety. No direct evidence has been found to suggest that measures which improve compliance (for example making pedestrian signals more responsive), actually reduce RTIs.
- Most existing research relating to pedestrian behaviour is for mid-block crossings rather than junctions. Pedestrians are at increased risk at junctions that have complex staging arrangements.

(J. Kennedy and B. Sexton, 2009)

- There is a lack of existing guidance relating to road safety training for adults with learning disabilities.

(S. Kay, 2009)

References

Department for Transport research and statistics

Title: Reported Road Casualties Great Britain 2014
Author / organisation: Department for Transport Date: September 2015 Format: pdf Link: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463797/rrcgb-2014.pdf Free / priced: Free
Objectives: Compilation of all reported casualty RTIs in Great Britain.
Methodology: Reports from road 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.
Key Findings: <ul style="list-style-type: none">• There were 446 pedestrian deaths in reported road crashes in 2014, 12% higher than 2013 and the highest number since 2011.• 5,063 pedestrians were seriously injured in reported road crashes in 2014, 13% higher than 2013.• 19,259 pedestrians were slightly injured in reported road crashes in 2014, 3% higher than 2013.• 417 (93%) of the 446 pedestrian deaths in 2014 were adults, as were 3,657 (72%) of the 5,063 pedestrians seriously injured.• On urban roads, pedestrians account for around a third of KSIs, whereas on rural roads they account for around 10 per cent.• In 2014, 191 older adult pedestrian (age 60 and over) were killed, an increase of 31% from 2013, and 1,256 older pedestrians were seriously injured, a 15% increase from the previous year.• The most common contributory factor attributed to pedestrian casualties was “pedestrian failed to look properly”, followed by “pedestrian careless, reckless or in a hurry” and “pedestrian failed to judge vehicle’s path or speed”.
Themes: road casualties, Great Britain
Comments: The largest single source of UK data, results are designated National Statistics.

Title: Reported Road Casualties Great Britain 2013
Author / organisation: Department for Transport Date: September 2014 Format: pdf Link: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359311/rrcgb-2013.pdf
Free / priced: Free
Objectives: Compilation of all reported casualty RTIs in Great Britain.
Methodology: Reports from road 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.
Key Findings: <ul style="list-style-type: none"> • On urban roads, pedestrians account for around a third of KSIs, whereas on rural roads they account for around 10 per cent. • The majority of child KSI casualties are pedestrians, accounting for 69 per cent of the total in 2013. • 372 adult pedestrians were killed in 2013, 3,597 were seriously injured and 13,156 were slightly injured on British roads in 2013. • Compared with 2012, there was a 13 per cent fall in child pedestrian KSI casualties in 2013. • In 2013, adult pedestrian (age 16-59) deaths were 5% lower than in 2012 and 25% lower than their 2005/09 average. • In 2013, older adult pedestrian (age 60 and over) were 4% lower than in 2012 and 42% than their 2005/09 average. • The most common contributory factor attributed to pedestrian casualties was “pedestrian failed to look properly”, followed by “pedestrian careless, reckless or in a hurry” and “pedestrian failed to judge vehicle’s path or speed”.
Themes: road casualties, Great Britain
Comments: The largest single source of UK data, results are designated National Statistics.

Title: Reported Road Casualties Great Britain: main results 2011
Author / organisation: Department for Transport
Date: June 2012
Format: Data tables (CSV format)
Link: http://www.dft.gov.uk/statistics/releases/reported-road-casualties-gb-main-results-2011/
Free / priced: Free
Objectives: Compilation of all reported casualty RTIs in Great Britain.
Methodology: Reports from road 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.
Key Findings: <ul style="list-style-type: none"> • There has been an increase in the number of adult pedestrian casualties over those reported in 2010.
Themes: road casualties, Great Britain
Comments: The largest single source of UK data, results are designated National Statistics. A good indicator of trends and RTI severities. This is an early release – the full 2011 report with more in depth data had not been released at the time of writing.

Title: Reported road casualties Great Britain: 2010 annual report
Author / organisation: P. Kilbey, D. Wilson, W. Huang, P. McEvoy, and A. Bhagat
Date: September 2011
Format: Pdf
Link: http://assets.dft.gov.uk/statistics/releases/road-accidents-and-safety-annual-report-2010/rrcgb2010-complete.pdf
Free / priced: Free
Objectives: This report delivers statistics relating to all road RTIs reported to the police in Great Britain in 2010.
Methodology: Statistics are compiled from the STATS19 database of road traffic RTIs.
Key Findings: <ul style="list-style-type: none"> • Up to 2010 there is a trend of decreasing adult pedestrian casualties.
Themes: RTI statistics, pedestrian contributory factors
Comments: The national road casualty statistics remain the single largest source of RTI data. It includes contributory factors, which give an indication of the role that safe routes for pedestrians might play.

Title: Road traffic injury risk in disadvantaged communities: evaluation of the neighbourhood road safety initiative
Author / organisation: N. Christie, H. Ward, R. Kimberlee, R. Lyons, E. Towner, M. Hayes, S. Robertson, S. Rana and M. Brussoni Date: September 2010 Format: Pdf. Free / priced: Free Link: http://assets.dft.gov.uk/publications/road-injury-risk-in-disadvantaged-areas/rswp19.Pdf
Objectives: An analysis of the Neighbourhood Road Safety Initiative (NRSI), which aimed to address the social gradients prevalent in road traffic casualties.
Methodology: Analysis of data, surveys and qualitative research amongst stakeholder groups.
Key Findings: <ul style="list-style-type: none"> • There is considerable variation in casualty figures, although social gradients linking deprivation to casualty rate are apparent. • Trends are most noticeable for child groups.
Themes: road casualties, deprivation, neighbourhood road safety initiative
Comments: Although this study focuses on the NRSIs, it presents useful statistical data on how deprivation remains linked to adult pedestrian casualties.

Title: Relationship between speed and risk of fatal injury: Pedestrians and car occupants
Author / organisation: D. Richards Date: September 2010 [b] Format: Pdf. Free / priced: Free Link: http://webarchive.nationalarchives.gov.uk/20121105134522/http://assets.dft.gov.uk/publications/pgr-roadsafety-research-rsrr-theme5-researchreport16-pdf/rswp116.pdf/
Objectives: A study exploring the relationship between speed and the risk of fatal injury for car drivers and pedestrians.
Methodology: The logistical regression method drew on RTI data from the On the Spot (OTS) project, police data files and the Co-operative Crash Injury Study.
Key Findings: <ul style="list-style-type: none"> • Pedestrian risk has decreased over time – i.e. pedestrian risk of being killed when hit by a car has reduced over the last 30 years. • Up to an impact speed of around 30 mph the risk of fatality increases slowly. Above 30 mph the risk increases rapidly – there is a 3.5 to 5.5 times increase in fatality risk from 30 mph to 40 mph impact speeds. • Even though the risk of pedestrians being killed at 30 mph is relatively low, approximately half of pedestrian fatalities occur at or below this impact speed (since a large number of pedestrian RTIs occur at 30 mph or less).
Themes: road casualties, speed, fatality risk
Comments: This study uses a range of data sets and approaches to quantify increase in risk as vehicle speed increases.

Title: Alcohol and pedestrians
Author / organisation: Department for Transport (DfT) Date: July 2001 Format: html Link: http://webarchive.nationalarchives.gov.uk/20100202152019/http://www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme3/alcoholandpedestriansno20
Free / priced: Free
Objectives: In the context of reductions in drinking and driving, problems relating to alcohol and pedestrians tend to increase. This report presents the results from studies on alcohol and pedestrians
Methodology: A study of coroner's files, a controlled study of Blood Alcohol Concentrations (BAC) from pedestrian casualties and a footpath survey of pedestrian BACs.
Key Findings: <ul style="list-style-type: none"> • The BAC distribution of those fatalities who were tested for alcohol showed no significant change since the earlier study undertaken in the mid 1970s. • The results of previous studies augmented by some evidence from the present studies of both fatal and non-fatal casualties suggest that, for males at least, the risk of RTI-involvement begins to increase dramatically at levels above 150mg/100ml. • The effect of countermeasures against drinking and driving was clear. Over a quarter of pedestrians who had been drinking had taken the conscious decision not to drive to and from their drinking venue. • It would be useful to monitor the drinking behaviour of pedestrians at intervals to determine whether their incidence is increasing. This study has shown that the footpath survey can provide useful information. • Countermeasures to the drinking pedestrian may be best based upon the general public health message of the dangers of excessive alcohol consumption.
Themes: pedestrian casualties, alcohol, impairment, risk
Comments: Studies were relatively small scale but agree with the widely held link between pedestrian alcohol consumption and RTI risk. The study also makes a link between the reduction in drink driving and the relatively high numbers of intoxicated pedestrians in certain areas at certain times (i.e. to an extent the drink drive risk may have been displaced to pedestrians).

Other works

Title: Proven countermeasures for pedestrian safety
Author / organisation: J. Bartlett, B. Graves, T. Petritsch and T. Redmon (FHWA)
Date: March 2012
Format: html
Link: http://www.fhwa.dot.gov/publications/publicroads/12marapr/04.cfm
Free / priced: Free
Objectives: To demonstrate engineering countermeasures which are proven to have improved pedestrian safety.
Methodology: Article summarising previous reports into effectiveness and showcasing examples of implementation.
Key Findings: <ul style="list-style-type: none">• Providing raised medians or refuge areas at unmarked crosswalk locations can reduce pedestrian RTIs by 39 per cent. At marked crosswalks, these countermeasures have resulted in even higher reductions (46 per cent).• Providing walkways that are separated from the travel lanes can help to prevent up to 88 per cent of RTIs involving pedestrians walking along (not crossing) roadways.• Roads without sidewalks are more than twice as likely to have pedestrian RTIs as roads with sidewalks on both sides of the street.
Themes: engineering, sidewalk, crosswalk, median, refuge
Comments: A collection of useful case study successes from North America; however the context of much of this work is that roads previously had very little or no pedestrian provision to start with.

Title: When distracted road users cross paths
Author / organisation: R. Brumfield and S. Pulugurtha (Federal Highway Administration)
Date: November 2011
Format: html
Link: http://www.fhwa.dot.gov/publications/publicroads/11novdec/01.cfm
Free / priced: Free
Objectives: To investigate distractions and attentive behaviour amongst pedestrians and drivers.
Methodology: Observational study of a number of crosswalk locations on the UNC Charlotte campus.
Key Findings: <ul style="list-style-type: none"> • 21.3 per cent of manoeuvres resulted in conflicts when the pedestrian displayed attentive behaviour and 16.8 per cent resulted in conflicts when the pedestrian displayed visibly distracted behaviour. • This may be partially explained by observations that 57.4 per cent of drivers yielded to the attentive pedestrians and 80 per cent yielded to the visibly distracted pedestrians.
Themes: distractions, inattention, mobile phone use, conflicts
Comments: The size of the sample studied is not disclosed, and the location has 20 mph speed limits so results are not likely to be scalable. However, they give a useful indication of the nature of inattentive behaviour, particularly that drivers may be more likely to yield to a visibly distracted pedestrian.

Title: Headphone use and pedestrian injury and death in the United States: 2004-2011
Author / organisation: R. Lichtenstein, D. Clance Smith, J. A. Ambrose and L. A. Moody Date: November 2011 Format: Pdf Link: http://press.psprings.co.uk/ip/january/ip040161.Pdf Free / priced: Free
Objectives: To identify and describe pedestrian-vehicle RTIs in which the pedestrian was using headphones.
Methodology: Search of news archives to identify relevant cases.
Key Findings: <ul style="list-style-type: none"> • There were 116 reports of death or injury of pedestrians wearing headphones. • The majority of victims were male (68 per cent). • The majority of victims were under the age of 30 (67 per cent). • The majority of vehicles involved in the RTIs were trains (55 per cent), and 89 per cent of cases occurred in urban counties. Cars were involved in 28 per cent. • 74 per cent of case reports stated that the victim was wearing headphones at the time of the RTI. Many cases (29 per cent) mentioned that a warning was sounded before the RTI.
Themes: pedestrian fatalities, distraction, headphones
Comments: The report is reliant upon media reporting, so is likely to significantly under-report. No method of collecting information about near misses. No causation can reliably be interpreted from the results.

Title: Assessing the perceived safety risk from quiet electric and hybrid vehicles to vision impaired pedestrians (PPR 525)
Author / organisation: P. Morgan, L. Morris, M. Muirhead, L. Walter and J. Martin (Transport Research Laboratory)
Date: August 2011
Format: Pdf
Link: https://trl.co.uk/reports/TRL620
Free / priced: Free
Objectives: To investigate the RTI risk posed by electric and hybrid vehicles due to their low noise.
Methodology: Consideration of RTI statistics and practical testing of vehicle noise outputs.
Key Findings: <ul style="list-style-type: none"> • Relative to the total number of registered vehicles, hybrid / electric vehicles were equally likely to be involved in an RTI with a pedestrian as conventionally powered vehicles. However, proportionally more RTIs for hybrid / electric vehicles involve hitting a pedestrian. • Hybrid / electric vehicles increase pedestrian risk exposure, when measured by audibly detectable distance.
Themes: electric vehicle, hybrid vehicle, audible, pedestrian risk
Comments: Study appears to be relatively robust, although sample numbers for RTIs involving hybrid / electric vehicles are small owing to these vehicles small share of the UK fleet. Some indicative evidence that lower noise vehicles will increase risk to pedestrians (particularly partially sighted).

Title: Puffin pedestrian crossing accident study (PPR 507)
Author / organisation: A. Maxwell, J. Kennedy, I. Routledge, P. Knight and K. Wood (Transport Research Laboratory)
Date: January 2011 Format: Pdf
Link: https://trl.co.uk/reports/PPR507?reportid=6680
Free / priced: Free
Objectives: To assess the road safety benefits of Puffin crossings compared to previous mid-block crossings and signal controlled junctions.
Methodology: Assessment of 'before' and 'after' RTI statistics at sites which have had crossing facilities updated.
Key Findings: <p>Following conversion to Puffin facilities personal injury RTI frequencies were:</p> <ul style="list-style-type: none"> • 24 per cent lower for all pedestrian RTIs; • 17 per cent lower at the mid-block sites; • 19 per cent lower over all the sites.
Themes: pedestrian safety, engineering, signalised crossings
Comments: This research shows statistically significant safety improvements when crossing facilities are altered to Puffin type.

Title: Literature review of road safety at traffic signals and signalised crossings (PPR 436)
Author / organisation: J. Kennedy and B. Sexton (Transport Research Laboratory) Date: November 2009 Format: Pdf Link: http://www.tfl.gov.uk/assets/downloads/literature-review-of-road-safety-at-traffic-signals-and-signalised-crossings.Pdf Free / priced: Free
Objectives: A literature review to inform policy and practice at Transport for London.
Methodology: Literature review, focus groups and video analysis of crossing behaviour.
Key Findings: <ul style="list-style-type: none"> • There is limited evidence that signal-controlled roundabouts are safer than normal roundabouts for pedestrians (and cyclists). • Pelican crossings enable users to cross easily, but there is some evidence that users take less care than when crossing away from such a facility. Puffin crossings have potential advantages over Pelican crossings, but appear to have a similar safety record. • Shorter signal cycle times benefit pedestrians and improve compliance, but provide additional opportunity for red light running.
Themes: pedestrian safety, engineering, signalised crossings
Comments: This research shows statistically significant safety improvements when crossing facilities are altered to Puffin type.

Title: DfT Shared Space project
Author / organisation: S. Reid, N. Kocak and L. Hunt (MVA) Date: November 2009 Format: Pdf Link: http://tap.iht.org/objects_store/200911/DfT%20Shared%20space%20project%20-%20Stage%201%20Appraisal%20of%20shared%20space.pdf
Free / priced: Free
Objectives: Report compiled to contribute towards developing evidence-based guidance for Shared Space highway schemes.
Methodology: The report included a literature review, interviews with Shared Space users, discussions with authorities who have implemented Shared Space schemes, and observational site visits.
Key Findings: <ul style="list-style-type: none"> • There is little UK evidence of consistent casualty reduction at Shared Space schemes. • However the evidence does not show a safety disbenefit at UK schemes either, although casualty numbers were typically low at these locations prior to implementation. • There is some evidence from Dutch schemes that casualty numbers may be greater in schemes with high vehicle flows. • There is evidence to suggest that Shared Space schemes bring perceived benefits, including to personal safety (although this is not shared by all user groups).
Themes: pedestrian safety, engineering, Shared Space, highway design
Comments: The number of schemes (especially in the UK) and the amount of time to assess them is limited, hence the findings in the report are not absolutely conclusive; the authors stress the importance of tailoring a Shared Space scheme to its location and context.

Title: Investigation of pedestrian accident analysis at signalised pedestrian crossings in Edinburgh
Author / organisation: K. Alnaqbi (Edinburgh Napier University) Date: September 2009 Format: Pdf Link: http://www.internationaltransportforum.org/irtadpublic/Pdf/seoul/P01_Alnaqbi.Pdf
Free / priced: Free
Objectives: To investigate factors that affect RTIs at pelican and traffic signal junction pedestrian crossings.
Methodology: Literature review, analysis of STATS19 data and of Edinburgh City Council data.
Key Findings: <ul style="list-style-type: none"> • More casualties occur at signalised pedestrian crossings than at other 'passive' crossings. • Areas of highest RTI rate are at or within 10m of the signalised crossing point.
Themes: pedestrian fatalities, statistics, intersections, alcohol involvement
Comments: Primary research constitutes a small study only – there is scope to further investigate RTI rates at or close to crossings. Highlights the apparent paradox that signalised crossings actually present a relatively high risk.

Title: Pedestrian training in a special needs environment
Author / organisation: S. Kay (AECOM) Date: July 2009 Format: Pdf Link: http://www.roadsafetyknowledgecentre.org.uk/knowledge/460.html Free / priced: Free
Objectives: A study for Gateshead Council to provide increased opportunity for adults with learning disabilities to participate in practical training and other accessibility projects relating to road safety.
Methodology: A review of policy and existing training resources.
Key Findings: <ul style="list-style-type: none"> • There is a lack of existing guidance relating to the road safety training of adults with learning disabilities with the majority of documents relating to children or as generic road safety training tools to be adapted to suit. • No common training resources or approach appear to have been used and there are no consistent training materials or advice available.
Themes: training, education, learning disabilities
Comments: The report is specific to Gateshead, however themes are applicable more widely: in particular identification of gaps in guidance and knowledge regarding adult road safety education.

Title: The effect of traffic signal strategies on the safety of pedestrians (PPR 414)
Author / organisation: J. Kennedy, M. Crabtree, J. Castle, J. Martin and M. Elliott (Transport Research Laboratory) Date: July 2009 Format: Pdf Link: https://trl.co.uk/reports/PPR414 Free / priced: Free
Objectives: To assess the effect that traffic signal strategies have on the safety of pedestrians. To provide guidance to local highway authorities regarding signal control strategies.
Methodology: Literature review, focus groups and video analysis of crossing behaviour.
Key Findings: <ul style="list-style-type: none"> • Pedestrians tend to cross the road according to their own desire lines and convenience. • Pedestrians are more likely to comply with a signal if they are older, female, their mobility is impaired (by disability or by pushing / carrying something), the traffic is heavy, other pedestrians are waiting or they have been waiting less than 30 seconds. • It was not possible to determine a link between different signal strategies and pedestrian safety.
Themes: pedestrian safety, engineering, signalised crossings
Comments: This research shows statistically significant safety improvements when crossing facilities are altered to Puffin type.

Title: “Dexiate ver”. “Make yourself visible”
Author / organisation: M. Cid and A. Ferro Date: October 2008 Format: Pdf Link: http://www.walk21.com/papers/Maximo%20Cid%20and%20Angelica%20Ferro%20Make%20yourself%20visible%20(ENG).Pdf
Free / priced: Free
Objectives: Focussed on the city of Ourense, Spain the initiative aimed to improve road safety by modifying pedestrian behaviour; raising awareness to make road safety a social issue and ensuring that adults set a good example to children.
Methodology: Education was administered by local volunteers and delivered through targeted units. High profile public figures were engaged in an ambassadorial role. Leaflets were distributed as well as 15,000 reflective bracelets and 4,000 high visibility vests.
Key Findings: Results as presented are observed / anecdotal only. <ul style="list-style-type: none"> • The use of reflective clothing has increased for pedestrians after dark. • The number of RTIs has reduced and citizen participation in good practice has increased.
Themes: countermeasure programme, visibility, community, social measure
Comments: Although evidenced results are not presented in this paper it does outline some interesting approaches, such as the method of community involvement, use of ambassadors and education around role models for children.

Title: Evaluation of the Miami-Dade pedestrian safety demonstration project
Author / organisation: C. Zegeer, D. Henderson, R. Blomberg, L. Marchetti, S. Masten, Y. Fan, L. Sandt, A. Brown, J. Stutts and L. Thomas (NHTSA) Date: June 2008 Format: Pdf Link: http://www.nhtsa.gov/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/810964.Pdf Free / priced: Free
Objectives: This study sought to identify and implement a comprehensive countermeasure programme that could reduce pedestrian casualties in an urban environment.
Methodology: Following selection of a suitable location and implementation of countermeasures, a before and after study was made.
Key Findings: <ul style="list-style-type: none"> • At the peak of countermeasure use, the programme reduced county wide pedestrian RTI rates by up to 13.3 per cent. • Targeting countermeasures to specific age and ethnic groups appears to have been successful in some locations. However in others, educational countermeasures had no discernable effect on target populations. • A limited number of engineering treatments were implemented as part of this programme. • Use of GIS to create an RTI database was seen as valuable in identifying, evaluating and communicating the issues.
Themes: countermeasure programme, casualty reduction, RTI zones
Comments: The nature of this project owes much to the American administrative systems around road safety. Nevertheless, it shows the potential value of a considered, targeted programme of varied countermeasures.

Title: Factors influencing pedestrian safety: a literature review (PPR 241)
Author / organisation: A. Martin (Transport Research Laboratory)
Date: February 2006
Format: Pdf
Link: http://www.tfl.gov.uk/assets/downloads/Factors-Influencing-pedestrian-safety-literature-review.Pdf
Free / priced: Free
Objectives: A report for Transport for London to ascertain ways in which pedestrian behaviour may be influenced to reduce casualties in London.
Methodology: Literature review.
Key Findings: <ul style="list-style-type: none"> • No simple universal solutions exist that are suited to London's high levels of vehicle and pedestrian traffic. • Enforcement measures are best applied on strategic routes where traffic calming can also reduce capacity. • Education is best targeted at a particular behaviour or a particular group.
Themes: pedestrian safety, engineering, enforcement, education
Comments: Although targeted specifically at London, this a comprehensive review of literature which collects effective interventions.

Title: Pedestrian roadway fatalities
Author / organisation: S. Umesh (NHTSA)
Date: April 2003
Format: Pdf
Link: http://www-nrd.nhtsa.dot.gov/Pubs/809-456.Pdf
Free / priced: Free
Objectives: This study sought to examine pedestrian fatalities and provide insight into causes.
Methodology: Compilation of data from National Centre for Statistics and Analysis' Fatality Analysis Reporting System (FARS).
Key Findings: <ul style="list-style-type: none"> • Alcohol involvement amongst pedestrians is a major problem. • Most fatalities occur at non-intersections. • 18 per cent of pedestrians killed were as a result of hit and run RTIs.
Themes: pedestrian fatalities, statistics, intersections, alcohol involvement
Comments: The data set is now over 10 years old, however the collection of statistics from one data set gives a useful insight on fatalities in North America.

Title: Analysis of pedestrian crashes
Author / organisation: M. daSilva, J. Smith and W. Najm (US DoT) Date: April 2003 Format: Pdf Link: http://www.nhtsa.gov/search/?q=pedestrian&site=nhtqnlas187_Pages&client=default_frontend&output=xml_no_dtd&ie=UTF-
Free / priced: Free
Objectives: Analysis of pedestrian RTIs in North America to inform a development programme for vehicle RTI avoidance systems.
Methodology: Analysis of a four year dataset (1995-98) to establish common pre-RTI scenarios.
Key Findings: <ul style="list-style-type: none"> • The most common scenario was vehicle going straight on and pedestrian crossing at non-junction. • A very high proportion of drivers reported obscured vision in scenarios where the pedestrian darted on to the road. • Almost 60 per cent of RTIs in which the pedestrian was walking along the road at a non-junction occurred at night.
Themes: pedestrian fatalities, statistics, scenarios, vehicle manoeuvres
Comments: Although the data set is old it is large and findings relating to pre-RTI scenarios are fairly unusual amongst other studies.

Title: An investigation of road crossing in a virtual environment
Author / organisation: G. Simpson, L. Johnston, M. Richardson Date: 2003 Format: Pdf Link: http://www.ncbi.nlm.nih.gov/pubmed/12850080
Free / priced: Priced
Objectives: Use of virtual reality system to investigate road crossing behaviour in children and young adults (aged 19 to 30).
Methodology: Trials were conducted in which vehicles passed at either a uniform speed (but with variable spacing), or with uniform gaps at the time they passed the pedestrian (but with variable speed).
Key Findings: <ul style="list-style-type: none"> • Road crossing performance was better in uniform speed rather than uniform distance trials. • This suggests that pedestrians base road crossing decisions on inter-vehicle distance rather than vehicle speed.
Themes: road crossing, behaviour, virtual reality
Comments: Virtual reality was used to illicit more realistic behaviour (i.e. a sense of risk) compared to computer based simulations.

Title: Safety of pedestrians and cyclists in urban areas
Author / organisation: European Transport Safety Council (ETSC)
Date: 1999
Format: Pdf
Link: http://www.etsc.be/documents/pedestrian.pdf
Free / priced: Free
Objectives: A review of safety to identify key problems and best practice countermeasures.
Methodology: A review of available studies and literature.
Key Findings: <ul style="list-style-type: none"> • Consultation is key to achieving safe routes for pedestrians, which need to accord with journeys they actually need to make. Pedestrian competence is also important (though this is typically less of an issue for adults). • Pedestrian RTI protection by better passively safe vehicle design should be progressed. • Separation and integration should be pursued: separation of pedestrians from vehicle traffic but integration of pedestrian facilities into key routes.
Themes: pedestrian safety, risk, casualty reduction
Comments: A high level report but a useful summary. The date should be noted in relation to, for example, vehicle design which has progressed markedly.

Title: Review of traffic calming schemes in 20 mph zones (TRL Report 215)
Author / organisation: D. Webster and A. Mackie (Transport Research Laboratory)
Date: 1996
Format: Pdf
Link: https://trl.co.uk/reports/TRL215
Free / priced: Free
Objectives: A review for the Department of Transport [sic] to ascertain the effects of traffic calming using 20 mph zones.
Methodology: Literature review.
Key Findings: <ul style="list-style-type: none"> • The frequency of all RTIs was reduced when '20 mph zones' were introduced – by 60 per cent overall, 63 per cent for pedestrians and 67 per cent for all child RTIs. • Overall vehicle speeds fell by 9.3 mph on average.
Themes: pedestrian safety, engineering, enforcement, 20 mph, traffic calming
Comments: Despite the age of this report it is still cited with regard to application of 20 mph zones (for example, the Forty Ninth Report of the Public Accounts Committee in 2009 cites these figures).

Title: Safer cars for pedestrians, but more costly to repair? (Thatcham Research News 10/no.7)
Author / organisation: M. Avery and A. Weekes (Thatcham) Date: [no date] Format: Pdf Link: http://www.thatcham.org/safety/pdfs/RN7_SPECIAL_ED.Pdf Free / priced: Free
Objectives: To disseminate news and trends in vehicle design relating to passive pedestrian protection.
Methodology: Consideration of lower leg - bumper test results and repair costs, plus testing of active bonnet deployment.
Key Findings: <ul style="list-style-type: none"> • There is no correlation between bumper repair cost and level of protection afforded to pedestrians (for the sample of vehicles selected). • There exist different active bonnet deployment mechanisms, with differing deployment trigger speeds, time to deploy and costs of repair.
Themes: pedestrian injuries, vehicle design, active bonnet, passive safety
Comments: A summary piece for on-going research – gives a high level overview of the state of some current passive system systems fitted to vehicles.