Synthesis title:

Pedal Cyclists

Category: Riders

Other Relevant Topics:

- Cycling Infrastructure (Riders)
- Traffic Calming (Roads)
- Alternative Wheelers (Other)

Keywords:

Cyclist,
Cycling,
Safety,
Road user behaviour

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

- In GB in 2016, pedal cyclist casualties made up 10 per cent of all road user casualties. KSI casualties had risen by 5 per cent from the 2011-15 average (from 3,316 to 3,491). Between 2013-2014, pedal cycle traffic increased by 10 percent, but between 2014-15 pedal cycle traffic fell by 6%.

  (RRCGB, DfT, 2017)

- In GB in 2016, there were 102 cyclist fatalities. This is a reduction from an average of 109 in the period 2011-15. In 2014 there were 113 fatalities and in 2015 there were 100. Note that fluctuations between years are expected when the numbers are low and should be interpreted with caution.

  (RRCGB, DfT, 2017)

- The most important barriers to cycling relate to other road users' behaviour, volume and speed.

- Research provides evidence in favour of the idea that when levels of cycling increase it becomes safer.

- There is evidence to suggest that the health benefits of cycling outweigh the risks.

- Infrastructure has a role to play in improving the culture of road sharing alongside other interventions.

- As junctions are particularly associated with cyclist collisions, interventions at junctions should be a high priority.

- There is strong evidence that reducing the general speed of motorised traffic provides a safety benefit for cyclists.

- There is little UK evidence that marked cycle lanes provide a safety benefit. Providing segregated networks may reduce risk to cyclists in general although evidence suggests that the points at which segregated networks intersect with highways offer heightened risk.

- A study concluded if cycle helmets had been worn, a proportion of 7 per cent of head injury cases in a hospital dataset may not have required hospital treatment and 10-16 per cent of fatalities in a police dataset may have been prevented.

Summary

Trends in pedal cycle use and casualties over time

In GB in 2016:

- Pedal cyclist casualties made up 10 per cent of all road user casualties.

- Pedal cycle KSI casualties have risen steadily since 2004. In 2016, KSI casualties have risen by 45 per cent from the 2011-15 average (from 3,316 to 3,491). Between 2013-2014, pedal cycle traffic increased by 10 percent, but between 2014-15 pedal cycle traffic fell by 6%.

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(RRCGB, DfT, 2017)

Cycling collisions

Who is being injured?

- There is no evidence to indicate a systematic gender difference in risk of pedal cyclist casualty when exposure is accounted for. However, in 2005-7 cyclists aged 10 to 15 years were more at risk of injury (per km cycled based on the National Travel Survey) than any other age group.

Where do collisions happen?

- In 2016, almost three quarters of all cyclists KSI in GB were injured on urban roads, while over half of cyclist fatalities occurred on rural roads. Two-thirds of cyclist KSIs were at or near junctions. Around 64 per cent of cyclist KSI occurred in fine weather conditions, in daylight on dry roads.

What other vehicles are involved?

From STATS19 data, in 2014-16:

- When a cycle user was killed or seriously injured in a collision where the only other vehicle involved was a large goods vehicle (over 3.5t mgw), they were much more often killed (18 per cent of cycle user KSI casualties resulting from such collisions were killed, compared with 2 per cent in all other collisions between a cycle and a single vehicle). Well over half of these cyclist fatalities involving a LGV occurred at an urban junction.

- Nine per cent of cycle user KSI casualties resulted from collisions which did not involve another vehicle.

- 'Failed to look properly' was the most commonly reported contributory factor in KSI collisions which involved a pedal cycle and one other vehicle. Between 2014 and 2016, 66% of these failures were attributed to other vehicles and 34% to cyclists.

- The most commonly attributed contributory factor for collisions involving only a cycle were 'loss of control' (reported in 29 out of 50 of fatal single vehicle cyclist collisions).

(RRCGB, DfT, 2017)

Cyclist injuries

From STATS19 data, in 2005-7:

- Casualty severity was found to increase with the posted speed limit. Cyclist injury severity was greater when contributory factors assigned to the driver involved speed, impairment by alcohol and blind spots for HGVs.
- An analysis of hospital in-patient data found that the head was most likely to sustain injuries, especially for children (45 per cent), closely followed by the arms (41 per cent).

Research findings

Perception of risk and cycling style

- Journey urgency, confidence and experience of cyclists are key factors in shaping participants' view of risk to cyclists.
- Reasons for cycling and cycling style vary according to cycling purpose so that individual cyclists may exhibit different styles at different times

Road sharing

- The most important barriers to cycling relate to other road users' behaviour, volume and speed.
- There is evidence that the culture of road sharing on English roads marginalises cyclists on the road and which may have important implications for road safety.
- Stereotypes of cyclists by other road users are characterised by poor attitudes, a disregard for road rules and the needs of other road users.
- Infrastructure has a role to play in improving the culture of road sharing alongside other interventions. The most significant infrastructure-related risk factors for cyclists in single vehicle incidents appear to be slippery road and poor road surface and for multi-vehicle collisions, speed limits and encounters with other road users.

Safety in numbers

- Research has shown that when the level of cycling increases, cycling becomes safer. A report by CTC (a cycling charity) found that cycling is safer in local authorities in England where cycling levels are high. However, the reasons for this effect are not clear.

Health benefits of cycling vs. safety risks

- A Dutch study looking at whether the health benefits of cycling outweigh the safety risk, found that the health benefits of increased physical activity with cycling resulted in significant gains in life-years than losses in life years due to increased inhaled air pollution and traffic accidents. These findings may well be relevant to the UK as the literature review on which the calculations were based included relevant literature from UK studies.

Methodology

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 .

This synthesis was compiled during February-April 2013.

Note
This review includes statistics from Reported Road Casualties Great Britain 2011, which were the latest available data when the review was written. More recent statistics are available in Reported Road Casualties Great Britain 2016.

Searches were carried out on the pre-defined sources identified in the methodology section. Search terms used to identify relevant papers included: cyclist, cycling, safety, road user behaviour. Thirteen pieces of research, statistical reports or policy documents have been included in this review.

Key statistics

This section reports on the latest confirmed statistics from the National Travel Survey (NTS) and Reported Road Casualties Great Britain (RRCGB) 2010 and 2011 Annual Reports.

Cycling Casualty Statistics

Trends in pedal cycle use and casualties over time

In GB in 2016:

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- There were 102 cyclist fatalities. This is a reduction from an average of 109 in the period 2011-15. In 2014 there were 113 fatalities and in 2015 there were 100. Note that fluctuations between years are expected when the numbers are low and should be interpreted with caution.

(RRCGB, DfT, 2017)

Levels of cycling

Cycling activity can be measured in several different ways. The level of cycling in a particular year, and trends over time, depends on the type of the measurement method. In 2011, the number of trips by bicycle had decreased since 1995-7, but the average number of bicycle miles has increased in GB as a whole.

The NTS 2011[1] shows:

- Two per cent of all trips were made by bicycle.
- There was a small drop in the number of bicycle trips per person per year from 18 trips in 1995/7 to 16 trips in 2011.
- The average trip length by bicycle increased steadily since 1995-7, from 2.3 miles to 3 miles in 2011.

[1] Accessed on 19/3/2013 at: https://www.gov.uk/government/publications/national-travel-survey-2011

The NTS 2010[2] shows:

- Fifteen per cent rode a bicycle at least once a week and a further 10 per cent at least once a month.
- Two-thirds (66 per cent) used a bicycle less than once a year or never.

Cycling collisions

Who is being injured?

Data from RRCGB (2011 data) and in-depth casualty analysis (2005-7) suggest that male riders comprise most of the cycling casualties. However, as more men cycle they are not necessarily overrepresented in the statistics and one study suggests that when exposure is taken into account, male cyclists are only very marginally more at risk than female cyclists. Children aged 10-15 were the age group at highest risk of injury of all age groups, and those aged 16-29 were at most risk of injury of the adult age groups.

In 2011:

- Eighty-one per cent of cyclist KSIs and 77 per cent of cyclists killed were male
- Sixty-two per cent of cyclist casualties and 54 per cent of fatalities were 16-59 year old men

(RRCGB: 2011 Annual Report, 2012)

In-depth analysis of cycling casualties during the period 2005-7 show that:

- Eighty-two per cent of cyclist KSI were male, although males were only slightly more vulnerable than females when exposure (number of km cycled from the NTS) were taken into account.
- Children accounted for almost a quarter of cyclist KSI casualties, with the majority being between 10 and 15 years old.
- Cyclists aged 10 to 15 years were more at risk of injury (per km cycled based on the NTS) than any other age group.
- Cyclists aged 16 to 29 years were more at risk of injury per km cycled than any other adult group.
- KSI casualties have increased sharply for the 30-49 year age group since 2000.
- Collisions involving cyclists aged 50 years old or more tended to have more serious outcomes than the younger age groups.

(Knowles et al, 2009)

[2] Accessed on 19/3/2013 at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/9920/nts0313.xls

Using data from the NTS 2011 and RRCGB 2011 annual report, there is no evidence of any systematic difference in the cycling casualty risk of males and females.

- Males travel about 4 times as far by bicycle than females (79 miles per person per year for males, 20 miles per person per year for females). [3]
- On a national scale, the ratio of male to female cycling fatalities is approximately 3.9 to 1, and the ratio of male to female cycling KSIs is approximately 4.6 to 1.

Where do collisions happen?

RRCGB provides data for 2011 on location of pedal cycle collisions, but the last in-depth analysis of this data is from 2005-7. This analysis suggests that almost all collisions happened on the main carriageway rather than cycle paths or footways and most (three quarters) were on roads in built up areas. Most (two thirds) were at a junction.

In-depth analysis of cycling casualties in the period 2005-7 show that:

- Ninety-seven per cent of bicycles involved in collisions resulting in a serious injury or fatality were on the main carriageway at the time of the collision. Two per cent were coded as being on a cycle lane on the main carriageway and one per cent were coded as being on a cycleway/shared footway. It should be noted that STATS19 includes only collisions that occur on the public highway and which were reported to the police.
- Almost three quarters of all cyclist KSI casualties in Great Britain were injured on urban roads, while almost half of cyclist fatalities occurred on rural roads. This indicates that, while the frequency of injuries is greater on urban roads, their severity tends to be greater on rural roads.
- Casualty severity was found to increase with the posted speed limit.
- Almost two-thirds of cyclist KSIs were at or near junctions where the risk of conflict between road users is greater.
- A high proportion of child casualties were injured on minor roads in urban areas, while the proportion of cyclist KSIs on rural roads increases with age for the over 30s.
- Exposure data for people cycling to work were compared with the numbers of collisions involving cyclists. This analysis suggests that there is not a straightforward relationship between levels of cycling to work and collision risk. For example, several areas (Cumbria, Northumberland, Durham, Lancashire, West and South Yorkshire, parts of Wales and London) had higher numbers of casualties relative to the numbers of people cycling to work, whereas some areas with relatively high levels of cycle commuting had lower casualty rates.
- Half of the cyclist fatalities involved a car or taxi and these collisions were divided almost equally between urban and rural locations.

(Knowles et al, 2009)

[3] Accessed on 20/05/2013 at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35618/nts0605.xls

What other vehicles are involved in collisions involving cycles?

Data from RRCGB in 2011 and in-depth analysis of cycling collisions in 2005-7 suggests that just over 80 per cent of pedal cycling collisions involve another vehicle, most often a car or taxi. While a smaller proportion of collisions in both datasets (in 2005-7 and in 2011) involved HGVs (in 2011 this was 25 per cent of cycling casualties), the severity of the casualties in the 2005-7 data was greater. Single cycle collisions are much less likely to be reported to police, and are therefore likely to be under-reported. In 2011 only 3 per cent of (reported) cycling collisions were single cycle and in 2005-7, 16 per cent were.

In 2011:

- Fifty-seven per cent of cycle casualties involving two vehicles also involved a car
- Twenty-five per cent of cycle casualties involving two vehicles also involved an HGV
- Three per cent of all cycle casualties were single cycle. However this type of accident is unlikely to be reported to police, so the actual proportion may be higher.

(RRCGB: 2011 Annual Report, 2012)

In-depth analysis of cycling casualties in the period 2005-7 show that:

- Most reported cyclist KSI casualties (83 per cent) in 2005-07 were involved in a collision with another vehicle, usually a car or taxi (69 per cent).
- The bicycle was generally hit by the front of the other vehicle. Over a quarter of fatal collisions involved the front of the vehicle hitting the back of the bike.
- When a cyclist was involved in a collision with a large goods vehicle, they were more likely to be killed (18 per cent of fatal cycle accidents involved a HGV compared with 4 per cent of serious accidents).
- Single cycle accidents (without a preceding collision with another vehicle) are less likely to be reported to the police. Nevertheless, 16 per cent of cyclist KSI casualties for the period 2005-07 in the STATS19 database did not involve a collision with another vehicle. The majority of non-collision cycle accidents occurred away from junctions and a higher proportion of non-collision fatalities occurred in rural locations.

(Knowles et al, 2009)

What were the circumstances of collisions involving cycles?

In-depth analysis of cycling casualties in 2005-7 indicate that junctions are a key location of collisions when a vehicle is turning right or left and a cyclist is going straight ahead. ‘Failed to look properly’ was the overall most common contributory factor attributed to drivers and cyclists – for drivers this was 56 percent, and for cyclists 43 percent, of accidents.

In-depth analysis of cycling casualties in the period 2005-7 show that:

- The main circumstances of collisions which involved a bicycle and car were the car turning right or left with the cyclist travelling straight ahead, and the cyclists turning right while the car was travelling straight ahead.
- Almost half of fatal cycling accidents involving HGVs in Britain occurred at an urban junction.
- When an HGV was involved, the main collision pattern was the HGV driver turning left with the cyclist travelling straight ahead.
- In over three-quarters of collisions where a child cyclist was seriously injured, the main contributory factor was reported as being the child's behaviour. However, it is unclear whether children's behaviour really is the cause of these collisions of whether this is due to police officers' perceptions of children's behaviour as being the cause.
- Where contributory factors were assigned to the driver, 'failed to look properly' was by far the most commonly reported factor (56 per cent of serious collisions), followed by 'poor turn or manoeuvre' (17 per cent) and 'careless, reckless, in a hurry' (17 per cent).
- Cyclist injury severity was greater when the following contributory factors were assigned to the driver: 'impaired by alcohol', 'exceeding the speed limit', 'travelling too fast for the conditions' and 'vehicle blind spot' for HGVs.
- 'Passing too close to the cyclist' was judged to be a contributory factor in a quarter of accidents resulting in a serious injury involving HGVs, buses and coaches.
- The main contributory factors attributed to the cyclist included: 'cyclist failed to look properly' (43 per cent of serious collisions) and 'cyclist entering the road from the pavement (20 per cent of serious collisions). 'Cyclist entering the road from the pavement' was most likely to be attributed to a child (34 per cent of fatal and serious collisions involving children). 'Loss of control', 'dark clothing being worn at night' and 'travelling too fast for the conditions' were more common factors in fatal collisions, being reported in twice as many fatal collisions as serious collisions.
- The main contributory factors for single cycle accidents were 'loss of control' (reported in 67 per cent of fatal cases), 'travelling too fast for the conditions', 'careless, reckless or in a hurry' and 'impaired by alcohol'.
- Cyclists who were killed at the weekend and in the evening were more likely to be over the legal drink drive limit (13 per cent at the weekend compared with 9 per cent on weekdays, 24 per cent in the 6pm-am period compared with 4 per cent in the 6am-6pm period).
- Weather was not found to be a key contributory factor in cyclist casualties.

(Knowles et al, 2009)

When are cyclists injured?

Data from in-depth analysis of cycling casualties in 2005-7 suggest that most adult cycling casualties took place during daylight hours, and in particular in conjunction with commuting during peak hours. This was also borne out in 2011 RRCGB data. However, child cyclist casualties, while following similar patterns to adult casualties, occurred mainly in the afternoons on most days of the week (other than Sunday). All cycling casualties were more likely to take place during summer, although this was particularly so for children.

In 2011:

- Fifty-seven per cent of casualties occurred during peak hour (7-10am and 3-6pm)
- Most casualties occurred during the week on Mondays to Thursdays

(RRCGB: 2011 Annual Report, 2012)

In-depth analysis of cycling casualties in the period 2005-7 show that:

- Eighty per cent of KSI cyclists were injured in fine conditions on dry roads.
- Seventy-eight per cent of cyclist casualties were injured in daylight.
- Collisions at night/in the dark were more likely to result in a fatality.
- Rural roads were particularly dangerous as speed limits are higher and are often unlit.
- In Britain, a high proportion of cyclist KSI occurred in the summer, with a particularly strong peak for child cyclists between May and September.
- A higher proportion of adults were injured on the bicycles during the working week, rather than at the weekend, and there were peaks in the morning (6am to 9am) and late afternoon (3pm to 6pm).
- Children were injured predominantly in the afternoon (42 per cent between 3pm and 6pm). The daily proportions of child cyclist KSI casualties were roughly equal on Monday through to Saturday with a lower proportion on Sunday.

What types of injuries are sustained by cyclists admitted to hospital?

In a study analysing hospital in-patient data it was found that vehicle speed was associated with particular types of injuries. In rural locations head injuries were the most common injury type and were also the most serious, due to higher vehicle speeds. In urban areas where vehicle speeds are lower, injuries to the body were more common.

An analysis of hospital in-patient data found that:

- The head was most likely to sustain injuries, especially for children (45 per cent of children in the database), closely followed by the arms (41 per cent of casualties in the database).
- The most serious or life threatening injuries were those to the head, closely followed by the thorax.

- Cyclists killed in urban areas were more likely to have injuries on the abdomen and lower extremities due to most of these accidents involving turning HGVs travelling at lower speeds. Accidents in rural areas were more likely to involve blunt trauma as a result of higher speeds causing impact with vehicles and the ground.

  (Hynd et al, 2009)

Research findings

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

Why do people cycle?

Barriers and facilitators to cycling are complex and depend on individual perception, attitudes and circumstances. However, one of the key barriers to cycling is the relationship between cyclists and other road users. Interactions between other road users and cyclists are seen to create safety risks to cyclists, which can potentially be mitigated by well designed cycling facilities.

A qualitative study of road users' attitudes, perceptions and behaviour found:

- Six types of motivation for cycling:
    - to get from A to B
    - to get exercise
    - performance aspects of cycling
    - experiential aspects of cycling
    - to get away from stress/routine
    - social aspects of cycling
- The types of motivation do not correspond to types of cyclist: any given cyclist may have more than one reason to cycle, or different reasons for different types of cycling.
- Many of the barriers to cycling represent the negative aspects of motivations, such as:
    - inconvenience
    - the perceived effort involved
    - negative aspects of being out in the open
    - commitment
    - personal security
- The most important barriers to road cycling are related to other road users (ORUs):
    - the behaviour of ORUs
    - the volume and speed of traffic
- Participants perceived the risks of cycling as negative, based on either having witnessed collisions or experiencing 'near misses'. However, BMX riders saw injurity as an inevitable part of BMXing, and a cause for celebration.
- The availability and quality of cycling facilities (such as cycle lanes) was an important topic of discussion in the groups.
- However, the authors argue that cycling facilities on their own do not necessarily present a barrier to cycling. Yet well designed facilities can encourage cycling through clarifying and controlling the interactions between cyclists and other road users. They can also provide a 'refuge' for cyclists from other traffic.

(Christmas et al, 2010)

Cycling style and behaviour

The qualitative research on cycling provides two typologies of different cycling styles. One study (Christmas et al, 2010) found four different strategies were used by cyclists in managing their relationship with other road users, presented in the table below. This may aid understanding of different cycling styles and behaviours and may inform cycling safety interventions. Another study (Musselwhite et al, 2010) provides a typology of different types of cyclists, according to journey purpose, with different perceptions of road safety and road safety behaviour. While this typology may be helpful to understand road user safety in relation to cyclist motivation, it does not represent different segments of the cycling population as a cyclist may move between types according to journey purpose.

A qualitative study of road users' attitudes, perceptions and behaviour found:

- Cyclists have greater choice in terms of positioning themselves of the road compared with cars but are more limited in terms of speed and acceleration.
- Four basic approaches for using these choices/limitations in response to the stress created by the behaviour of ORUs and traffic were identified:

Name of Approach	**Basic strategy**	**Positioning strategy**
Avoidance	Avoid traffic completely	Off-road wherever possible; left-of-lane on quiet roads only
Guardedness	Keep out of the way	Consistent use of left-of-lane positioning as default position; may avoid the busiest roads and most challenging junctions
Assertion	Stay in control of the situation	Consistent use of middle-of-lane position to establish position in traffic; bold and well-signalled moves between lanes-within-lanes
Opportunism	Make the most of the bike	Situational judgement of which position best balances needs against risks

- A cyclists' choice of approach is linked to their level of confidence as well as motivations for cycling. This choice is also flexible, depending particularly on journey purpose.

(Christmas et al, 2010)

Another qualitative study of adult road users found:

- Participants categorised cyclists in three ways:
  - Professionals (e.g. couriers);
  - Commuters;
  - Leisure cyclists
- Each group was perceived different in terms of safety:
  - Couriers were seen as the least safety conscious, exhibiting aggressive and inconsiderate behaviours and often flouting traffic rules. Yet they were also seen as more confident due to greater levels of experience.
  - Commuter cyclists were also associated with risky cycling behaviours due to their high volume in urban areas during rush hours, causing congestion. Also, the lack of experience of a subset of commuter cyclists ('fair weather' cyclists) was seen as a concern as was the lack of visibility gear (lights and clothing) on some commuters.
  - Overall, leisure cyclists were seen as the safest although within this category, younger cyclists were seen as a threat in terms of risk taking.

(Musslewhite et al, 2010)

Young cyclists

There are specific cycling safety issues for young cyclists. These include lower awareness of road rules and needs of other road users (due to less experience on the road), lower levels of confidence among some young cyclists (possibly young female cyclists) and problematic risk-taking among other, mainly young male, cyclists.

A qualitative study of road users' attitudes, perceptions and behaviour found:

- Children may lack an understanding of the perspectives of other road users due to their obvious lack of experience as car drivers.
- Child cyclists were concerned about their perceived need to cycle on the pavement as they felt it was often unsafe to cycle on the road (and may be told by parents to do so).
- For some young male cyclists, risk-taking, aggression and peer pressure can present safety risks. The authors argue that this cultural aspect of cycling for younger males should form part of the understanding of road safety for cyclists.
- The authors argue that while BMX riding may encourage risk-taking it may also help develop cycling skills and provide an outlet for 'young male risk-taking'.

(Christmas et al, 2010)

Safety equipment

The perspectives of road users, including cyclists, in two qualitative studies suggest that safety equipment, including helmets and visibility wear, could play a more significant role in cycling safety. Currently, many cyclists express doubts as to whether helmets increase safety and some see it as a safety measure for children only. While study participants had more positive views on the safety potential of visibility wear, few actually wore it. The perspectives discussed in these two studies provide opportunities for extending current use of these two key pieces of safety equipment.

A qualitative study of road users' attitudes, perceptions and behaviour reports:

- A number of key themes in participants' reasons for and against wearing a cycle helmet were identified:
  - Feeling safer with a helmet on, especially in traffic and/or when cycling faster.
  - 'Looking the part – or looking a prat'.
  - The inconvenience of carrying the helmet round.
  - Helmets seen as being specifically for children
- Participants expressed doubts as to the efficacy of helmets and whether they really provide safety benefits, especially when cycling in traffic or at high speed.
- Opportunities may exist to:
  - Promote more consistent wearing of helmets by those who already wear them in some situations.
  - Tackle the perception that helmets are specifically for children.
- High-visibility clothing was seen as important by many cyclists, though very few actually wore it. The authors reported that promoting better visibility would be easier than promoting helmets. Moreover, it could be incorporated into a wider programme to promote better road sharing, since visibility is for the benefit of both cyclists and other road users.
- There may be particular issues around young men not wearing visibility clothing and lights.
- If helmets fit and are worn correctly, they should be effective at reducing risk of different types of head injury.

(Christmas et al, 2010)

Another qualitative study of road users found that:

- Of all road users, participants highlighted cyclists as among those as most risk due to their relative physical vulnerability. The factors which influenced their perception of risk among cyclists included the journey urgency and cyclists' level of confidence and experience.
- Cyclists themselves identified their visibility and awareness of other road users as the main factors influencing their perception of risk. From the cyclist perspective, the most dangerous behaviours included pedestrians crossing the road through stationary traffic when cyclists are still moving; stationary cars opening doors into cyclists; and car drivers turning without indicating or checking mirrors.

(Musselwhite et al, 2010)

Sharing the road

A qualitative study (Christmas et al, 2010) of road user perspectives focused on the issue of road sharing in cycling safety. In this study, cyclists failing to look and signal were seen as key problems for other road users. There is evidence of an associated negative stereotype of cyclists, of which one of the characteristics is poor attitude, incompetence and disregard for the law. However, the authors of the study point to a deeper issue in the culture of road sharing where norms of road sharing do not reflect law, leaving cyclists relatively marginalised.

A qualitative study of road users' attitudes, perceptions and behaviour found:

- The main factors which road users identified as contributing to 'things going wrong' on the road related to aggressive behaviours; 'failures' of attitude, competence/understanding and expectation; and pressure from other road users.
- The most common problem behaviours – not looking and failing to signal – were open to multiple interpretations. For instance, not looking could be understood as an example of any but the first of the above factors.
- Look-but-failed-to-see (LBFTS) did not seem to feature as an explanatory concept in the qualitative workshop. The authors suggest this could be due to a range of reasons including: a lack of self-awareness in terms of perceptual ability; the need to justify actions after making a mistake; or the research process.
- Study participants across all road user groups displayed more empathy for car users than other groups, including 'minority road users' such as cyclists. This may be a reflection of participants being more likely to have experience as a car driver.
- Perhaps as a result, there was a more definite stereotype of cyclists as a group (which did not exist for the general category of car drivers). This stereotype related to a 'failure of attitude' and disregard for road rules and the needs of other drivers. It also included a perception that cyclists lack competence.
- This stereotype of cyclists is also linked to the fact that cyclists do not need to undertake training, are unlicensed and uninsured, and do not pay road taxes (at least not by virtue of the fact that they cycle)
- The authors argue that there is evidence of a 'deeper failure in the culture of road sharing' on English roads, which may help to determine interactions between road users on the road. Additionally, roads which are designed for cars, in terms of width and speed limits, leave cyclists marginalised. There is also a more general question, on which even cyclists are divided, as to whether cyclists should be accommodated on the roads and if so how this should happen.

(Christmas et al, 2010)

Road sharing and infrastructure

A study on the role of infrastructure in cycling safety suggests that infrastructure can play a role in improving road sharing culture. However, there are arguments for and against providing separate facilities for cyclists. For example, segregating cyclists from other road users could be seen as an advantage by some road users (including some types of cyclists (avoidant cyclists– see section on cycling styles above) but could further marginalise cyclists on the road. The Dutch Sustainable Safety principles provide an example of how road sharing can be successfully managed to promote safety for cyclists.

A literature review on the role of infrastructure in cycling safety (Reid and Adams, 2011) found:

- Infrastructure, alongside other interventions can play a role in improving the culture of road sharing. This should sit alongside other interventions based on marketing, education, legislation and enforcement.
- The provision of cycling lanes may mean that other road users expect cyclists to stay off the road. Road infrastructure should clarify where cyclists and road users should be on the road and avoid creating further confusion. Complex infrastructure which needs to be decoded by road users should be avoided and road users should be given clear instructions
- Cyclists themselves have differing and potentially conflicting needs from infrastructure. This varies according to the cycling typology presented in the section on cycling styles above. Those choosing the 'assertion' approach require infrastructure that enables them to assert their right to use the road and clarifies how the road should be shared. Those who select the 'avoidance' approach need facilities which enable them to avoid traffic.
- The most significant infrastructure-related risk factors for cyclists in single vehicle incidents on highways are:
  - Slippery road (due to weather)
  - Poor or defective road surface
- For multi-vehicle collisions the infrastructure risk factors appear to be:
  - Speed limits
  - Encounters with other road users[4]

(Reid and Adams, 2011)

[4] Note that these are selected by police officers from a list of available factors and are not designed to be specific to cycle accidents.

An ETSC review of EU cycling safety policies and evidence argues that:

- Infrastructure-based interventions can help road users, including cyclists, comply with traffic rules more effectively and thereby reduce collisions caused by lack of compliance where this is an issue.
- Cyclist collisions should be analysed to ascertain whether road infrastructure should be adapted to encourage greater compliance with road rules
- The Dutch Sustainable Safety principles can be used to categorise the functional use of roads which influences the type of road user travelling on each road type. The speed management regime for each road type and section can then be based on this information in response to the needs of the mix of road users.
- A speed limit of 30km/h is recommended for roads used by cyclists and pedestrians
- The German Guidelines for Cycling Facilities provides an example of how it is decided whether bicycle-specific infrastructure is needed (see ETSC 2012)
- The ETSC review provides guidelines and recommendations for managing cyclist safety on different types of roads (ETSC 2012).

Safety in numbers

Research investigating the idea that when the level of cycling increases cycling becomes safer provides evidence in favour of this theory. A report by CTC (a cycling charity) briefly reviews the international literature in this area and presents the findings from their own analysis of data from English towns and cities. Using cycling to work as a proxy for levels of cycling, the researchers contrasted the cycle commuting use in 104 English local authorities from the 2001 census against the Killed and Seriously Injured statistics for around 5 years. Their findings provide evidence supporting the existence of this effect in the British context:

- The evidence base shows that when cycling levels increase, casualty rates are reduced. There are examples of this in the UK:
    - In London there has been a 91 percent increase in cycling since 2000 while cycle casualties have fallen by 33 percent since 1994-98. The result is that cycling is 2.9 times safer than previously.
    - In York, cycling levels rose from a 15 percent share in 1991-3 to 18 percent in 1996-8. During that time, cyclist KSI fell from 38-15 (total numbers).
- As a result of the authors' analysis, the average number of KSIs is the same in areas where there is a high level of cycling as in areas where cycling levels are very low. This suggests that the exposure to risk for cyclists in areas with high cycle use is lower than those where there is lower cycle use.

- While it is unclear why the increase in cycling levels leads to lower risk, the authors put forward some potential reasons:
    - Drivers become accustomed to cyclists and develop effective strategies for sharing the road with them
    - Drivers may themselves cycle and therefore be more aware of cyclists' needs on the road.
    - An increased volume of cyclists may lead to greater political will to improve conditions for cyclists.

(CTC, undated).

Risk of cycling vs. other modes

A study by Mindell et al (2012) found that when they compared cycling with walking and driving, using hours of exposure as a denominator, the level of risk was similar across the three modes. However, when broken down by age and gender, the risk for young males aged 17-20 was 5 times greater when driving compared with cycling.

- The study analysed hospital admissions and deaths in England 2007-9 by age and gender for pedestrians, cyclists and car drivers. It used the National Travel Survey to convert distance travelled to time travelled.
- The analysis showed that risk is similar across the three modes although there is variation according to age and gender.
- Yong males aged 17-20 years are at five times greater risk when driving compared with cycling.
- Also, male cyclists aged over 70 years were overall at greatest risk across all three modes.
- Females had low risk compared with males for all three modes except as older drivers
- The authors conclude that when comparing modes of travel using time as a denominator, cycling is not necessarily more hazardous than driving, especially for young males.

Health risks of cycling vs. safety risks

A Dutch study (Hartog et al, 2010), looking at whether the health benefits of cycling outweigh the safety risk, found that the health benefits of increased physical activity with cycling resulted in significant gains in life-years than losses in life years due to increased inhaled air pollution and traffic collisions. These findings may well be relevant to the UK as the literature review on which the calculations were based included relevant literature from UK studies.

- Cyclists were found to have inhaled higher doses of air pollution than car drivers and the risk of fatality was also higher for cyclists. However, as a result of increased physical activity there was a significant decrease in cardiovascular disease and mortality.
- People who shift from car to bicycle, experience around 9 times more gains in life-years than the losses in life years due to increased inhaled air pollution doses and traffic accidents. There will also be benefits to society as a whole due to decreases in air pollution.

(de Hartog et al, 2010).

How effective?

Cycle helmets

A study based on in-depth analysis of Hospital Episode Statistics and police fatal files attempted to estimate the potential effectiveness of helmet wearing in cycling collisions (Hynd et al, 2009). The study concluded if cycle helmets had been worn, a proportion of 7 per cent of head injury cases in a hospital dataset may not have required hospital treatment, and 10-16 per cent of fatalities in a police dataset may have been prevented. However, this is a conservative estimate due to the methodological limitations of the study.

- The Hynd et al (2009) study investigated the extent and nature of the head injuries sustained by pedal cyclists, which were then correlated with accident circumstances. In conjunction with consideration of the biomechanics of head injury and the mechanics of helmeted head impacts, this information was used to predict the potential effectiveness of cycle helmets at mitigating or preventing a proportion of the more severe types of head injury, i.e. cranium fractures and/or intracranial injury.
- The accident databases used were:
  - The hospital episode statistics (HES) database for England (1999 to 2005)
  - Police fatal file derived pedal cyclist database (2001 to 2006).
- Ten per cent of the HES casualties sustained serious cranium fracture and/or intracranial injuries. The majority of this group (7 per cent of the total) only sustained these injuries and had no other head or other body region trauma. Therefore, if cycle helmets had been worn, a proportion of this 7 per cent may not have required hospital treatment at all.
- The review of cyclist fatality police reports highlighted that between 10 and 16 per cent of the fatalities reviewed could have been prevented if they had worn a cycle helmet.

- There are limitations associated with the predictive approaches undertaken by this type of study, so conservative estimates of helmet effectiveness were assumed for different accident scenarios (10-50 per cent). Further, the police fatal files reviewed were biased towards London and therefore the percentage benefit is only indicative of a national estimate.
- No evidence was found for an increased risk of rotational head injury with a helmet compared to without a helmet.
- Cycle helmets would be expected to be effective in a range of accident conditions particularly where the collision does not involve another vehicle or where a vehicle has light impact with the cyclist causing their head to hit the ground,

(Hynd et al, 2009)

Cycle Helmet Testing

Cycle helmet testing sets a minimum standard for helmet effectiveness, which is specific to particular jurisdictions. Helmets are expected to be effective in a range of collision types but effectiveness depends on the particular circumstances of the collision such as the physical characteristics of the rider and nature of the object the head collides with.

A study reporting on helmet effectiveness testing found:

- In most jurisdictions, cycle helmets are tested to ensure a minimum level of performance for a range of criteria that affect safety. Typically these include:
  - Construction requirements
  - Impact test requirements
  - Retention system (strap) strength and helmet stability
  - Definition of the minimum area of the head covered by the helmet
  - Definition of a minimum field of view (to ensure that the helmet does not impede the vision of the wearer)
- Most cycle helmet standards are based on similar impact tests but the outcome measurements may be set at different levels. Studies into helmet effectiveness should therefore take these differing standards into account
- Helmets manufactured to current English standards (EN 1078 for child and adult helmets and EN 1080 for younger child helmets) have been estimated to be effective in a range of collision situations. However, effectiveness depends on the stature and injury tolerance of the rider and the shape and stiffness of the object struck by the head (e.g. a flat road surface, a kerb, or a deformable car bonnet).

(Hynd et al, 2009)

Links

Research on cycle lanes provide little evidence of effectiveness in the UK context. However, effectiveness seems to vary according to the level of segregation from other traffic. Cycle lanes that provide complete segregation from other traffic may provide a higher level of effectiveness than cycling lanes which do not provide segregation at all times. In these latter types of lanes, points which intersect with roads and pavements expose cyclists to risk. One study suggests that this risk may be greater than the risk cyclists are exposed to if there is no cycle lane.

A literature review on the role of infrastructure on cycling safety found:

- There is little UK evidence that marked cycle lanes provide a safety benefit and where they cause the cyclist to come into close proximity of cars, where cycle lanes intersect with car traffic, the increased may reverse any safety benefits.
- The nature of cycle lanes is likely to influence cyclists' casualty risk. For example, footways that have been converted to cycleways and illegal use of footways have been identified as increasing risk.
- Cycle paths which are segregated from motorised traffic may result in a decrease in casualty severity, however, there is no available national data to confirm this. Also, for segregated cycle paths to be effective, their surface must be maintained.

(Reid and Adams, 2011)

Junctions

Road junctions are a particular source of risk to cyclists, with a significant proportion of cycling collisions occurring at junctions (see section above on where cycling collisions happen). The literature suggests that junctions should be a focus for road safety interventions aimed at cyclists. A range of intervention types are suggested including reducing speed of motorised traffic at junctions, which seems to be the most effective. TfL (TfL 2010) carried out a trial of roadside safety mirrors in London to increase the visibility of cyclists to HGV drivers. While various road users thought it would have a positive effect on their driving behaviour in relation to cyclists, the results of the trial are not yet available.

A literature review on the role of infrastructure on cycling safety found:

- Junctions are a particularly common location for cyclist collisions and should therefore be a target for safety interventions.
- Reducing the speed of traffic through junctions by introducing traffic calming interventions are an effective way of reducing cyclist casualties. Although it should be borne in mind that collisions involving HGVs are likely to be at low speed.
- Junctions that involve traffic travelling at greater speed such as roundabouts are particularly risky for cyclists.

- The is little evidence to support the effectiveness of cycle advanced stop lines (ASLs) although the review suggests that ASLs may be useful where there are heavy flows of right-turning cyclists.
- Infrastructure interventions in continental Europe, which have not been implemented in UK, may be of beneficial. These include cycle lane markings that continue across junctions and cycle pre-mirrors.

(Reid and Adams, 2011)

A study reporting on a trial of roadside safety mirrors, designed to improve the visibility of cyclists that have entered a large goods vehicle (LGV) driver's near-side blind spot, reported that[5].

- The roadside safety mirrors were installed at key junctions, primarily on the Barclays Cycle Superhighway routes.
- From the perspective of LGV drivers, the mirrors were seen as a helpful intervention to improve the visibility of cyclists and reduce blind spots.
- The majority of LGV drivers reported that the mirrors would enable them to drive more safely but that this positive effect would not transfer to cyclist behaviour. However, those who did believe that cyclists' behaviour would change thought this would be in terms of cyclists being more aware of their positioning in relation to LGVs.
- A minority of LGV drivers, and some cyclists, identified a concern that knowledge of the presence of the mirrors might cause drivers and cyclists to be less careful.

(TfL, 2010)

Systemic Approaches

Evidence from a study on the role of infrastructure in cycling safety and An All Party Parliamentary Cycling Group report (Goodwin, 2013) suggests that systemic approaches, involving a range of interrelated interventions, are likely to be more effective than single or more piecemeal interventions. Speed reduction (in the form of speed limits and traffic calming) are an important part of systemtic approaches, alongside other interventions. Although it should be borne in mind that most cyclist collisions involving HGVs turning at junctions are at low speed, which will be of particular relevance in urban areas.

[5] The results are based on a relatively small number of individuals and this should be kept in mind when interpreting the findings.

A literature review on the role of infrastructure in cycling safety found:

- Strong evidence that reducing speed limits will result in safety benefits for cyclists as well as other road user types. Traffic calming measures and wider use of 20mph speed limits can help achieve this.
- In other European countries, systemic interventions involving network-wide segregated cycle paths and traffic calming measures has managed to increase levels of cycling whilst ensuring safety. It is important to note that for such interventions to be successful, a piecemeal approach needs to be avoided.
- For such a system-wide intervention to be successful in the UK, the authors argue that cycle traffic must be prioritised and invested in on a long term basis and there must be a systemic approach which balances increased cycling levels with safety.
- The evidence on adopting legal conventions e.g. concerning priority at junctions, from other European countries in the UK is less clear and further research is needed in this area.

(Reid and Adams, 2011)

References

Title: Reported Road Casualties Great Britain: 2011 Annual Report
Published: Department for Transport, September 2012
Link: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/9280/rrcgb2011-complete.pdf
Objectives: Presents detailed statistics regarding the circumstances of personal injury road collisions, including the types of vehicles involved, the resulting casualties, and factors which may contribute to the collisions.
Methodology: Majority of the statistics in the report are based on information about collisions reported to the police.
Keywords: Collisions, casualties, alcohol, killed or seriously injured.
Comments: National statistics.

Title: Reported Road Casualties Great Britain 2013 Annual Report
Published: Department for Transport, September 2014
Link: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359311/rrcgb-2013.pdf
Objectives: To present detailed statistics regarding the circumstances of personal injury road collisions, including the types of vehicles involved, the resulting casualties, and factors which may contribute to the collisions.
Methodology: Majority of the statistics in the report are based on information about collisions reported to the police.
Key Findings • Pedal cyclists accounted for 11% of all road casualties in 2013, 6% of road deaths, 15% of serious injuries and 10% of slight injuries. • Pedal cyclist deaths have fallen over the long term, but have fluctuated between roughly 100 and 120 over the last six years. • In 2013, 109 pedal cyclist were killed, an 8% decrease from 2012. • The number of pedal cyclists seriously injured also fell by 2% to 3,143, the first decrease in reported seriously injured cyclist casualties since 2004. • The total number of pedal cyclist casualties in road accidents in 2013 was 19,438, up 2% from the 2012. • Males make up more than 80% of pedal cyclist casualties. Of the 109 pedal cyclist fatalities in 2013, 20% were female and 80% male. • Pedal cycle traffic levels rose by 1% between 2012 and 2013. • Reporting rates for pedal cyclists are lower than for other road users, and cyclist non-fatal casualties are amongst the most likely to be underreported, especially where the pedal cycle was the only vehicle involved. • Trends in pedal cyclist casualties can be partly explained by changes in how much people cycle, so it is important to consider the number of pedal cyclist casualties per mile cycled. • On urban roads pedal cyclists comprise roughly a fifth of casualties, whereas on rural roads they account for around 10%.
Keywords: Collisions, casualties, drink drive, alcohol, killed or seriously injured.
Comments: National statistics.

Title: Reported Road Casualties Great Britain 2014 Annual Report

Published: Department for Transport, September 2015

Link:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463797/rrcgb-2014.pdf

Objectives: To present detailed statistics regarding the circumstances of personal injury road collisions, including the types of vehicles involved, the resulting casualties, and factors which may contribute to the collisions.

Methodology: Majority of the statistics in the report are based on information about collisions reported to the police.

Key Findings

- Pedal cyclists accounted for 11% of all road casualties in 2014, 6% of road deaths, 15% of serious injuries and 10% of slight injuries.
- Pedal cyclist deaths have fallen over the long term, but have fluctuated between roughly 100 and 120 over the last seven years.
- In 2014, 113 pedal cyclist were killed, a 4% increase from 2013.
- The number of pedal cyclists seriously injured also rose, by 8% to 3,401.
- The total number of pedal cyclist casualties in road accidents in 2014 was 21,287, up 10% from the 2013.
- Males make up more than 80% of pedal cyclist casualties. Of the 113 pedal cyclist fatalities in 2014, 18% were female and 82% male.
- Reporting rates for pedal cyclists are lower than for other road users, and pedal cyclist non-fatal casualties are amongst the most likely to be underreported, especially where the pedal cycle was the only vehicle in the accident.
- On-road pedal cycle traffic rose by 3.8% to 3.25 billion vehicle miles in 2014. Cycle traffic has risen by 27% since 2007, and cyclist casualties have risen by 31% over the same period.
- It is likely that the increase in cycling has resulted in more accidents as cyclist become more exposed to motor vehicle traffic.
- On urban roads pedal cyclists comprise roughly a fifth of casualties, whereas on rural roads they account for around 10%.
- Most pedal cyclist killed or seriously injured casualties occur at crossroads and t-staggered junctions.
- The main contributory factors for all RTIs, attributed to pedal cyclists were: failed to look properly (23%), failed to judge the other person's path or speed (10%), careless, reckless or in a hurry (9%) and cyclist entering from pavement (6%).

Keywords: Collisions, casualties, drink drive, alcohol, killed or seriously injured.

Comments: National statistics.

Title: Raising the bar. Review of cycling safety policies in the European Union
Published: European Transport Safety Council, 2012
Link: http://www.etsc.eu/documents/scientific_review_of_cycling_safety_web.pdf
Objectives: Reviews policies on cycling safety in the EU
Methodology: Not stated – but appears to be a literature review
Key Findings: Reviews EU cycling policy and discusses evidence related to cycling safety in EU countries. Presents recommendations based on the Dutch Sustainable Safe Cycling principles. Presents a range of other policy and intervention options from various European countries and a list of policy recommendations.

Title: Like-by-like assessment of Road Safety Mode
Published: PLOS One 7 (12), 2012, Mindell JS, Leslie D, Wardlaw M
Link: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0050606
Objectives: To develop a method to more accurately compare the safety of walking, cycling and driving, as modes of travel by age and gender.
Methodology: Analysis of hospital admissions and deaths in England 2007-9 by age and gender for pedestrians, cyclists and car drivers. Distance travelled was converted to time travelled as a more appropriate measurement for comparison between the two travel modes. A similar analysis is carried out in the Netherlands for comparison.
Key Findings: • When the risk associated with the three modes of travel are calculated by the hour, the risk is similar across the modes although there is significant variation according to age and gender. • Young makes aged 17-20 years are at five times greater risk when driving compared with cycling. • Also, male cyclists aged over 70 years were overall at greatest risk across all three modes. • Risks for drivers decrease with age whereas the risk for pedestrians and cyclists increase with age. • The authors conclude that when comparing modes of travel using time as a denominator, cycling is not more hazardous than driving, especially for young males.
Comments: The study overcomes some of the methodological issues in comparing different transport modes although there are also limitations associated with the methodology using hospital admission records. This meant that results for driver risks did not include third parties killed or seriously injured.

Title: Infrastructure and Cyclist Safety
Published: S. Reid and S. Adams (2011) TRL report PPR580 **Link:** : Findings summary: http://assets.dft.gov.uk/publications/infrastructure-and-cyclist-safety/infrastructure-and-cyclist-safety.pdf Report: https://trl.co.uk/reports/PPR580
Objectives: This review considers the role of infrastructure in the causation and reduction of injuries to cyclists. It was undertaken as part of the wider research programme, Road User Safety and Cycling, being led by TRL on behalf of the Department for Transport.
Methodology: This literature was undertaken to establish what is already known about casualties involving cyclists. This report specifically covers literature relating to the influence of infrastructure on cycle casualties, focussing on the context in which injuries to cyclist happen and can be reduced.

Key Findings:
• There is a notable lack of evidence on the amount of cycling activity in the UK and the exposure of cyclists to different forms of infrastructure. This lack represents a serious barrier to more detailed understanding of how to reduce risk to cyclists.
• Taken as a whole, the most significant infrastructure-related risk factors for cyclists in a single vehicle incidents on highways appear to be:
  • Slippery road (due to weather)
  • Poor or defective road surface
• For multi-vehicle collisions the infrastructure risk factors appear to be:
  • Speed limits
Encounters with other road users

Comments: The results are based on a relatively small number of individuals and this should be kept in mind when interpreting the findings. Note though that these are selected by police officers from a list of available factors and are not designed to be specific to cycle collisions

Title: Understanding Public Attitudes to Road User Safety
Published: C. Musselwhite, E. Avinen, Y. Susilo, E. Fulcher, D. Bhattachary, A. Hunter, R. Stockley (2010), Road Safety Research Report No. 111, DfT **Link**: http://webarchive.nationalarchives.gov.uk/20120606181145/http://www.dft.gov.uk/publications/rsrr-theme5-report-111/
Objectives: in-depth understanding of how the public engage with the issue of road user safety.
Methodology: The research used qualitative methods and brought together the views of a wide range of adult road users. Specifically, a deliberative approach was used to explore the public's insights, perceptions and conceptualisation of road user safety and to go beyond their top of mind responses. A total of 240 participants were recruited in 4 areas across the UK (United Kingdom – Bradford, Glasgow, London, north-west Wales). In total, each area had six groups of ten participants. Group composition was based on a life-stage and attitude to road user risk. Each group was reconvened three times in the spring of 2009.
Key Findings: • Findings suggest, on the whole, respondents felt that the UK's roads are fairly safe to use for all modes of transport and are especially safe for cars. • However, certain groups of road users were viewed as at greater risk – in particular younger drivers and teenage pedestrians. • Motorcyclists were also perceived to be at great risk of a collision. • Walking and cycling was largely felt to be less safe than driving, and this was especially true for cycling in city centres (particularly in Glasgow and London) and walking on rural roads.

Title: Do the Health Benefits of Cycling Outweigh the Risks?
Published: Jeroen Johan de Hartog, Hanna Boogaard, Hans Nijland, and Gerard Hoek (2010), Environmental Health Perspectives, Vol 118, number 8 **Link**: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920084/
Objectives: To describe whether the health benefits from the increased physical activity of a modal shift for urban commutes outweigh the health risks
Methodology: The authors review literature on the health risks related to air pollution, traffic collisions, and physical activity as main exposures of car travel in contrast to pedal cycling. For deriving the relative risks comparing car driving and cycling, we specified a hypothetical scenario based on statistics in the Netherlands. The scenario assumes a transition from car driving to cycling for 500,000 people 18–64 years of age for short trips on a daily basis in the Netherlands.
Key Findings: • On average, the estimated health benefits of cycling were substantially larger than the risks of cycling relative to car driving. • For the society as a whole, this can be even larger because there will be a reduction in air pollution emissions and eventually fewer traffic collisions. • Policies stimulating cycling are likely to have net beneficial effects on public health, especially if accompanied by suitable transport planning and safety measures.

Title: **Cycling, Safety and Sharing the Road: Qualitative Research with Cyclists and Other Road Users**
Published: S. Christmas, S. Helman, S. Buttress, C. Newman (2010) Road Safety Web Publication No.17, DfT **Link**: http://assets.dft.gov.uk/publications/safety-cycling-and-sharing-the-road-qualitative-research-with-cyclists-and-other-road-users/rswp17.pdf
Objective: This report presents findings from qualitative research carried out with cyclists and other road-users in June 2009 by Simon Christmas Ltd, the Transport Research Laboratory (TRL) and SHM, as part of the wider research programme, Road User Safety and Cycling, being led by TRL on behalf of the Department for Transport. This phase of work has been largely 'descriptive', aiming to provide a map of the diversity of safety-relevant motivations, attitudes, perceptions and behaviour among cyclists and other road users (ORUs).
Methodology: Each of eight groups of cyclists took part in two two-hour workshops, in which participants were engaged in a series of exercises to explore their views on the positives and negatives of cycling; their accounts of stress and risk on the road; their views on potential problems in interactions between cyclists and ORUs; and their use of safety gear.
Key Findings: • Cycling is not a single homogeneous activity, but a number of different activities that have in common the use of a two-wheeled unpowered vehicle. • Understanding people's motivations to cycle is important for road safety because risk may be interpreted, experienced and managed in qualitatively different ways, depending on what one perceives oneself as doing and why one is doing it.

Title: Trial of Roadside Safety mirrors for Cycle visibility

Date: TfL, 2010
TfL report 10016
Link: http://www.tfl.gov.uk/cdn/static/cms/documents/trial-of-roadside-safety-mirrors-for-cycle-visibility-report.pdf
Free / priced: Free

Objectives: Transport for London (TfL) has obtained permission from the Department for Transport (DfT) to undertake a trial of roadside safety mirrors, which are designed to improve the visibility of cyclists that have entered a large good vehicle (LGV) driver's near side blind spot, thus reducing the risk of a collision between cyclists and LGVs, particularly when the LGV is turning left. These roadside safety mirrors have been installed at key junctions, primarily on the Barclays Cycle Superhighway routes.

Methodology: 51 LGV drivers were asked about their experience and opinions of the roadside safety mirrors. These interviews were conducted over the telephone. Only drivers that had either been spotted travelling along the route, or were confirmed to have used the route following an approach to their company, were included in the sample.
20 cyclists and 20 car/van drivers were intercepted and interviewed at natural stopping places (for example bicycle/car parks) after they had been through a junction fitted with a roadside safety mirror.

Key Findings

- **Awareness of roadside safety mirrors** - Almost half of the LGV drivers that had driven through the trial junctions recalled the roadside safety mirrors when prompted and over a quarter stated that they used them. A third of cyclists and car/van drivers recalled seeing the mirrors.
- **Understanding of roadside safety mirrors -** LGV drivers understood that the purpose of the mirrors was to help them see cyclists and other road users in their near side blind spot. Almost all stated that the mirrors would improve the safety at the junctions for cyclists and LGVs. Three quarters stated that the mirrors would increase safety for pedestrians. Cyclists and car/van drivers understood that the mirrors would help increase visibility but fewer made the link specifically with LGVs.
- **Perception of roadside safety mirrors' impact on safety -** The majority of LGV drivers, cyclists and car/van drivers believed that roadside safety mirrors would improve cyclists' safety, and most LGV drivers said unprompted that they were intended to help them either see cyclists better or reduce their blind spots.
- **Impact of roadside safety mirrors on behaviour -** LGV drivers expressed concern about the safety of cyclists, many mentioning without prompting the dangers of cyclists entering their blind spots (particularly those on the near side of their vehicle, though this was not always specified).

Title: **Collisions involving pedal cyclists on Britain's roads: establishing the causes**
Published: J. Knowles, S. Adams, R. Cuerden, T. Savill, S. Reid, and M. Tight (2009) TRL report PPR445 **Link**: https://trl.co.uk/reports/PPR445
Objective: This report provides an in-depth assessment of the key risk factors relating to cycling.
Methodology: The work involved an international literature review and a detailed analysis of cyclist casualties in Great Britain, drawing on both national and in-depth databases of road collisions and cycling. The main source of the casualty data was the national STATS19 injury and collision data for 1994-2007. Contributory factors have been recorded nationally as part of the STATS19 system from 2005 and analyses of these data are also reported. The main source of cycling activity data was the National Travel Survey (NTS) of 2006 (the most recent data available at the time of analysis).
Key Findings: • In 2008, 115 pedal cyclists were killed and 2,450 reported as seriously injured on Britain's roads, accounting for 9 per cent of all killed or seriously injured (KDI) road casualties (DfT 2009). • The number of cyclists KSI has steadily increased in recent years, with the figure for 2008 being 11 per cent higher than for 2004. • However, the number of cyclists killed and injured makes no allowance for the number of people cycling or the distance travelled. • The number of KSI per 100 million KM travelled (as measured by the National Road Traffic Survey) was fairly constant between 2002 and 2006 but increased in 2007.
Comments: At the time the analyses were undertaken, the 2008 data was unavailable and so the majority of the report refers to data up to 2007.

Title: **The potential for cycle helmets to prevent injury – a review of the evidence**
Published: D. Hynd, R. Cuerden, S. Reid, S. Adams (2009) TRL report PPR446 **Link**: https://trl.co.uk/reports/PPR446
Objective: This report focuses on understanding whether cycle helmets reduce the frequency and severity of injury in the event of a collision. It does not include detailed consideration of whether wearing or not wearing a helmet influences the likelihood of being involved in an collision, either through behaviour in the rider or in other road users.
Methodology: This research report was commissioned to provide a comprehensive review of the effectiveness of cycle helmets in the event of an on-road collision, building on previous work undertaken for the Department for Transport. The objectives were to evaluate the effectiveness of cycle helmets from several perspectives: • Review of cycle helmet testing and standards • A biomechanical assessment of the potential limitations to helmet effectiveness • A literature review of helmet effectiveness from real world studies • An in-depth accident data investigation to identify the potential for cycle helmets to prevent injury
Key Findings: • In 2008, 115 pedal cyclists were killed and 2,450 reported as seriously injured on Britain's roads, accounting for 9 per cent of all killed or seriously injured (KDI) road casualties (DfT 2009). • Approximately 40 per cent of pedal cyclists admitted to hospital in England suffer head injuries. • Cycle helmets are designed to reduce head injuries by absorbing the energy during a head impact and distributing the load. This is intended to reduce the risk of scalp laceration, cranium fracture, and severe brain injury. • Cycle helmet wearing rates have increased steadily since 1994 for most cyclist groups and in 2008 they were 34 per cent on major roads and 17 per cent on minor roads, up from 22 per cent on major roads and from 8 per cent on minor roads in 1999.

Title: Safety in Numbers in England
Published: CTC, the national cyclists' organisation, undated
Link: http://www.ctc.org.uk/sites/default/files/0905_sin_full_rpt_0.pdf
Objectives: The paper reviews the evidence on safety in numbers of cyclists in England and abroad and presents the findings of an analysis contrasting levels of cycling with KSI data. It also presents implications and recommendations for policy on encouraging more cycling.
Methodology: Brief literature review; quantitative analysis of census 2001 data on cycling to work and KSI data.
Key Findings: Research suggests that a doubling of cycling would lead to a reduction in the risks of cycling by around a third, ie. the increase in cycle use is far higher than the increase in cyclists' casualties.[1] There are plenty of examples to show that steep increases in cycling can go with reductions in cycle casualties. For example, in the UK: ○ London has seen a 91% increase in cycling since 2000 and a 33% fall in cycle casualties since 1994-98. This means that cycling in the city is 2.9 times safer than it was previously. ○ York, comparing 1991/3 and 1996/8: mode share for cycling rose from 15% to 18%, cyclist KSI fell 59% (from 38 to 15).

Title: Get Britain Cycling, Report from the Inquiry
Published: Phil Goodwin All Party Parliamentary Cycling Group, April 2013
Link: http://allpartycycling.files.wordpress.com/2013/04/get-britain-cycling_goodwin-report.pdf
Objectives: The report is of an All Party Parliamentary Cycling Group inquiry into cycling in Britain. The inquiry topics include: • The Basic Statistics and what is Wrong with them • Case Studies of Particular Places • Road Traffic Forecasts, 'Peak Car' and the Future of Cycling • Benefits of Cycling: traffic, health, economy • Planning and Design • Safety, Speed, and Regulation: a problem of the Hierarchy of Legal and Moral Responsibility • Training and education • Action checklist and Policy Recommendations from the Inquiry
Methodology: The inquiry draws on the expert evidence of group members which include ministers, organisations representing cyclists, pedestrians, motorists and freight transport, professional engineers, designers and road planners working for national and local government agencies, police and law agencies, researchers and other specialists. The author has also consulted the evidence base of published literature.
Keywords: Cycling, policy, health, safety, case studies, forecasts, economic benefits, planning, design, training, education
Comments: The report does not contain references to published literature but it was been written by an expert in the field and informed by expert evidence.

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