Reported Road Casualties Great Britain: 2013 Annual Report

Understanding short term casualty trends; the impact of the weather

Department for Transport

Key findings

The key findings from this article include:

- ► As the number of road casualties gets smaller, understanding the reasons behind **year-on-year changes** becomes more important. Weather patterns provide useful context to explain year-on-year changes in road casualty statistics.

- ► **Significant and extended snowfall throughout Britain at the start and end of 2010** is likely to have suppressed the number of users on the road leading to a reduction in traffic, accidents and casualties in these periods. This is likely to have reduced the number of fatalities in 2010 and as a result an increase in fatalities was seen in 2011. The return to the long term downward trend in fatalities in 2012 and 2013 after the increase between 2010 and 2011 reinforces the hypothesis that the 2010 figures were affected by the weather.

- ► **2012 was the second wettest year on record**. The likely result of this additional rainfall in 2012 would have been to reduce the number of vulnerable road users, particularly pedal cyclists and motorcyclists on Britain's roads, especially during the spring and summer months. This may have had the effect of reducing the number of accidents and casualties from these user groups. Both 2011 and 2013 were drier than 2012 so some caution is needed in interpreting changes in casualties between years over the period 2011-2013.

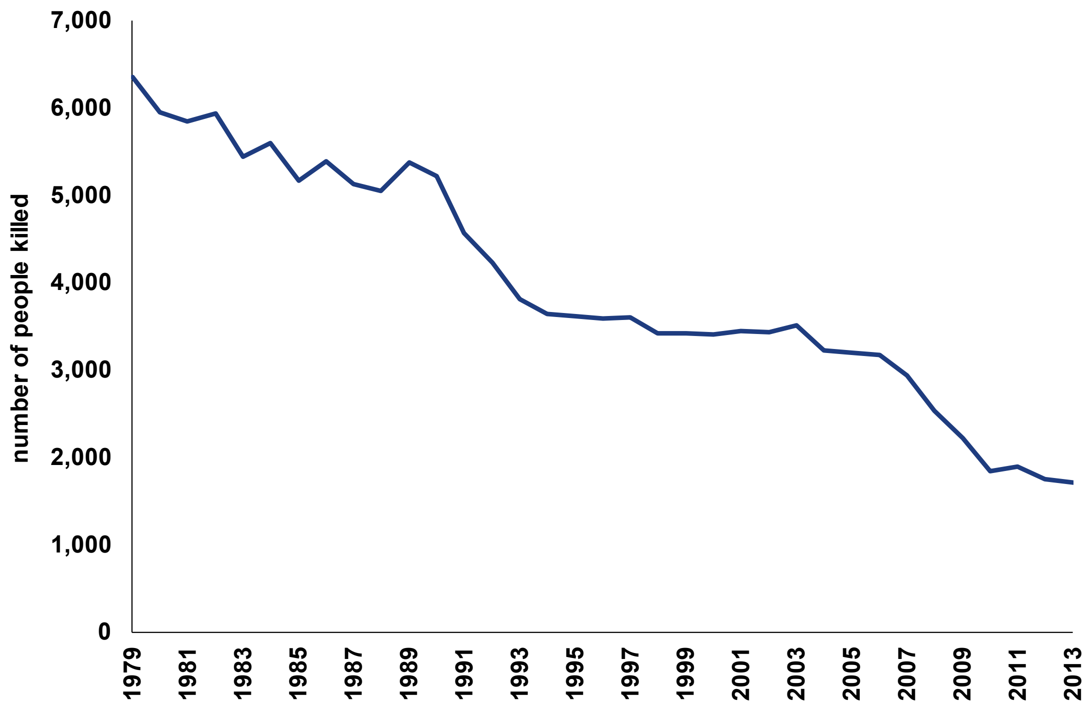
About this article

This article summarises the literature available on weather impacts on road accidents and casualties as well as discussing the main weather trends seen since 2010 and their likely impact on road casualties. We are carrying out more detailed research looking at the relationship between weather events (such as rain or sub-zero temperatures) and casualties.

Introduction

There has been a **long term downward trend** in the number of people killed in reported road accidents over the period 1979-2013. There are a number of factors which are likely to have contributed to this trend such as technology advances, improved driver education and training and improvements in post-accident care.

Chart 1: Number of people killed in reported road accidents, Great Britain: 1979-2013



Further information...

More detailed information on long-term casualty trends can be found in the Overview chapter, available here.

The above factors help to explain long term trends, but **weather patterns provide useful context to explain year-on-year changes** in road casualty statistics. As the number of road casualties gets smaller, understanding the reasons behind year-on-year changes becomes more important. Over the past few years we have included sections on how weather patterns affected trends in road casualties in both annual and quarterly publications (see here). This chapter summarises the literature available on weather impacts on road accidents and casualties as well as discussing the main weather trends seen since 2010 and their likely impact on road casualties.

Further information...

Weather data available from the Met Office here.

Summary of existing literature

There are several factors which occur during a prolonged period of extreme winter weather which may lead to a reduction in the number of accidents that occur on roads (Fridstrom et al., 1995). Extreme winter weather, relative to the more mild winters usually observed in most parts of Britain, can typically lead to a reduction in traffic. This, in turn, results in a reduction in accidents. In extreme conditions, such as heavy snow or ice, it can be very hard, if not impossible, for road users to access roads at all. Alternatively, they may become reluctant to travel in such conditions, and therefore only carry out journeys which are essential (Parry, 2000). This effect may be exaggerated further for vulnerable road users, as extreme winter weather conditions make travelling more dangerous (i.e. ice/snow makes roads extremely slippery for motorcyclists and pedal cyclists) and also less desirable (due to low temperatures), thereby discouraging travel.

Another possible contributing factor is a reduction in traffic speed during periods of extreme winter weather. This could be as a result of poor visibility or simply because people are aware that such conditions are particularly dangerous when travelling at speed. This results in a reduction in the overall probability of an accident occurring (Hassan & Barker, 1999). In addition, given that accidents occurring in these conditions will probably happen at lower speeds, there is a lower probability of a casualty when an accident does occur (Koetse & Rietveld, 2009). A reduction in the average free flow speed of traffic may also cause a reduction in the severity of an accident, for instance, if a typical accident which may lead to a slight injury happens at a reduced speed, there is a higher chance that the accident does not result in any injuries at all – hence the accident will not be reported to the police. Similarly, a reduction in speed may be enough to save someone’s life in an accident, converting a death into a serious injury, or a serious injury into a slight injury. This could result in a redistribution of accidents throughout the three levels of severity.

References...

Fridström, L., Ifver, J., Ingebrigtsen, S., Kulmala, R., Thomsen, L.K., 1995. Measuring the contribution of randomness, exposure, weather, and daylight to the variation in road accident counts. Accident Analysis and Prevention 27 (1), 1–20.

Parry, M.L., 2000. Assessment of Potential Effects and Adaptations for Climate Change in Europe: the Europe ACACIA Project. Jackson Environment Institute, University of East Anglia.

Hassan, Y.A., Barker, D.J., 1999. The impact of unseasonable or extreme weather on traffic activity within Lothian region, Scotland. Journal of Transport Geography 7, 209–213.

Koetse, M.J., Rietveld, P., 2009. The impact of climate change and weather on transport: an overview of empirical findings. Transportation Research Part D 14, 201–205.

The impact of cold weather in 2010

UK weather and GB road casualties, 2009-2011

2009

UK rainfall was 8% above the 1971-2000 average.

UK mean temperature was 0.6 °C above the 1971-2000 average.

2010

UK rainfall was 16% below the 1971-2000 average.

Coldest year since 1986 with temperatures well below average in Jan, Feb, Nov and Dec.

Widespread snowfall and frosts in Jan, Feb, Nov and Dec.

2011

UK rainfall was close to the 1971-2000 average.

Second warmest year since Met Office records began in 1910.

2009 v 2010

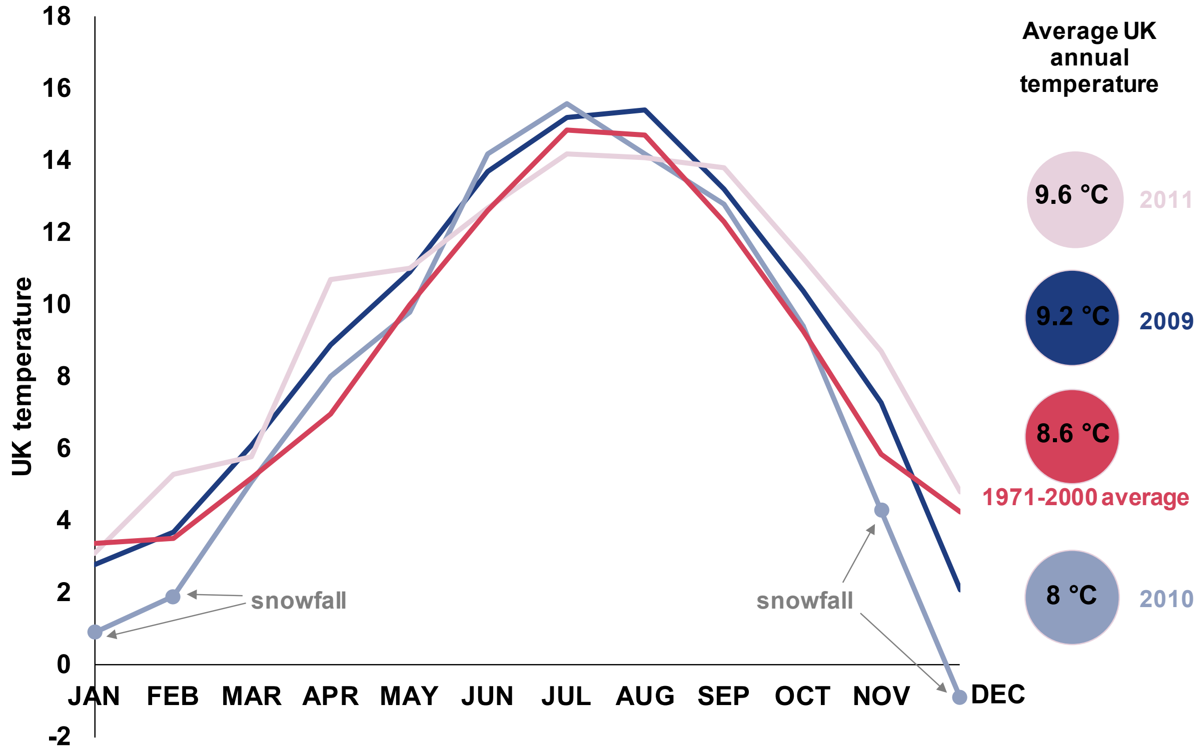
Killed	↓17%
Serious	↓ 8%
KSI	↓ 9%
Slight	↓ 6%
All casualties	↓ 6%

2010 v 2011

Killed	↑ 3%
Serious	↑ 2%
KSI	↑ 2%
Slight	↓ 3%
All casualties	↓ 2%

- As shown in chart 2, **temperatures in January, February, November and December of 2010** were below those in 2009 and 2011 as well as the 1971-2000 average for these months. In addition, there was widespread snowfall and frosts in January, February, November and December of 2010.

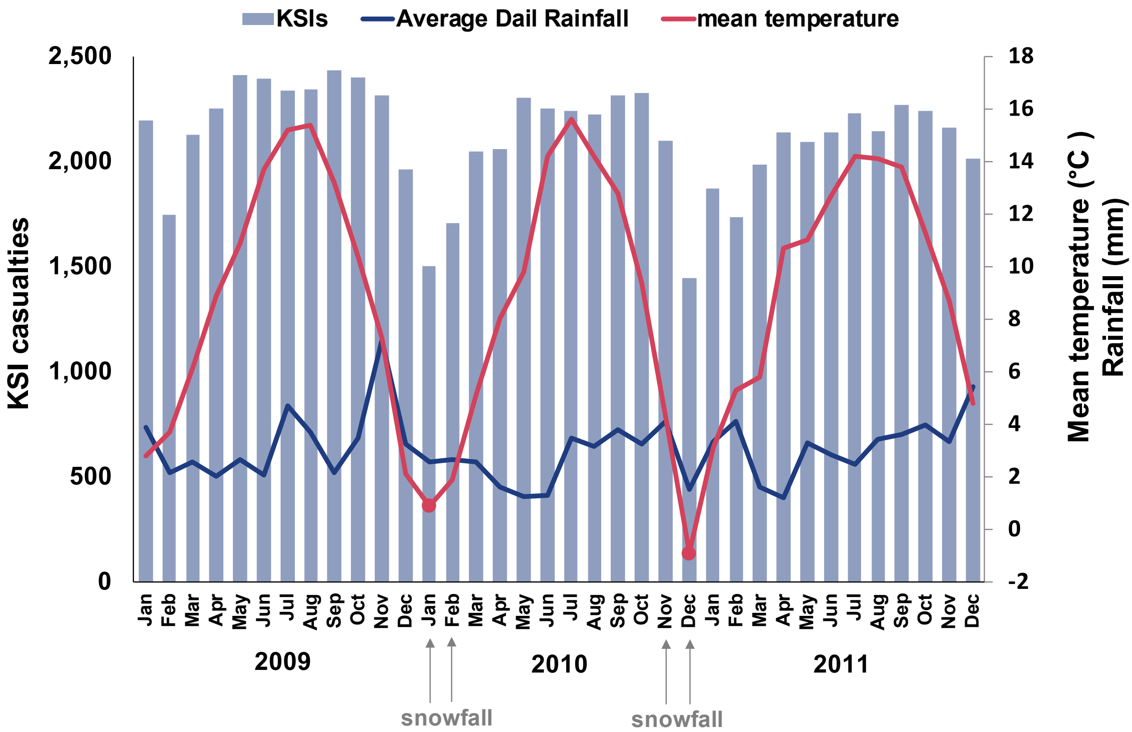
Chart 2: UK mean temperature 2009-2011 compared to the 1971-2000 average



- The cold temperatures combined with heavy snowfall and frosts in January and December 2010 are likely to have **suppressed the number of users on the road** (particularly pedestrians, pedal cyclists and motor cyclists who are more exposed to the weather). This is illustrated by the reduction in traffic levels that occurred in both the first and fourth quarters of 2010 compared to 2009. The first quarter of 2010 saw the lowest **traffic levels** in the first quarter of any year since 2002, whilst quarter four of 2010 was the lowest since 2000. There were larger falls in the traffic levels for the ‘other motor vehicles’ category (which incorporates motorcycles) in both the first and fourth quarters of 2010.

- The reduction in **traffic** is likely to have lowered the number of **accidents and casualties** in these months. This may explain why there were significantly fewer KSI casualties in January and December 2010 than in the same months of 2009 and 2011. This can be seen through the lower blue bars in chart 3 for these months.

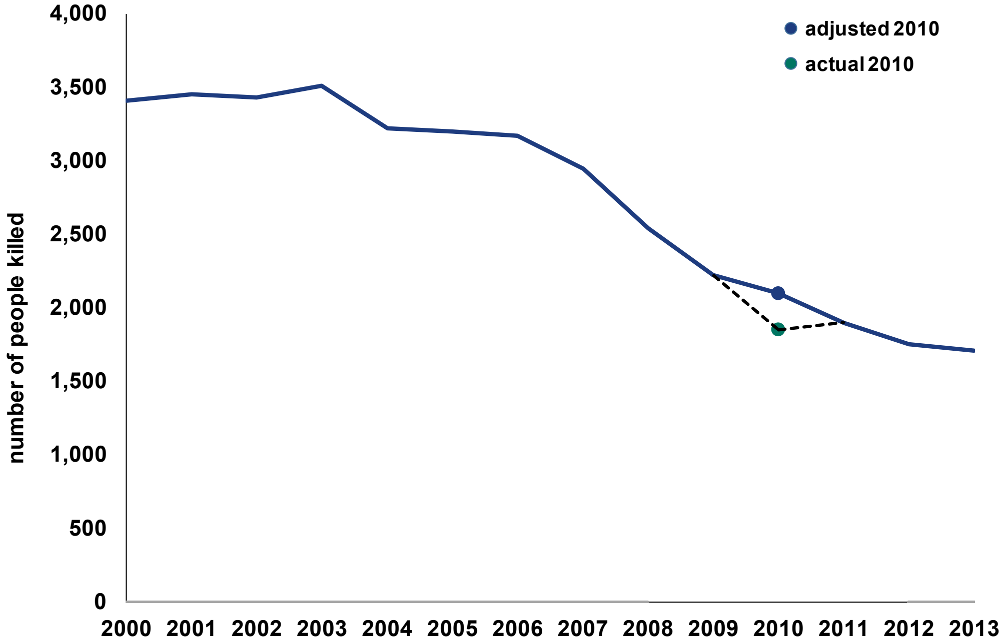
Chart 3: Killed or seriously injured casualties, average daily rainfall and mean temperature by month, 2009-2011[1]



1 Casualty figures cover GB whereas weather data is for UK

- The changes in the temperatures and weather conditions may partly explain why there was a **large fall in fatalities in 2010** (by 17 per cent) compared with 2009, followed by a 3 per cent rise between 2010 and 2011. It is reasonable to assume that had the weather been closer to average in 2010, we may have seen year-on-year falls in fatalities over 2009-2011.
- Chart 4 shows the number of fatalities over recent years, but with an **adjusted 2010 figure** based on the average year-on-year change over 2000-2013 excluding 2010. As can be seen, had the change in fatalities between 2009 and 2010 been more like other recent years, we would have had ten consecutive years of falls in fatalities.
- The **return to the long term downward trend in fatalities in 2012 and 2013** after the increase between 2010 and 2011 reinforces the hypothesis that the 2010 figures were affected by the weather.

Chart 4: Number of people killed in reported road accidents with adjusted 2010 figure, Great Britain: 2000-2013



Although the behaviour of all road user groups are likely to be influenced by the weather, by the very nature of how exposed to the elements **pedestrians, pedal cyclists and motorcyclists** are, these groups are likely to be more sensitive than other road users to abnormal weather.

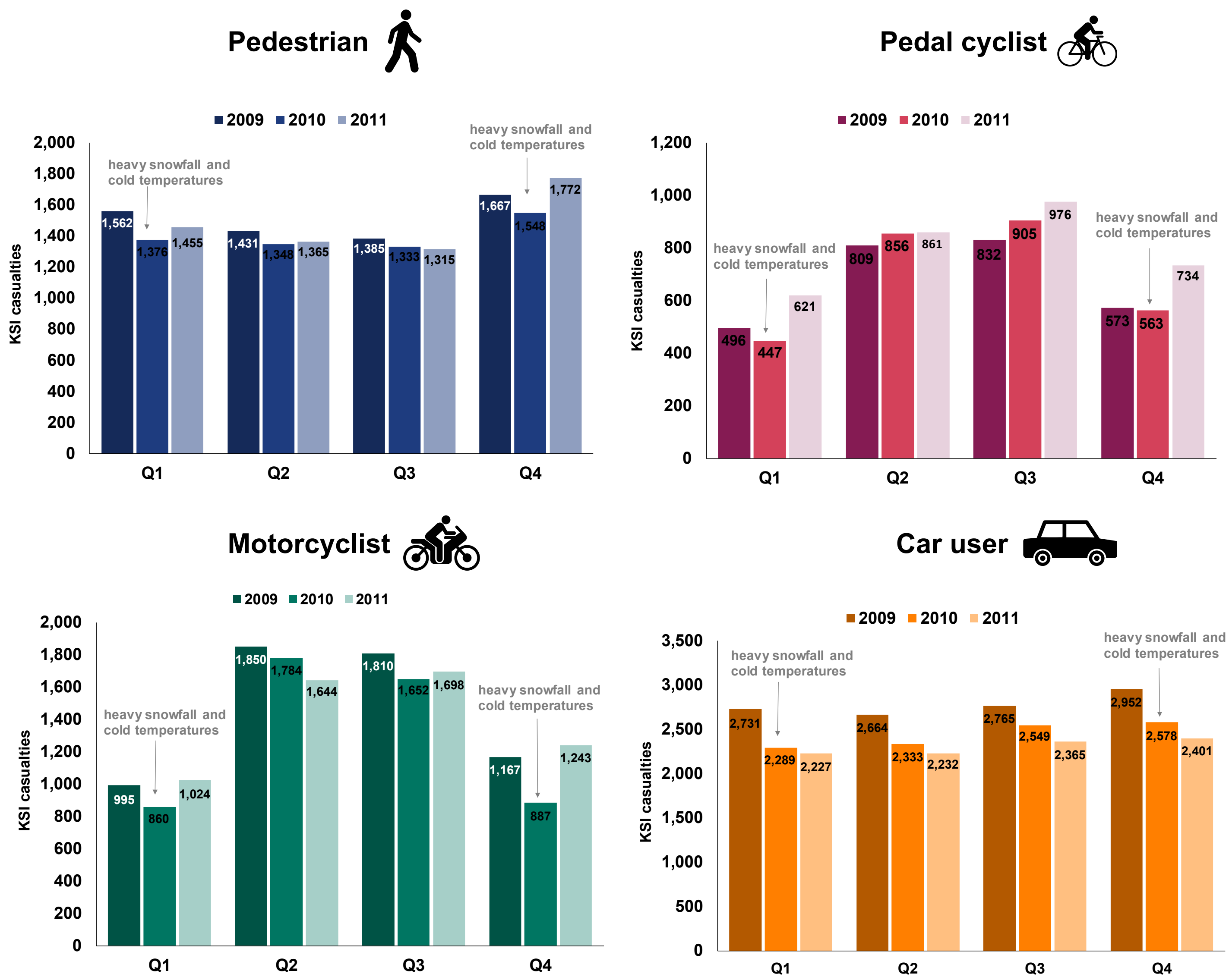
Chart 5 compares quarterly KSI casualties for the **more exposed road user types** (pedestrians, pedal cyclists and motorcyclists) with **car users.** The number of KSI casualties for all road user groups fell in quarters one and four between 2009 and 2010. Given that pedestrians, pedal cyclists and motorcyclists might be expected to be more sensitive to bad weather, we might expect these groups to show the largest falls. KSI casualties for these groups fell by 12 per cent in both quarters, comparing 2010 with 2009. In contrast, though, the number of car user KSI casualties fell by 16 per cent in quarter one and 13 per cent in quarter four, quite a bit higher than for the more exposed groups.

There are two possible explanations for this. Firstly, as will be discussed in the following section, **pedal cyclists and motorcyclists show strong seasonality**. They are much more active in the late spring, summer and early autumn months than the winter months. As the extreme weather being discussed here fell in December and January, there are likely to have been only a relatively small number of pedal cyclists and motorcyclists on the roads. And given that the weather in winter is usually fairly cold and wet, the road users that are out at that time can be expected to be fairly hardened to the weather and less sensitive to conditions than other 'fair-weather' road users. This could mean that the dampening effect on pedal cyclists and motorcyclists of bad weather in winter is lower than unseasonably bad weather in summer would be.

The second explanation can be seen from what happened between 2010 and 2011. As has been noted, there were falls in the number of KSI casualties for all road users in the first and fourth quarters between 2009 and 2010. However, this fall continued into 2011 for car users. In contrast, the number of KSI casualties increased in the first and fourth quarters of 2011 for pedal cyclists, motorcyclists and pedestrians. Although this section is looking at the specific changes between 2009 and 2011, it is important not to forget the overall context of road casualties; namely that, for a number of years, the number of fatalities and KSI casualties has been coming down for car users. And, as car users make up 60 per cent of road casualties, any short-term change is being driven both by this long-term fall as well as the external year-on-year effects, such as from the weather.

So, in the specific question of the 2010 bad weather, the falls in quarters one and four are made up of a combination of extreme winter weather affecting all road user types, and the continued long-term falls in casualties being seen more strongly in the car user group.

Chart 5: KSI casualties by road user type, quarterly, 2009-2011



The impact of wet weather in 2012

UK weather and GB road casualties, 2011-2013

2011

UK rainfall was close to the 1981-2010 average.

Second warmest year since Met Office records began in 1910.

2012

Second wettest year since Met Office records began in 1910.

UK mean temperature was close to the 1981-2010 average.

2013

UK rainfall was close to the 1981-2010 average.

UK mean temperature was close to the 1981-2010 average.

2011 v 2012

Killed	↓ 8%
Serious	↓ 0.4%
KSI	↓ 1%
Slight	↓ 4%
All casualties	↓ 4%

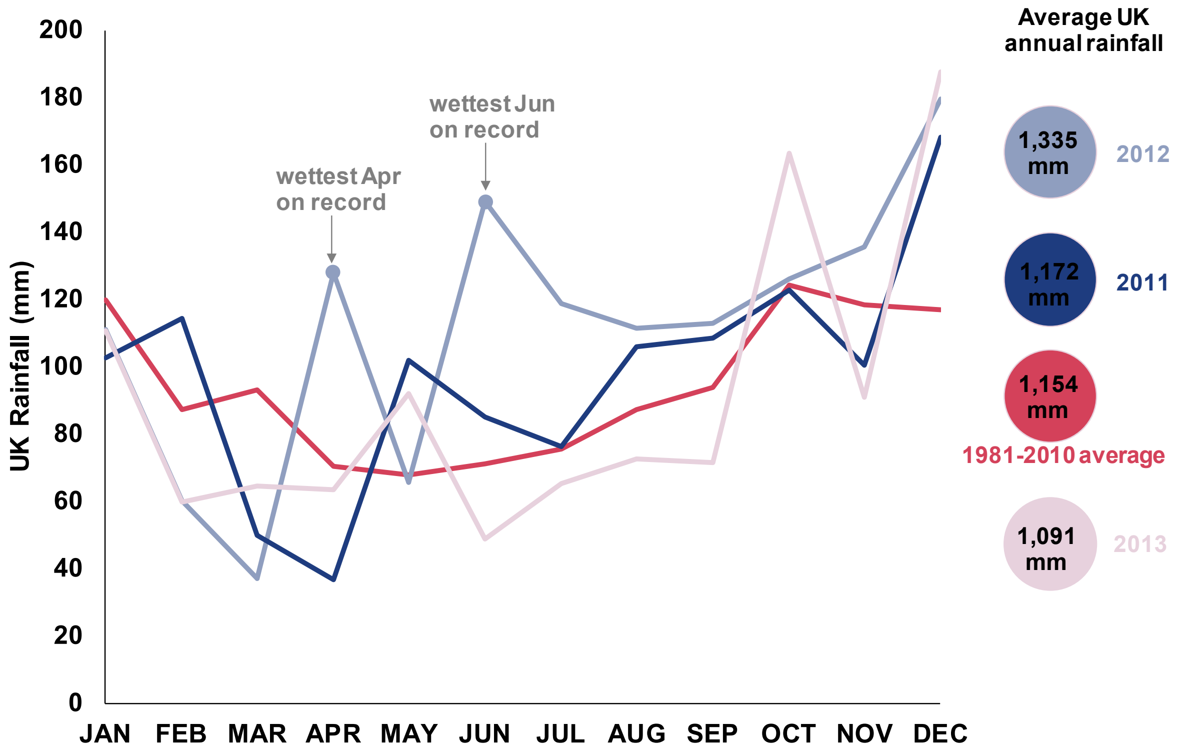
2012 v 2013

Killed	↓ 2%
Serious	↓ 6%
KSI	↓ 6%
Slight	↓ 6%
All casualties	↓ 6%

- Unlike the period of 2009 to 2011, which was predominately affected by the temperature, across the UK in 2012 there were no extreme or unusual deviations from the long term average temperature and despite a cold March and warm July in 2013, the average temperatures in 2012 and 2013 were similar. However, **2012 was the second wettest year on record**, behind 2000.

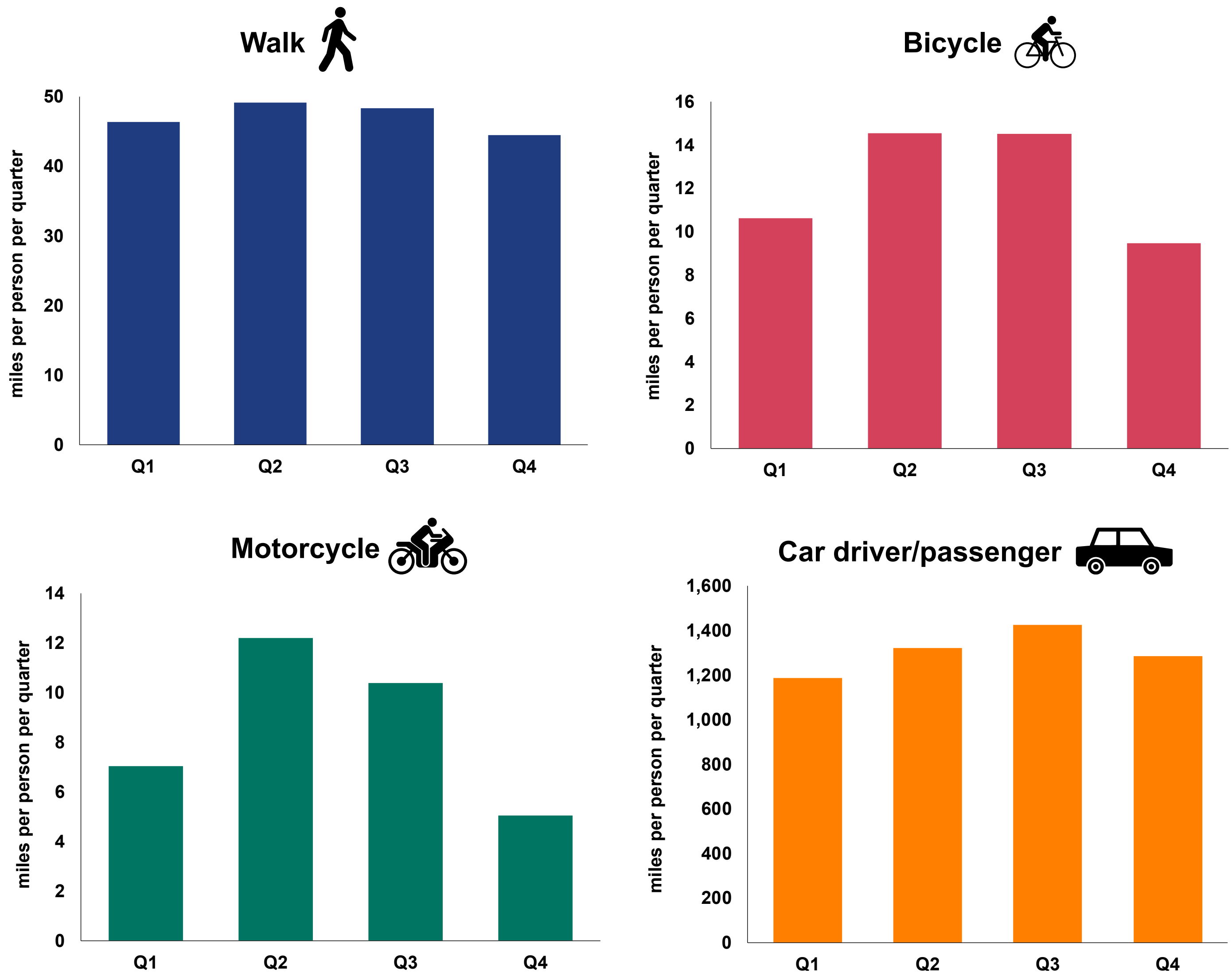
- As shown in chart 6, **eight of the last nine months of the year had more rainfall than the 1981-2010 long term average**. In particular, there were sustained periods of heavy rainfall during late spring and early summer in the UK. Rainfall in April, June and July was well above the long term average for that month. The second quarter of 2012 (April to June) was the wettest second quarter since Met Office records began in 1910 with rainfall roughly 60 per cent above the 1981-2010 average.

Chart 6: UK monthly rainfall 2011-2013 compared to the 1981-2010 average



- Traditionally, **pedal cyclists and motor cyclists are more active during the summer period** than the winter period. This can be seen in chart 7, which shows a peak of activity during the second and third quarters of the year for these groups. Much of the unusually high levels of rainfall in 2012 came during this summer peak period. The likely result of this would have been to reduce the number of all the vulnerable road users, but especially pedal cyclists and motorcyclists, on Britain's roads. There was a decrease in **vehicle traffic levels** in the second quarter of 2012 compared to 2011 with a larger fall in the traffic levels for the 'other motor vehicles' category (which incorporates motorcycles). A reduction in exposure in this way may have had the effect of reducing the number of accidents and casualties from these user groups.

Chart 7: Average distance travelled by calendar quarter and mode, England: 2009/13

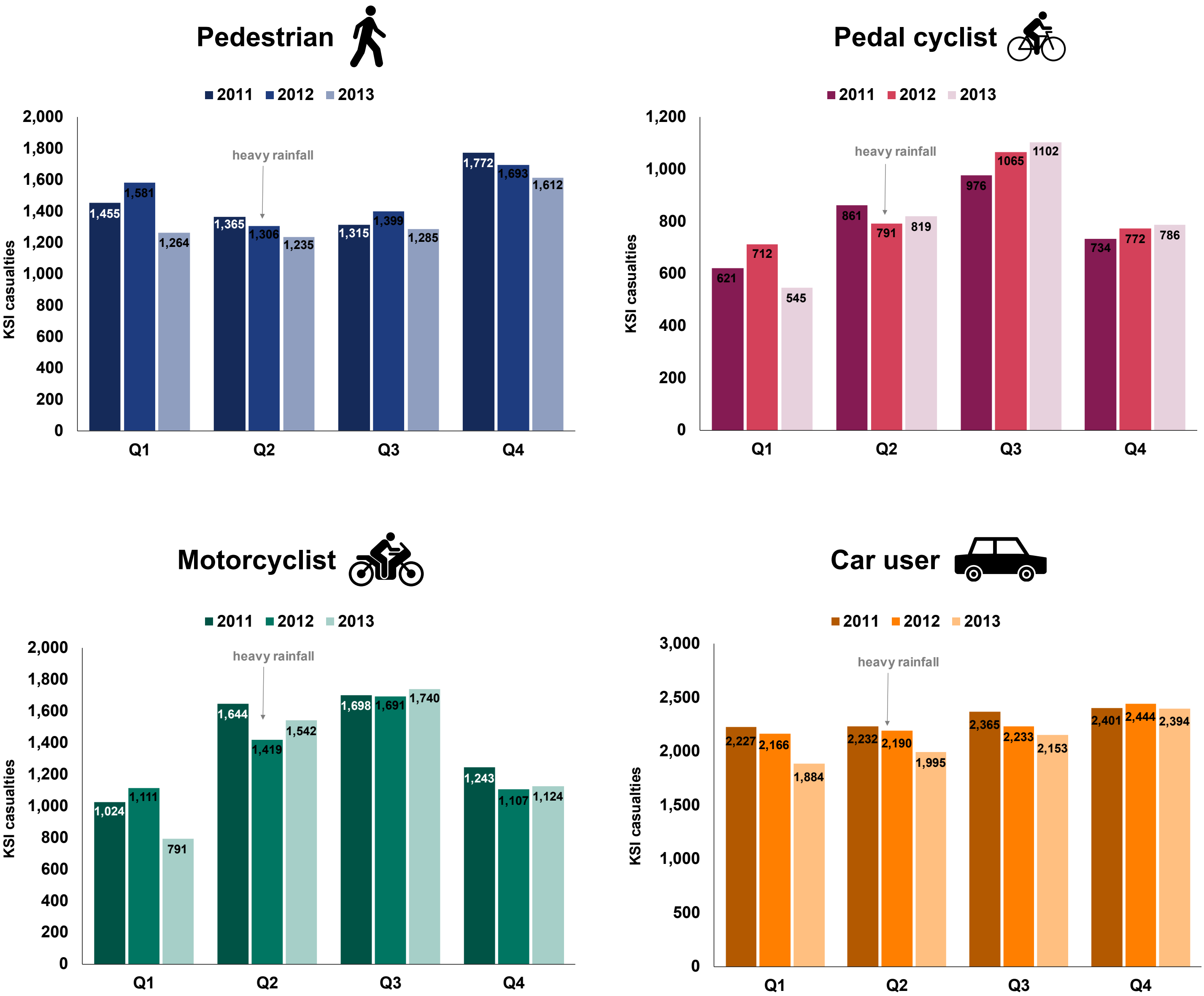


- As with low temperatures and snowfall, **other road users, such as car occupants, are less sensitive to the rain**, and are therefore unlikely to have been as strongly affected by the heavy rainfall observed in 2012.
- This can been seen in chart 8. There were **falls in KSI casualties across all the user groups between the second quarters of 2011 and 2012**. However, whilst there was only a 2 per cent reduction in car user KSI casualties, the pedal cyclist and motorcyclist users fell by 8 per cent and 14 per cent respectively, considerably more.
- Interestingly, though, the changes between the third quarters of 2011 and 2012 are less easy to explain. Although July 2012 was much wetter than July 2011, the rainfall in August and September of both years was fairly similar (as well as being significantly over the long term average). It is possible, therefore, that pedal cyclists and motorcyclists started to return to the road in more typical numbers during this quarter in 2012, especially as all months were drier than the wet April and June earlier in the year. It should be noted, though, that we do not have

any specific empirical evidence to support such a theory.

- It is reasonable to assume that had 2012 been drier there may have been a higher number of casualties and accidents. In comparison, **both 2011 and 2013 were drier than 2012** and close to the 1981-2010 long term average for rainfall. Therefore, some caution is needed in interpreting changes in casualties between years over the period 2011-2013. Had the 2012 rainfall been lower, there may have been a larger number of vulnerable road user casualties, particularly pedal cyclists and motorcyclists in 2012 and thus a smaller fall in casualties between 2011 and 2012 and a larger fall in casualties between 2012 and 2013.
- There was considerably **less rainfall in the middle two quarters (Apr – Sep) of 2013 compared to 2012**. The likely effect would have been to increase the number of vulnerable users on the roads, especially pedal cyclists and motorcyclists in 2013 compared to the same period in 2012. Vehicle traffic levels were higher in quarters two and three of 2013 than the same periods of 2012 with traffic levels for the 'other motor vehicles' category (which incorporates motorcycles) also higher. This may have led to a higher number of casualties than might have been expected from these groups during that period in 2013. This may explain why there were increases in both pedal cyclist and motorcyclist KSIs in the second and third quarters of 2013 compared to 2012, as shown in chart 8.

Chart 8: KSI casualties by road user type, quarterly, 2011-2013



Summary

Overall, **2010 is the year which is likely to have been most affected by the weather**. The cold weather and heavy snowfall at the start and end of 2010 is likely to have suppressed the number of users on the road (particularly pedal cyclists, motor cyclists and pedestrians who are more exposed to the weather) leading to a reduction traffic, accidents and casualties in these periods. Although the 2011 casualty figures were in line with the long term downward trend, the potentially artificial low of 2010 resulted in an increase in fatalities and serious injuries between 2010 and 2011.

It is reasonable to assume that **had the weather in 2010 been closer to the long term average** it is likely that more people would have been on Britain's roads during the year. And, as a result, we could have expected to see more accidents and more casualties. Chart 4 shows the number of fatalities over recent years, but with an adjusted 2010 figure based on the average year-on-year change over 2000-2013 excluding 2010. As can be seen, had the change in fatalities between 2009 and 2010 been more like other recent years, we would have had ten consecutive years of falls in fatalities. The return to the long term downward trend in fatalities in 2012 and 2013 after the increase between 2010 and 2011 helps reinforce this hypothesis.

Analysis of weather data will continue in **future publications** where it shows unusual or abnormal weather patterns have occurred. The **latest quarterly publication** (see here) included an analysis of weather data. There was heavy rainfall in the first quarter of 2014 which would be expected to reduce vulnerable road user activity during this quarter and thus suppress casualty numbers, as was the case in 2012. However, given the large increases in casualties for all road user types in this quarter compared to 2013 (particularly pedal cyclists and motorcyclists) it does not seem that the high rainfall had the expected impact. As shown in chart 7 above, pedal cyclists and motor cyclists tend to be less active in the first and last quarters of the year, but more active in the summer months. This may explain why the rainfall in the first quarter of 2014 did not have as much of an impact on casualties from these groups as the heavy rainfall in the summer of 2012 (particularly quarter 2). Hence, the effect weather has on casualties from each of the different road user groups are likely to depend on the time of year. It is also important to recognise that the relationship between casualty numbers and the weather is complex. Different groups may respond to different thresholds. In addition, other external factors (such as the price of fuel, school term-times, how long the unseasonable weather lasts for, etc.) can play a significant role in mitigating or exaggerating the effects of weather.

We are carrying out **more detailed research** looking at the relationship between weather events (such as rain or sub-zero temperatures) and casualties. This includes being part of a cross government group looking at how we assess the weather effects of different types of statistical series. Work is being undertaken by the ONS Methodology Advisory Service to model the relationship between the weather and road casualty figures. Outputs from this work will be published once completed.