THE BEHAVIOURAL INSIGHTS TEAM

Reducing Killed and Seriously Injured (KSI) Collisions in East Sussex

Update Report: initial data science findings

24 April 2017 (updated May 2017)

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Executive Summary

Across England, the number of collisions that result in a person being killed or seriously injured (KSI) has declined over the past decade whereas in East Sussex it has increased by almost 20 per cent. The proportion of people Killed and Seriously Injured (KSI) on roads in East Sussex is 64.5 per 100,000, compared to 39.3 per 100,000 people for England, or 50.2 per 100,000 for Dorset.[1] [2]

The Behavioural Insights Team (BIT) is working with East Sussex County Council to address this challenge by: using new data science techniques to understand what increases the likelihood of KSI collisions in East Sussex; and working with the Council and partners to develop interventions informed by evidence from behavioural science research to reduce the number of KSIs caused by behavioural factors.

This update report sets out findings from the data analysis undertaken; identifies the behaviours that may underpin these findings; and recommends three groups of drivers who should be the primary recipients of interventions informed by evidence from behavioural science. The findings in this report will inform a workshop with East Sussex County Council and partners, at which a series of interventions to reduce KSI collisions in East Sussex will be identified.

Project deliverables

Deliverable	Contents
Update Report (this document)	This update report sets out findings from data science against hypotheses; sets out the behavioural and other factors likely to be at play in KSI collisions; and identifies three target groups for interventions. It is intended as background preparation for workshop attendees.
Policy Workshop on 27 April	At the workshop we will present in detail the likely behavioural factors at play; channels for reaching target groups; and intervention points. The objective of the workshop is to identify a series of interventions, informed by research from behavioural science, to take forward.
Post-workshop Report	In this report, we will write up the interventions identified in the workshop, include evidence from the behavioural science literature, assess likely impact and propose evaluation methods.

[1] 2012 – 2014 figures
[2] We draw the comparison with Dorset because it is similar to East Sussex in terms of weather and demographic patterns, and like East Sussex has no motorways and little of the strategic road network.

Findings

In this report, we use data science to test eight hypotheses identified through interviews with road safety experts and experienced professionals in Sussex. A summary of our findings against these hypotheses is overleaf.

We find that what the driver is doing at the point of a collision, along with driver and vehicle characteristics, strongly predicts whether a given collision will be a KSI collision, while road characteristics and the reasons for a journey are less predictive. This suggests that interventions that target specific behaviours and specific types of driver are likely to be effective in reducing KSI rates. Based on these findings, we identify three categories of road users that we recommend should be the primary recipients of behavioural interventions:[3]

1. **Motorcyclists** who are both disproportionately likely to cause KSI collisions, and likely to be involved in KSI collisions without causing them.

2. **Young drivers aged 17 – 24, and particularly young male drivers**, who are disproportionately likely both to cause and to be involved in KSI collisions.

3. **Car drivers in general** who are likely to cause KSI collisions by hitting vulnerable road users, such as cyclists, motorcyclists and over 65s.

Next steps

These findings will inform a workshop on April 27, where we will present in greater detail the behavioural factors that underpin the behaviours of drivers in the target groups, as well as setting out proposed channels and intervention points for changing those behaviours.

[3] Given the low frequency of KSI collisions, it is not possible to narrow those categories down further.

Summary of findings against hypotheses

Hypothesis	Findings
1. **Older drivers (above the age of 65) are more likely to be involved in KSI collisions.**	We do not find evidence to support this, as over 65s are involved in approximately as many KSI collisions as their percentage of the population. In fact, over 65s are proportionately less likely to cause of KSI collisions.
2. **Younger drivers (aged 17 – 24) are more likely to be involved in KSI collisions, particularly if they are male.**	We find evidence to support this. As well as being more likely to be involved in KSI collisions, younger drivers are disproportionately more likely to cause KSI collisions. This is particularly true of young male drivers.
3. **Occupational drivers are more likely to be involved in KSI collisions and, relatedly**, a collision involving a goods vehicle is more likely to result in someone being KSI.	We find no evidence to support this. Journey type is unimportant in determining whether a collision will be KSI; goods vehicles are proportionately less likely to cause KSI collisions.
4. **KSI collisions may be caused by drivers who are not from the local area.**	We do not find evidence to support this. Most KSI collisions are caused by drivers who live in East Sussex.
5. **Drivers of powered two wheelers are more likely to be involved in KSI collisions.**	We find evidence to support this. Powered two wheelers cause a disproportionate number of KSI collisions, they are also likely to be involved in a high proportion of KSI collisions caused by cars.
6. **Reductions in the number of Road Policing Unit officers over the past decade means there is no longer a credible fear of enforcement.**	Vehicles with prior-speeding offences recorded against them are disproportionately involved in KSI collisions and speeding reoffending is high. However, we only have speeding offence data for the last four years so we have insufficient evidence to accept or reject this hypothesis.
7. **The introduction of new speed limits, particularly 20mph zones has reduced the perceived legitimacy of speed limits, making drivers less likely to comply.**	Speeding reoffending is high, and the evidence on the effect of new speed limits on KSIs is mixed. However, the low frequency of KSIs means it is not possible to draw robust conclusions about the impact of new speed limit zones so we have insufficient evidence to accept or reject this hypothesis.
8. **The prevalence of narrow rural roads contributes to the higher than average rate of KSI collisions in East Sussex.**	Rural roads have been found nationally to have a higher risk of KSI and there are more rural roads in East Sussex. However, based on our data, we have insufficient evidence to accept or to reject this hypothesis.

Introduction

In this introductory section, we explain our project methodology and set KSI rates in East Sussex in context.

Project Methodology

The aim of this project was to determine the causality or non-causality of factors related to KSI collisions, and to quantify causal factors. In doing so, we aimed to test assumptions and historically held beliefs about which types of drivers are likely to be involved in these types of collisions. Experience is often influenced by behavioural biases, such as the availability heuristic, which occurs when we draw on the examples that most easily come to mind regarding a given situation.[i] Given that ease of recall is not always an accurate representation of the probability that an event will occur this heuristic can lead to errors in judgement. For example, people have a tendency to overestimate the probability that they will die in an airline accident, while underestimating the risk of more frequent and probable causes of death, like common diseases.[ii] For this reason, it is important that we examine available data to assess the accuracy of our predictions.

In addition, by analysing data on observable outcomes, we can better quantify the problem we are seeking to address. We can also quantify the factors that cause this problem and establish their relative importance. This enables us to target interventions and resources towards those areas or individuals where they are likely to have the greatest impact.

In this project, we undertook qualitative research to form a series of hypotheses. We then applied new data science techniques to analyse available data sets. In effect, this allowed us to "test" those hypotheses retrospectively based on a decade's worth of data. Based on our findings, we identify three categories of road users that we recommend should be the primary recipients of behavioural interventions:

Qualitative Research:

Based on interviews with experienced practitioners and professionals from Sussex Police, the Sussex Safer Roads Partnership, East Sussex Fire and Rescue Service, East Sussex Council and Wealden Council, we formed eight hypotheses:

1. **Older drivers (above the age of 65) are more likely to be involved in KSI collisions.**

2. **Younger drivers (aged 17–24) are more likely to be involved in KSI collisions, particularly if they are male.**

3. **Occupational drivers are more likely to be involved in KSI collisions and, relatedly, a collision involving a goods vehicle is more likely to be KSI.**

4. **Drivers of powered two wheelers are more likely to be involved in KSI collisions.**

5. **KSI collisions are caused by drivers who are not from the local area.**

6. **Reductions in the number of Road Policing Unit officers over the past decade[4] means there is no longer a credible fear of enforcement. Because of this, drivers do not comply with road safety rules, such as observing the speed limit, thereby increasing their KSI risk.**

7. **The introduction of blanket speed limits has reduced the perceived legitimacy of road safety rules, so drivers do not comply with them and so are more at risk of KSIs.**

8. **The prevalence of narrow rural roads contributes to the higher than average rate of KSI collisions in East Sussex.**

Data Science

Methodology

We applied data science techniques to test these eight hypotheses. Using Stats19 data, which captures information about collisions reported to or recorded by the police, we modelled the probability that *any given reported collision* would be *a KSI collision*. We did this because it allows us to take a known alternative (all reported slight collisions), against which we can measure what makes a KSI collision different. Instead, we could have modelled the probability that *any given journey* results in a KSI collision. In this scenario, our alternative would have been all journeys that did not involve a KSI collision, and we would have measured what makes a KSI journey different from any given journey. However, data on uneventful journeys is not directly measured and we lack detailed information on behavioural factors where no collisions occur.

To achieve our objective, we used a Gradient Boosted Model (GBM). Unlike traditional statistical techniques, this model does not assume a linear relationship between a predictor and an outcome. For instance it does not assume that the change from being aged 18 to 19 is the same as the difference between 69 and 70. It also does not assume variables have independent effects from each other. I.e. it does not assume that the change is the same for motorcyclists and car drivers. This enables us to

[4] According to data provided by Sussex Police, the number of Road Safety Unit officers has decreased from 380 to 80 over the decade to 2016.

identify issues that result from an interaction of multiple factors, in a way that linear regression models do not. For example, we are able to identify that collision involving a driver over the age of 65 is more likely to be KSI collision if the other vehicle in the collision driven by a 40-50 year old. The model achieves this by 'learning' how to predict whether a collision is KSI based on an initial model and then refining this by focussing on the collisions where the initial predictions were wrong.

This model tells us the predictive power of each variable included in it. A variable is deemed as "important" if it both occurs frequently and is highly predictive. For example, driver age is a factor present in all KSI collisions (therefore frequent) and it is predictive Therefore it is an important variable. On the other hand, although snow is dangerous and highly predictive of whether a given collision will be KSI, it is very rare (infrequent), so it not as important. Importance is useful for our purposes because it is inefficient to design interventions around dangerous but rare events.

Annex A includes the full list of variables included in the model, and the rationale for their inclusions. **Annex B** is a copy of the Stats19 form, which officers use to record data at the scene of a collision.

Limitations

To inform policy decisions, ideally we would like to predict whether a given *journey* would result in a KSI collision, rather than whether a given *collision* would be KSI. To go some way towards addressing this problem, we report factors that are both *prevalent* in the sense that they cause high amounts of total KSI and are *risky* in the sense that they make a given collision more likely to be KSI. This allows us to target both the number and proportion of KSI collisions.

There are three important limitations to the Stats19 data. First, slight collisions are less likely to be reported to the police, especially as there is no statutory duty to do so for some instances (e.g. personal injury on a bike). Second, some data captured on the Stats19 form at the scene of a collisions was not included in the dataset we used for East Sussex (information linking the vehicle that caused to collision to the contributory factors present and information on visibility were missing). Third, this data is recorded by the officer at the scene, although we understand that Sussex Police has stringent recording practices, it is important to note the limitations of data captured in this way: the accuracy of these statistics is dependent on the judgement and recording accuracy of the officer at the scene.

For example, we took the first vehicle listed in the data to be the one that caused the collision, as per the recording guidelines. However, the cause of the accident may not always be clear, meaning this data will be influenced by the officer's judgement. In addition, there are likely to be collisions that are not caused by any vehicle, for example, where the collision is caused by an animal, so our measure of which vehicle caused the accident is imperfect.

We should note that while we were able to obtain data for East Sussex up to 2016, we were only able to access national data up to 2015. For this reason, in the rest of this report, where we draw comparisons between East Sussex and other areas we use data up to 2015; and where we make statements about East Sussex only, we use data up to 2016.

Areas for further data science application

In principle, we could build a more accurate predictive model if we were able to access data that is not dependent on human recording. With access to telematics data, which records GPS location, acceleration and speed, we could infer which journeys are more dangerous, rather than which collisions are more likely to be KSI. However, privacy laws and commercial concerns mean that insurance companies are unlikely to share this data. In addition, it is only available for drivers that care enough about lower premiums on their insurance to have a telematics device installed in their vehicle (who are likely to be safer drivers).

The East Sussex Traffic Safety team shared data with us on ten new speed limit zones, introduced since 2013. This data suggests mixed evidence on the effectiveness of these speed limit zones. However, given the relative infrequency of KSI collisions, we were not able to draw robust conclusions on the effect of these zones on driver behaviour. We believe that there is cause for further analysis of this issue at a national level, where more data will be available, so a greater likelihood of drawing meaningful conclusions.

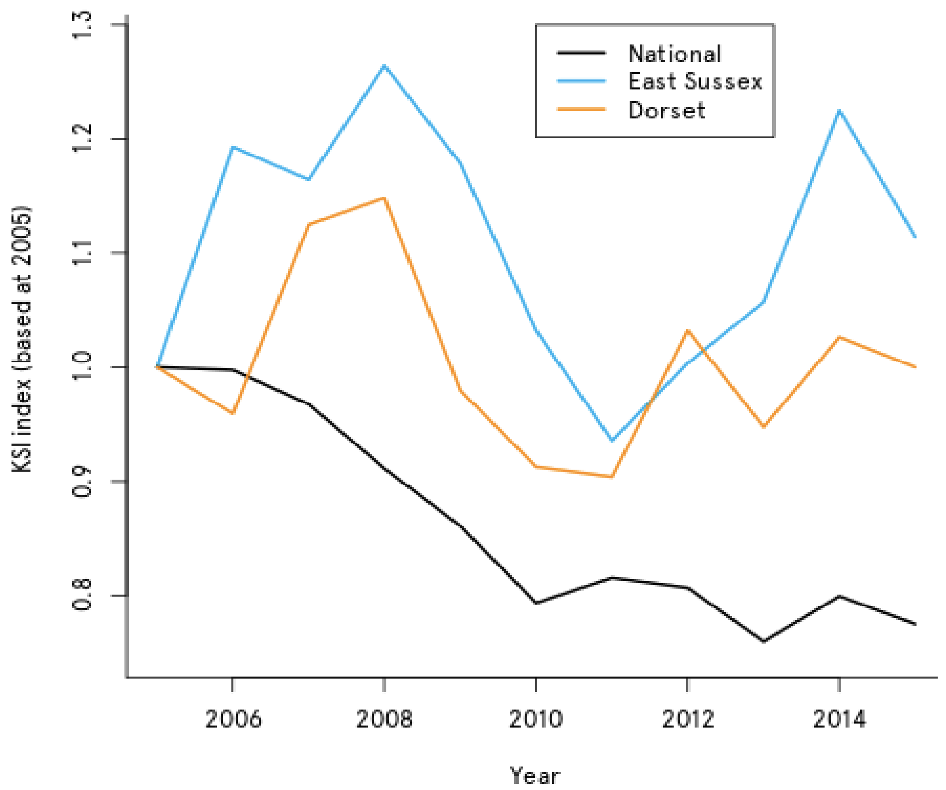
Finally, we obtained data from Sussex Police that captures details of drivers who committed speeding offences from 2013 – 2016 and we were able to match this data to Stats19 data to identify whether drivers who commit speeding offences are also involved in KSI collisions. With more data on traffic offences, we could better predict the link between these offences, the disposal types given and subsequent risk of KSI collisions.

Context

In this section, we compare trends in KSI collisions in East Sussex to national data and data for a comparator region, Dorset. We take Dorset as a comparator due to its similarities with East Sussex. Like East Sussex, Dorset has no motorways and little of the strategic road network. The regions also share similar demographic and weather patterns. We draw this comparison for the decade to 2015, the latest year for which national data is available. It is important to note that these comparisons take no account of differences in recording practices that might exist across police forces in these areas.

Across England, the number of collisions that result in a person being killed or seriously injured (KSI) has declined over the past decade. This is not the case in East Sussex, where, since 2005 KSI collisions have increased by 19.6 per cent (see **Figure 1** below). In contrast, while KSI collisions in Dorset have not declined in line national trends they have not increased, as is the case in East Sussex. KSI collisions in Dorset are currently approximately equal to their 2005 level.

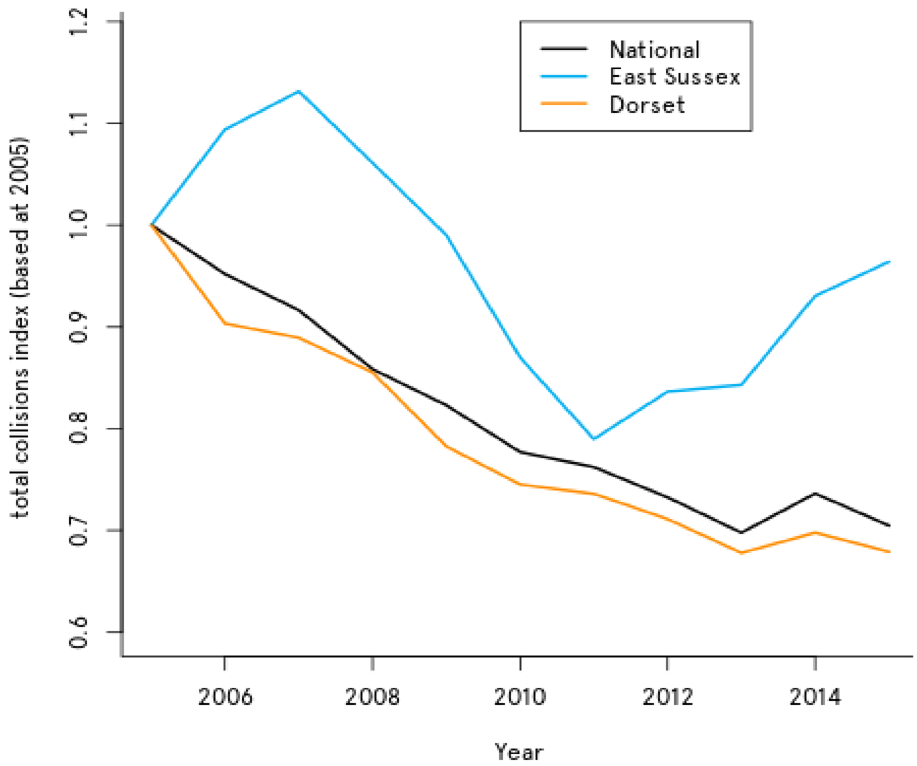
Figure 1: Changes in the number of KSI collisions since 2005



This increase in KSI collisions cannot be explained by an increase in the number of vehicles on the roads. Traffic throughput in East Sussex has increased by less than one per cent since 2005, while KSI collisions have increased by 11.43 per cent. However, there does seem to be *some* correlation between traffic throughput and KSI collisions. From 2005 – 2007, throughput was high but steady, before decreasing to 2010. This may explain the fall in KSIs from 2008 to 2010.[5]

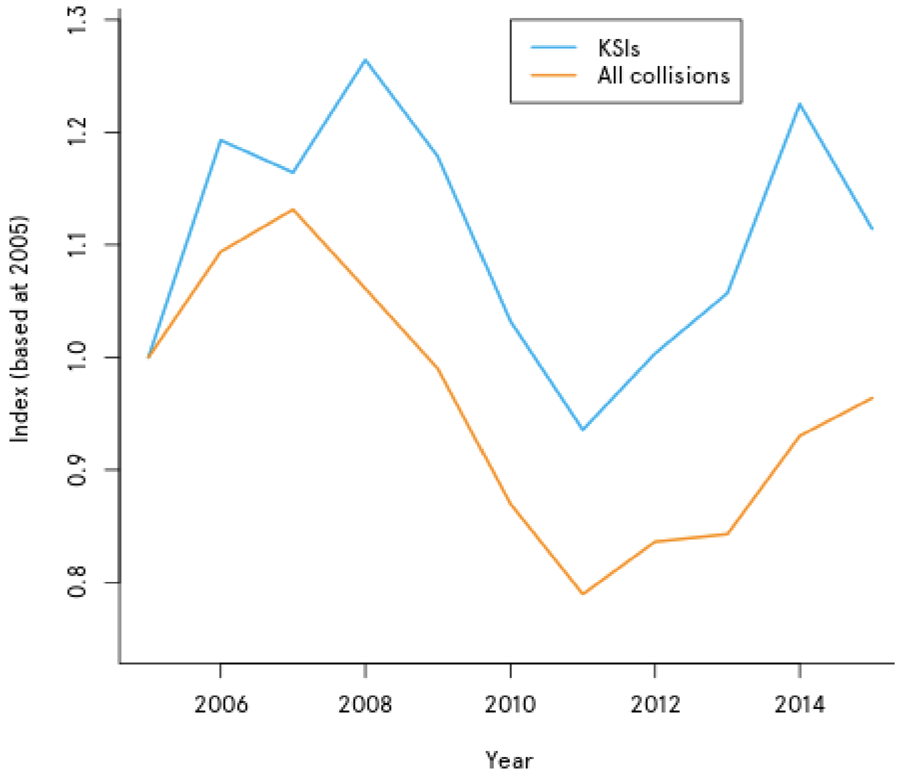
Collision rates overall in East Sussex have not decreased in line with national trends (see **Figure 2** below). In fact, the trend in overall collisions has been upwards in East Sussex since 2011. However, the increase in KSIs in East Sussex over the past decade cannot be explained by an increase in the number of collisions overall during the same period. KSI collisions have increased while the total number of collisions has decreased from 1522 in 2005 to 1467 in 2015 (see **Figure 3**).

Figure 2: Changes in the number of all collisions since 2005



[5]Department for Transport, East Sussex Traffic Profile, 2000 – 2015

Figure 3: Changes in KSI collisions and changes in all collisions, since 2005



Most KSI collisions in East Sussex do not result in a fatality. Taking the years 2005 – 2016 approximately 8 per cent of KSI collisions lead to a fatality. In 2016, there were 1361 collisions, with 311 of those resulting in a serious injury and 24 resulting in a fatality. These figures should also be read in context of improving medical treatment over this period, which means that those involved in serious collisions are more likely to survive

The structure of this report

The rest of this report is structured as follows:

1. **Data Science Findings:** this section identifies the factors most associated with KSI collisions; tests these findings against the hypotheses identified; identifies behavioural factors likely to be at play; and recommends three target groups for interventions.
2. **Target Groups:** this section describes detailed findings for each of the target groups identified.

Data Science Findings

In this section we begin generally, identifying the factors which are associated with KSI collisions in East Sussex according to our data. Based on this, we present evidence against the eight hypotheses formed and identify three groups of drivers who should be the target of interventions to reduce KSI collisions in East Sussex.

Determinants of KSI collisions

At the scene of any collision, the officer attending notes:

1. **Contributory factors that describe the behaviour of one or more of the drivers involved**. Examples of contributory factors include: "careless or in a hurry" or "impaired by alcohol".

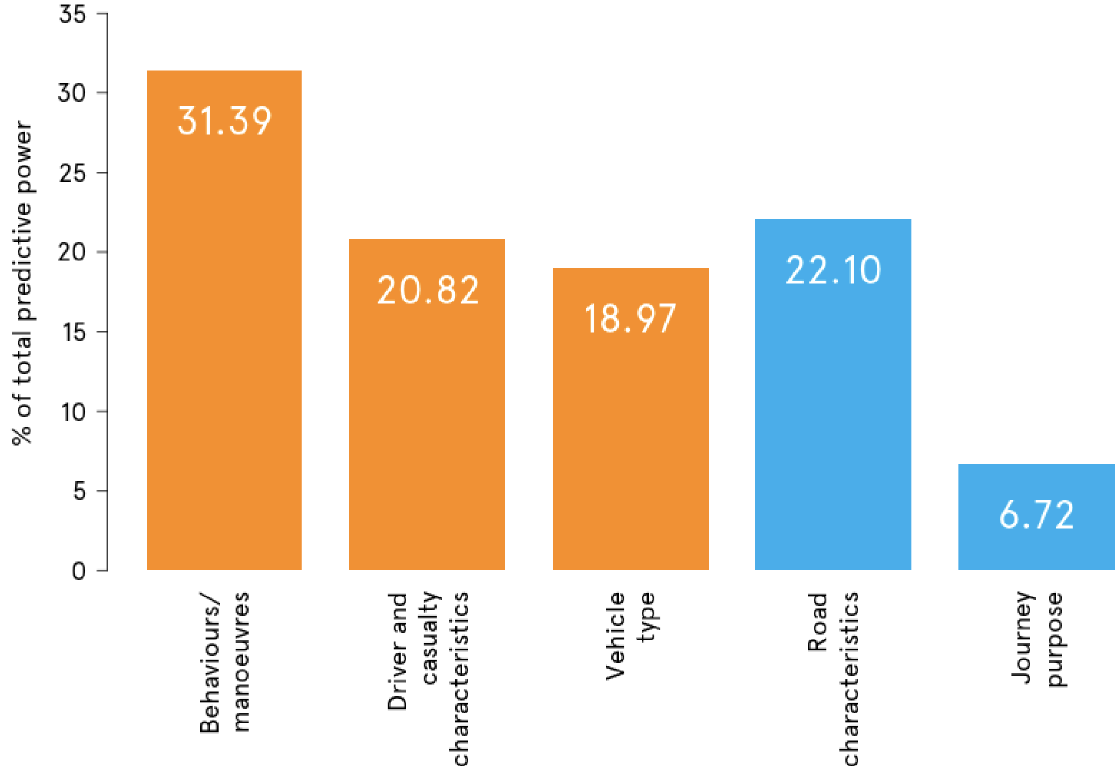
2. **Driver and casualty characteristics** such as age, gender, vehicle type (of the vehicle that caused the collision and all vehicles involved) and whether pedestrians were involved in the collision.

3. **Road and environmental characteristics**, which capture the speed limit at the site of the collision, the precise location of the collision, the road environment, road type, time, season and weather.

4. **Journey characteristics,** which include journey type (occupational, school-related or other).

We used data science to establish the relative predictive power of each these factors. As the orange bars in **Figure 4** shows, we found that what the driver is doing at the point of a collision, the type of driver they are and the type of vehicle they are driving predicts whether the collision they are involved in will be a KSI collision. Taken together, these three factors contribute to 60 per cent of the model's predictive power for determining whether a given collision will be a KSI collision, while road characteristics only account for around 20 per cent of the model's predictive power. **This suggests that interventions that successfully target the specific behaviours of specific types of driver are likely to influence KSI rates.**

Figure 4: Determinants of a KSI collision



Contrary to **Hypothesis 3 that occupational drivers are more likely to be involved in KSI collisions**, we find that journey purpose is not an important predictive factor.[6] Relatively few KSI accidents are caused by commuters or parents dropping their children at school in particular.

Driver behaviours in KSI collisions

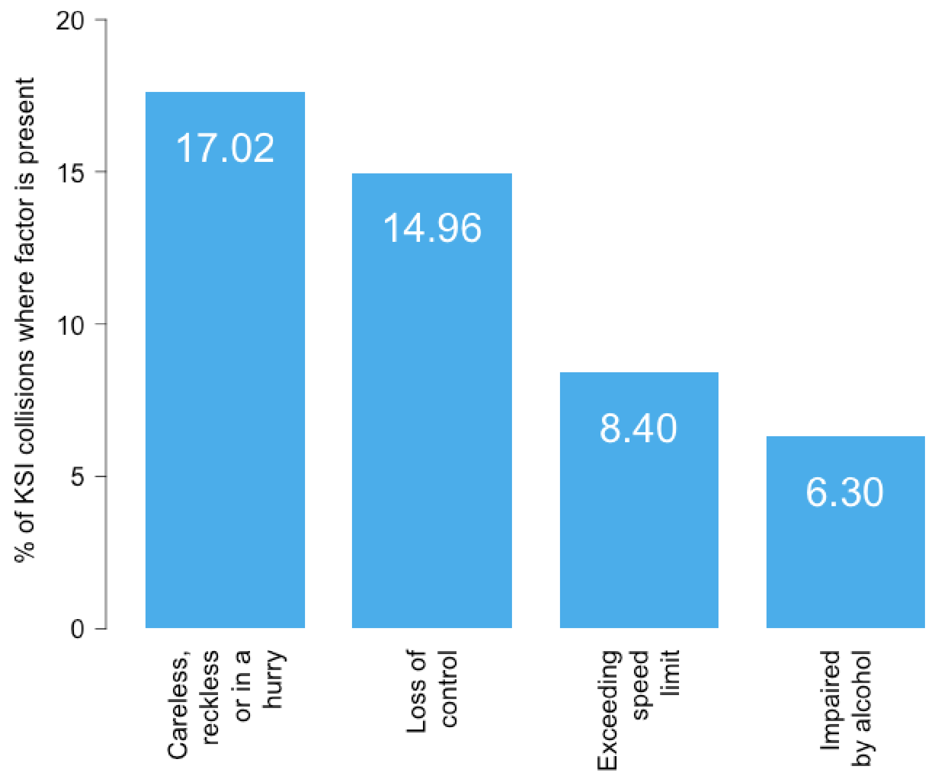
As described above, driver behaviour is an important determinant of whether a collision will be a KSI collision. More than 80 per cent of KSI collisions in East Sussex are associated with driver error or a behavioural factor[7]. In this section, we highlight the driver behaviours that occur most frequently in the data, and highlight behavioural principals that are likely to be at play.

Figure 5 below sets out the contributory factors that are the most common in KSI collisions. Note that most accidents have more than one contributory factor.

[6] This does not mean that occupational journeys are less important than other journey types, just that journey types in general are not important. This could be because journey types are not accurately recorded.

[7] These include factors associated with: injudicious action (e.g. disobeying the speed limit); driver error (e.g. failure to look properly); impairment of distraction (e.g. drink driving or fatigue); behaviour or inexperience (e.g. aggressive driving or being a learner).

Figure 5: driver behaviours recorded as most frequently present in KSI collisions



Behavioural factors likely to be present in KSI collisions

Here we discuss some of the behavioural factors that may underpin the recorded behaviours presented in **Figure 5** above.

- **Optimism bias:** people often overestimate the likelihood of positive events and underestimate the likelihood of negative events when predicting what will happen to them. For example, we underrate our chances of getting divorced or suffering from cancer.[iii] Research suggests this bias holds for driving competency. As a result, people are excessively and unrealistically optimistic when judging their accident risk.[iv] The presence of optimism bias may lead people to not take necessary cautions or pay enough attention when driving, leading them to make careless mistake.

- **Cognitive burden:** at almost every moment of every day there are multiple factors that compete for our attention. We only have so much attention we can give to things so focussing on something, whether consciously or not, necessarily hurts performance in other tasks.[v] Between 1984 and 2000, vehicle deaths accounted for 20 per cent of firefighter deaths. In 79 per cent of these cases the firefighters were not wearing seatbelts. Firefighters know these statistics, but at the moment of entering the vehicle, their cognitive energy is focussed on preparing for the burning building they are driving towards, so they fail to take necessary precautions.[vi] In similar vein drivers who are in a hurry to arrive at their destination may be focussed on what expects them there, leading them to expend less effort on the important decisions at hand and resulting in increased risk of a collisions.

- **Overconfidence:** drivers who are familiar with the roads may be over confident in their own driving abilities and think that a collision would never happen to them. A study documenting the "better than average" effect reports that over 80 per cent of drivers think they are better than average.[vii] People rely on mental shortcuts or heuristics in making decisions.[viii] Though often useful in enabling us to make decisions quickly these can lead to errors in judgement, for example, around perceptions of risk.[ix] Drivers familiar with their environment may over-rely on the representativeness heuristic, which triggers the subconscious cue "how similar is the situation to a familiar one?" or the recency heuristic "what happened last time I was in a similar situation?" This may lead them to underestimate the risk to themselves and therefore drive carelessly.[x]

- **Lack of experience:** the flip side of this coin is that drivers who have little experience of their environment, for example because they are driving in a new area or have just passed their driving test, may lack experience on which to base their decision making. As a result they may not adjust their behaviour appropriately to their environment, leading them to make seemingly careless errors or lose control of their vehicle.

- **Drivers do not think that speed limits are legitimate:** drivers may actively choose not to comply with speed limits because they do not believe them to be legitimate or necessary. We recently worked with the West Midlands Police on a trial to test whether making the consequences of speeding more salient by explaining the reasons behind speed limits would increase compliance with speed limits. To do this, we redesigned the leaflet that is sent to drivers along with the Notice of Intended Prosecution following a speeding offence to include information on the children killed or seriously injured in collisions in the West Midlands and explain the rationale behind speed limits. The intervention decreased the likelihood of speeding re-offending within 6 months by 20 percent.

- **Drivers may self-identify as rule breakers:** People's identity largely influences their behaviour. In one study that tried to reduce cheating, researchers found that asking 'Please don't be a cheater' was more effective than asking them 'Please don't cheat' because participants did not want the identity of a cheater.[xi] When it comes to driving young drivers may feel the opposite, taking pride in their 'rule breaking' identity. This may also be true of motorcyclists.

KSI collisions by vehicle type

Vehicle type is an important factor in determining KSI collisions. As **Table 3** below shows, drivers of powered two wheelers and cyclists are disproportionately more likely to cause KSI collisions. In total, powered two wheelers cause approximately 8 per cent of all collisions.

In addition, drivers of powered two wheelers and cyclists are also likely to be *involved* in KSI collisions, without necessarily *causing* them. More than a fifth of the KSI collisions caused by cars are ones where they hit either drivers of powered two wheelers. This supports **Hypothesis 5 that drivers of powered two wheelers are more likely to be involved in KSI collisions.** However, as **Table 3** shows, goods vehicles make a very low contribution to KSI rates, **which does not support Hypothesis 3 that a collision involving a goods vehicle is more likely to result in someone being killed or seriously injured.**

Table 3: KSI Collisions by Vehicle Type[8] (2015 data)

Vehicle Type[9]	% share of total vehicle miles	% of all collisions caused by vehicle type	% of KSI collisions caused by vehicle type	KSI collisions caused per 1000 vehicle miles
Powered Two Wheeler	0.91	10.02	19.7	5.21
Cyclists	0.24	3.54	4.78	4.79
Cars	77.74	75.23	62.09	0.2
Goods Vehicle (heavy and light)	20.62	9.34	5.97	0.07

KSI collisions by driver characteristics

We find evidence to support **Hypothesis 2 that younger drivers (aged 17 – 24) are disproportionately more likely to be involved in KSI collisions. We also find evidence that young drivers who cause KSI collisions are disproportionately male.**

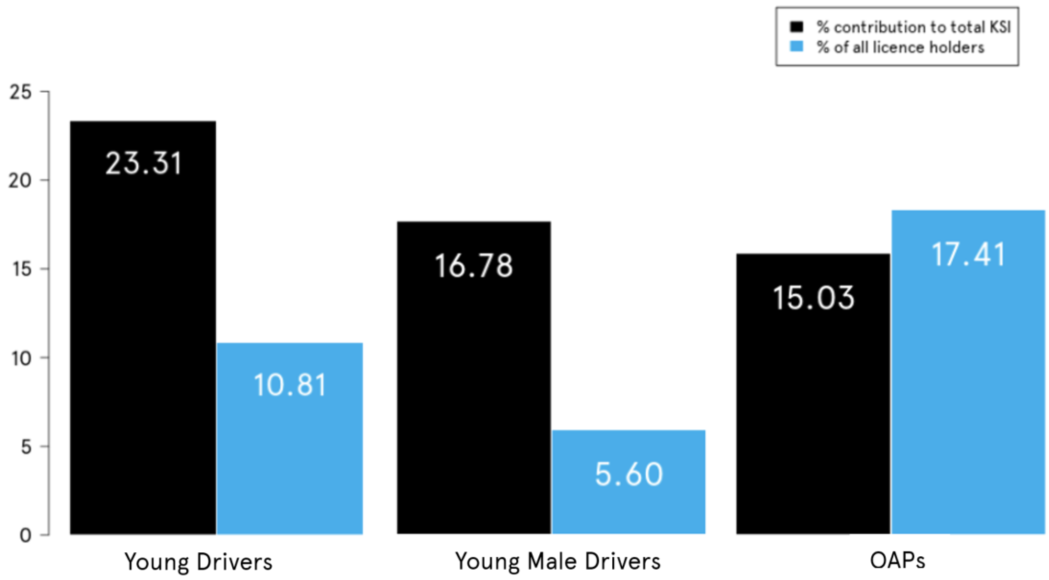
[8] Department for Transport, East Sussex Traffic Profile, 2000 – 2015

[9] Note that KSI collisions where vehicle labels were missing in the data were excluded from the analysis. There were some collisions where the vehicle class is other, which is why the vehicle miles percentages do not total 100 per cent.

Older drivers are likely to be involved in KSI collisions but, contrary to Hypothesis 1, not disproportionately so. Over 65s represent 25.74 per cent of East Sussex's population and 24.61 per cent of KSI collisions involve a driver aged over 65. I.e. the high number if KSI collisions in East Sussex that involve over 65s can be explained entirely by the high number of over 65s who live in the area.

In addition, while **younger drivers, and younger male drivers are disproportionately likely to cause KSI collisions, this is not true of over 65s. Over 65s are proportionately less likely to cause KSIs.** This is demonstrated in **Figure 6** below which shows the percentage of KSI collisions *caused* by young drivers; young male drivers; and old age pensioners relative the percentage of licences held by those groups in Great Britain.[10]

Figure 6: Percentage of KSIs caused and percentage of licences held, by driver type



Origins of KSI drivers

Contrary to Hypothesis 4 that KSI collisions may be caused by drivers who are not from the local area, most (84.1 per cent) KSI collisions, for which the driver's county of residence is recorded, are caused by drivers who live in East Sussex. [11] In East Sussex, just over two thirds of collisions and KSI collisions occur within 10 miles of the home of the driver who caused the collision; **approximately a third occur within 3 miles of the home of the driver who caused the collision.** This also suggests it is unlikely that drivers from outside East Sussex cause many KSI collisions.

[10] We were not able to obtain data on licence holders by age for East Sussex specifically, so we use data for GB licence holders.

[11] It is important to note that this is often misspelt or not recorded. Fixing this field should be a priority for record keeping purposes. There are a small amount of non-UK drivers for whom their county is normally a foreign state or province e.g. Alberta, Canada.

Locations of KSI collisions

Nationally, for any given road class, collisions in rural areas are more likely to be KSI compared to urban roads of the same class. For example, the proportion of collisions that are KSI on rural roads and urban roads is 20.44 per cent and 13.2 per cent respectively on B roads; and 23.78 per cent and 14.54 per cent respectively on A roads.

Given that rural roads are more dangerous nationally, and there are more rural roads in East Sussex, it does not seem unreasonable to infer that rural roads may contribute to the higher rate of KSI collisions in East Sussex. However, given the relatively crude definition of urban and rural roads in the data (e.g. roads passing through Lewes are categorised as urban) **we have insufficient evidence to accept or reject Hypothesis 8 that the prevalence of rural roads contributes to the higher than average rates of KSI collisions in East Sussex.**

The effect of new speed limit zones on KSI collisions

We obtained data from the East Sussex Traffic Safety team which sets out where ten new speed limits have been introduced to specific areas of road, since 2013. All these changes involved introduction of a lower speed limit, away from the national default speed limit.

Given KSI collisions are a relatively rare event it is difficult to draw definitive conclusions from this data. Any observed patterns may be as a result of chance. We are also not able to control for the fact that generally, new speed limit zones are introduced on stretches of road that are deemed more dangerous. However, with these caveats, the available data shows that of the ten speed limit zones that have been introduced, five had a positive impact on KSI collisions; three have had no impact; and two have had a negative impact. This suggests very mixed evidence of their effectiveness. While this is not a robust finding given the low instances of KSI collisions, we believe it cause for further analysis of this issue, possibly at a regional or national level where more data will be available.

The effect of speeding offences on a driver's subsequent KSI risk

We obtained data from Sussex Police that captures details of drivers who committed speeding offences from 2013 – 2016. Matching this to Stats19 data, we found that in this three year period, **7.17 per cent of KSI collisions and 10.57 per cent of all collisions were caused by vehicles with at least one prior speeding offence against their registration number.**[12]

[12] We cannot control for who is using the car at a given time, but it seems reasonably likely that it is often the same individual.

The rate of speeding re-offence within a year was 7.7 per cent. This percentage only reflects the instances where those speeding were caught. In reality, it is likely that re-offence rates are higher. Re-offence rates vary by the disposal that the driver receives: 6.68 per cent of those who attended a speeding course re-offended within a year; this percentage increased to 7.92 per cent for those who received points; 12.32 per cent for those who were prosecuted and 14.96 per cent for those receiving no further action.

This is interesting for two reasons. First, it shows that the sanction that follows a speeding offence does not categorically reduce a drivers' risk of subsequently causing a KSI collision. **This is evidence to support both Hypotheses 6 and 7, that there is not a credible deterrent to speeding and that speed limits are not perceived as legitimate.** Second, it shows that **this point of contact that a driver has with the police following a speeding offence may be a powerful intervention point for reducing subsequent KSI collisions.** As a result, two of the recommendations we have identified specifically target speeding**.**

Summary of findings against hypotheses

Hypothesis	Findings
1. **Older drivers (above the age of 65) are more likely to be involved in KSI collisions.**	We do not find evidence to support this, as over 65s are involved in approximately as many KSI collisions as their percentage of the population. In fact, over 65s are proportionately less likely to cause of KSI collisions.
2. **Younger drivers (aged 17 – 24) are more likely to be involved in KSI collisions, particularly if they are male.**	We find evidence to support this. As well as being more likely to be involved in KSI collisions, younger drivers are disproportionately more likely to cause KSI collisions. This is particularly true of young male drivers.
3. **Occupational drivers are more likely to be involved in KSI collisions and, relatedly**, a collision involving a goods vehicle is more likely to result in someone being KSI.	We find no evidence to support this. Journey type is unimportant in determining whether a collision will be KSI; goods vehicles are proportionately less likely to cause KSI collisions.
4. **KSI collisions may be caused by drivers who are not from the local area.**	We do not find evidence to support this. Most KSI collisions are caused by drivers who live in East Sussex.
5. **Drivers of powered two wheelers are more likely to be involved in KSI collisions.**	We find evidence to support this. Powered two wheelers cause a disproportionate number of KSI collisions, they are also likely to be involved in a high proportion of KSI collisions caused by cars.
6. **Reductions in the number of Road Policing Unit officers over the past decade means there is no longer a credible fear of enforcement.**	Vehicles with prior-speeding offences recorded against them are disproportionately involved in KSI collisions and speeding reoffending is high. However, we only have speeding offence data for the last four years so we have insufficient evidence to accept or reject this hypothesis.
7. **The introduction of new speed limits, particularly 20mph zones has reduced the perceived legitimacy of speed limits, making drivers less likely to comply.**	Speeding reoffending is high, and the evidence on the effect of new speed limits on KSIs is mixed. However, the low frequency of KSIs means it is not possible to draw robust conclusions about the impact of new speed limit zones so we have insufficient evidence to accept or reject this hypothesis.
8. **The prevalence of narrow rural roads contributes to the higher than average rate of KSI collisions in East Sussex.**	Rural roads have been found nationally to have a higher risk of KSI and there are more rural roads in East Sussex. However, based on our data, we have insufficient evidence to accept or to reject this hypothesis.

Recommended groups for behavioural interventions

Based on these findings, we identify three categories of road users that we recommend should be the primary recipients of behavioural interventions:[13]

1. **Motorcyclists** who are both disproportionately likely to cause KSI collisions, and likely to be involved in KSI collisions without causing them.
2. **Young drivers aged 17 – 24, and particularly young male drivers**, who are disproportionately likely both to cause and to be involved in KSI collisions.
3. **Car drivers in general** who are likely to cause KSI collisions by hitting vulnerable road users, such as cyclists, motorcyclists and over 65s.

We now set out detailed findings relating to each of these three groups, which should inform the detail and implementation of any interventions to reduce KSI collisions.

Motorcyclists

Collisions caused by motorcyclists are a bigger component of KSI collisions in East Sussex (44.27 per cent) than they are nationally (29.2 per cent). Interventions should target young and middle-aged males. Almost all (92.4 per cent) of motorcyclists who cause KSI collisions are male. 33.1 per cent are caused by young riders, and the rest almost entirely by riders under 65.

Interventions should also focus on riders of motorcycles with bigger engines. 61 per cent of KSI collisions caused by motorcyclists are on engines above 500cc, 31 per cent are between 125cc and 500cc and 8.27 per cent on engines under 125cc. Behaviours to target are compliance with speed limits and maintaining control of the vehicle. Motorcycle-caused KSI collisions are more likely to involve exceeding the speed limit (9.8 per cent of motorcycle caused KSI collisions, relative to 6 per cent of car-caused KSI collisions). They are also twice as likely to involve loss of control, relative to car-caused KSI collisions (23.1 per cent, compared to 13.46 per cent).

Drink-driving does not seem to be a significant factor in motorcycle-caused KSI collisions. They are less likely to involve alcohol impairment than KSI collisions caused by a car. 87 per cent of motorcycle-caused KSI collisions are caused by drivers who live in East Sussex. Motorcycle KSI collisions do not seem to be related to weather conditions. Of the 653 motorcycle-caused KSI collisions that occurred in the period for which we have data only 3 were in foggy weather; 13 in windy weather; and 49 in rainy weather. This is likely to be because motorcyclists are less likely to use the roads in bad

[13] Given the low frequency of KSI collisions, it is not possible to narrow those categories down further.

weather conditions. Motorcyclists are less at risk of KSIs when close to home. Their KSI risk increases quite steeply over the first 5 miles, and levels off after about 20 miles.

Young Drivers (17 – 24)

The majority of KSIs caused by young drivers occur in cars (66.4 per cent) with of 25.9 per cent caused by young people on motorcycles.

Behaviours to target for this group are: exceeding the speed limit; drink-driving; and carelessness or recklessness. KSI collisions caused by young drivers are 3 times as likely to involve exceeding the speed limit as KSI collisions in general. They are 2 times as likely to involve alcohol impairment and also 2 times as likely to involve aggressive drinking. KSI collisions caused by young drivers are 1.5 times as likely to involve careless, reckless or hurried driving. 22 per cent of KSI caused by young people are associated with a Learner or inexperienced driver or rider. In addition, young drivers are most at risk of a KSI collision when they are close to home.

Car drivers at risk of hitting vulnerable road users

Of the KSI collisions caused by cars, about 15 per cent are due to car drivers colliding with motorcycles and 7 per cent are due to car drivers hitting cyclists. These collisions account for 14.67 per cent of all KSI collisions. More than half of the KSI collisions that involve older drivers are not caused by them.

The principal behaviour to target here is driver concentration. These collisions are most commonly associated with driver errors (86.52 per cent, compared to 56.87 per cent across all KSI collisions). Cars are most likely to cause a KSI collision by hitting a motorcyclist or cyclist when entering a main road (18.2 per cent) or mid junction (18.2 per cent), or when driving away from a junction (27.87 per cent).

The risk of a collision involving an over 65 resulting in them being killed or seriously injured is highest when the driver causing the accident is aged 40-50. This suggests either a lack of patience with older drivers or a decreasing ability to react quickly to minor errors made by fellow road users.

Annex A – Stats19 variables included and excluded in the predictive model

We have included the following variables in the model:

- Contributory factors; manoeuvres; breath test; driver age and sex (we have re-coded driver age <16 error in the data as blank as we suspect that most of these are miscodes); whether a cyclist was involved; junction location; road class; whether a powered two-wheeler was involved; whether children were involved; whether pedestrians were involved; whether old people were involved; vehicle type; distance from home; journey type; speed limit; location; road type; time; season; year; and weather.

We have excluded the following variables because their effects are picked up by other included variables:

- The number of vehicles; casualty age and gender.

We have excluded the following variable because of errors in the data:

- Visibility (this was miscoded in the data)

We have excluded the following variables because we deemed them not important, or too small to be of interest:

- Pedestrian location and movement; skidding; impact site; punishment for speeding; carriageway hazards; towing; junction details and control; crossing controls; colour and model of vehicles; and cyclist wearing a helmet.

Endnotes

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