Fully Accessible Zebra Crossings

SRRB Research Framework

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Fully Accessible Zebra Crossings

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1. Executive Summary

1.1 Introduction

Zebra crossings provide an alternative to uncontrolled crossings, with local authorities utilising zebra crossings to aid pedestrian safety across their road networks. They also provide a more economical alternative to signalised crossings.

However, current zebra crossings are sometimes perceived to not provide any additional benefit to some disabled user groups. There are no indicators to blind and partially sighted people that any approaching vehicle or cycle has stopped. Also, blind and partially sighted people may be reliant on sound when deciding if it is safe to cross. With the continuing rise of active travel in the Scottish Government's priorities, as well as increasing use of hybrid and electric vehicles, this reliance on sound is becoming more problematic. Other people with disabilities encounter difficulties using zebra crossings, including but not limited to wheelchair users given the different eye height and people with learning disabilities. Therefore, a zebra crossing may offer no improvement over an uncontrolled crossing for some people, particularly people with disabilities. They will, however, still provide advantages to other groups of users.

Under the Equalities Act, Public Bodies legally have a duty to make reasonable adjustments for people with disabilities. Transport Scotland wish to explore issues that those most at risk may experience with zebra crossings and propose possible solutions applying reasonable adjustments.

Jacobs was commissioned to undertake the research and produce this report.

1.2 Aims and Objectives

The study considers the use of zebra crossings by all users but pays particular attention to the needs of people with disabilities and their attitude to and experiences of zebra crossings.

The aim of the study is to:

- Improve road safety
- Influence current practice in the deployment of zebra crossings across Scotland on all road types
- Promote good practice.

The objectives of the research are:

- To appraise the current understanding of the effectiveness of zebra crossings
- To investigate users' attitude to zebra crossings
- Identify potential improvements to the design of zebra crossings for further investigation, primarily with regard to increasing perceptions of safety for users most at risk.

Potential improvements would need to consider whether or not they comply with the Traffic Signal Regulations and General Directions 2016 (TSRGD). Improvements that do not require amendment to the TSRGD would be easier to investigate using on-street trials.

1.3 Research Methodology

The study used three methods to gather information about the use of and attitudes to zebra crossings.

1. Literature Review

A literature review was undertaken by researchers at the Scottish Collaboration for Public Health Research and Policy (SCPHRP), University of Edinburgh. The literature review examined the attitudes and experiences of road users in relation to zebra crossings, and their perceived safety, with particular reference to people with disabilities.

Findings were grouped into three main themes:

- Functional and technical adaptations
- User behaviours
- Issues facing pedestrians with health or mobility limitations.

2. Online Questionnaire

A questionnaire was developed to ascertain the views of the public towards zebra crossings and to gather their views on what improvements could be made to the crossings. The questionnaire was open to anyone to take part, but it was considered that the views of people with disabilities were of particular interest.

A website link for the survey was distributed to networks of representative organisations who were then asked to share the website link wider to their members, contacts, and through their social media and communication platforms. There was also a Word Document version and Easy Read version of the survey available upon request.

3. Consultation with Local Authorities

Relevant transport officers at each of Scotland's local authorities were contacted by email asking them to complete a brief questionnaire about their opinions on the safety and appropriateness of zebra crossings.

The officers were also asked to suggest design improvements that could help make zebra crossings safer, or accessible to a wider range of people.

1.4 Summary

The literature review examined zebra crossings from the perspectives of both drivers and pedestrians, including people with disabilities. It highlighted some of the challenges facing both pedestrians and drivers/vehicles when using or approaching zebra crossings.

The online questionnaire investigated the views of the public towards zebra crossings and to gather their views on what improvements could be made to the crossings. The total number of respondents to the online questionnaire was representative of the population in terms of gender and disability proportions. The age trends of the survey followed the national average in general, with the exception of the over 75 age group, which was underrepresented. The underrepresentation of the over 75 age groups was most likely due to this age group being less likely to be active online.

The majority of the respondents (87%) used zebra crossings when they were on a convenient route for their journey with 2% of the total sample size going out of their way to avoid them. However, people with a disability were more likely to have never used a zebra crossing or go out of their way to avoid using them. There was no clear difference in the way this question was answered by each disability group.

The main reason for hardly ever using a zebra crossing was that there were no zebra crossings on the routes that the respondents use (63%). People with a disability were more likely to not feel comfortable using zebra crossings. Each disability group answered this question in a similar way.

The majority of the respondents were generally comfortable using zebra crossing with only 21% expressing a score of 1 or 2 when asked ‘On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)?’ People with a disability tended to be less comfortable than people with no disability.

When expressing discomfort when using a zebra crossing, the majority of people find it difficult to know whether traffic has stopped before crossing (56%). When asked to comment on key issues on why people may feel uncomfortable using crossings, the most common theme was that ‘vehicles do not stop’ (42%). The most common comment was that ‘it is hard to judge that cars are stopping’ (26%). People with a disability answered this question in a similar way to all users.

People with a disability were more likely to find it difficult to locate a crossing than people without a disability. There is a higher proportion of individuals with visual impairments that stated they find it difficult to locate the crossing compared with people with other disabilities. Deaf people and those with hearing loss were in the highest proportion of those finding it difficult to know if the traffic has stopped before they started to cross.

The most common risk scenario at zebra crossings witnessed by drivers is other drivers failing to give way to pedestrians waiting to cross. However, 22% of respondents answered that they had witnessed pedestrians stepping out very quickly, making it difficult to stop in time. This was closely followed with 20% of people agreeing that as a driver it sometimes difficult to see pedestrians approaching or on the crossings, causing a conflict.

46% of respondents had witnessed a potentially dangerous situation as a pedestrian or cyclist. When asked to comment, respondents reported that the most common occurrence was ‘cyclists do not stop’ (32%). People with disabilities were more likely to have experienced or witnessed a potentially dangerous situation involving a cyclist at a zebra crossing.

Most local authorities were in favour of keeping existing zebra crossings and are happy to install new ones, where appropriate. No local authority expressed a wish to remove existing zebra crossings. However, they also highlighted that zebra crossings can be exclusive to

certain groups within the population and therefore more work needs to be done on their design and training and awareness around their correct, and safe, use.

People who are blind and partially sighted are more likely to want audible and tactile indicators to inform pedestrians when traffic has stopped, however a very low proportion of people with mobility and dexterity disabilities wanted tactile indicators.

When asked to provide ideas other than those suggested in the questionnaire suggestions included: ‘improve visibility and lighting’ (13%), ‘replace the type of crossing’ (12%), ‘increase training/awareness of rules’ (9%) and ‘stricter enforcement’ (9%).

An idea that was suggested both in the online survey and the local authority comments was the removal of Belisha Beacons to allow for a cheaper alternative of the type of crossing to be installed. This could in turn increase the frequency of zebra crossings on the network and, therefore, expose both road users and pedestrians to this type of crossing more often, allowing a greater understanding of how to use them safely. This suggestion was also highlighted in the local authority survey when asked about good international practice.

The study identified suggested measures to improve zebra crossings from the literature review, online questionnaire respondents and local authority officers. It is important to note that these are suggestions that have arisen from the investigations undertaken in this report, they have not been verified as effective or desirable. In some instances, the suggestions would require amendment to the TSRGD, other suggestions may not be appropriate to cultural practice in Scotland and the UK (e.g. use of hand gestures). Notwithstanding the above, the most common themes are set out below:

- Changing tactile paving to indicate the difference with traffic signalled crossings
- Use of an audible feature to indicate that traffic has stopped or is stopping (such as rumble strips)
- Raised crossings
- Stricter compliance and enforcement to include increased use of enforcement measures such as e-police cameras
- Shorter crossings (using footway build-outs or islands, to reduce the length of time the pedestrian is in the carriageway)
- Increase frequency of zebra crossings
- Automated vehicle communication systems
- Improved driver and pedestrian awareness training
- Agreed hand gestures to indicate intention of drivers or pedestrians may help improve non-verbal communication between road users.

1.5 Conclusions

The study investigated the attitudes of users and practitioners towards zebra crossings which was largely favourable. There were, however, a number of concerns identified on how they operate.

People with disabilities were more likely to feel uncomfortable using zebra crossings. The report highlighted a number of issues that people with disabilities experience when using zebra crossings. Although the majority of those in the middle age ranges felt very comfortable using zebra crossings, there were still a considerable amount who were not comfortable therefore highlighting that it is not just older people that may struggle with zebra crossings.

A wide range of potential improvements, including physical design adaptations as well as stricter compliance measures and increased training, were identified that may improve the safety of zebra crossings and make them more appropriate to the needs of all users.

1.6 Next Steps

The findings of this study should be explored further with the aim of moving towards the objective of identifying improvements to zebra crossings, primarily with regard to increasing perceptions of safety for users most at risk.

The next steps to meet this objective would include:

1. Explore the findings of the online questionnaire in more detail with regard to how people with disabilities perceive and experience zebra crossings

2. Investigate further the views of those groups who may not have had equal access to the online questionnaire, primarily older people, deaf people and those with hearing loss.

3. Explore how people with disabilities consider that zebra crossings may be improved using their own suggestions together with those identified in the literature review and those put forward by local authority officers in this report.

These can be done by:

1. A series of focus groups with distinct disability groups

2. A site survey at existing zebra crossings.

The focus groups and site surveys would conclude on what are the most important issues that need to be addressed to improve zebra crossings. This will enable the options for improvement to be considered in detail.

2. Introduction

2.1 Background

Zebra crossings provide an alternative to uncontrolled crossings, with local authorities utilising zebra Crossings to aid pedestrian safety across their road networks. They also provide a more economical alternative to signalised crossings.

However, current zebra crossings are sometimes perceived to not provide any additional benefit to some disabled user groups. There are no indicators to blind and partially sighted people that any approaching vehicle or cycle has stopped. Also, blind and partially sighted people may be reliant on sound when deciding if it is safe to cross. With the continuing rise of active travel in the Scottish Government's priorities, as well as increasing use of hybrid and electric vehicles, this reliance on sound is becoming more problematic. Other people with disabilities encounter difficulties using zebra crossings including but not limited to wheelchair users given the different eye height and people with learning disabilities. Therefore, a zebra crossing may offer no improvement over an uncontrolled crossing for some people, particularly people with disabilities. They will, however, still provide advantages to other groups of users.

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The study considers the use of zebra crossings by all users but pays particular attention to the needs of people with disabilities and their attitude to and experiences of zebra crossings.

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3. Research Methodology

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3.1 Literature Review

A literature review was undertaken by researchers at the Scottish Collaboration for Public Health Research and Policy (SCPHRP), University of Edinburgh. The literature review examined the attitudes and experiences of road users in relation to zebra crossings, and their perceived safety, with particular reference to people with disabilities.

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- User behaviours
- Issues facing pedestrians with health or mobility limitations.

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A questionnaire was developed to ascertain the views of the public towards zebra crossings and to gather their views on what improvements could be made to the crossings. The questionnaire was open to anyone to take part but it was considered that the views of people with disabilities were of particular interest.

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3.3 Consultation with Local Authorities

Relevant transport officers at each of Scotland's local authorities were contacted by email asking them to complete a brief questionnaire about their opinions on the safety and appropriateness of zebra crossings.

The officers were also asked to suggest design improvements that could help make zebra crossings safer, or accessible to a wider range of people.

Detail of the methodologies for each research item is set out in the following chapters.

4. Literature Review

4.1 Introduction

The review was carried out by researchers at the Scottish Collaboration for Public Health Research and Policy (SCPHRP), University of Edinburgh. This chapter summarises the findings of the literature review.

Details of the method used in the literature review and its findings are contained in the full report contained in Appendix A.

4.1.1 Overview of Literature Review

Types of Study Method

Qualitative, quantitative, and grey literature/reports were open for inclusion. However, dissertations and books, and conference proceedings without full findings were excluded.

Inclusion Dates

Initial searches focussed on the period from 1980 onwards. However, due to the large volume of potentially relevant information (i.e. more than 1800 papers), and in order to obtain information relating to more recent transport and traffic circumstances, work produced or published within the last 10 years was included in the final screening (i.e. 2010-2020).

Inclusion/exclusion criteria

Inclusion and exclusion criteria are summarised in Table 1 below.

Table 1- Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• **Zebra or uncontrolled road crossings** • **User attitudes/experiences of zebra or non-signalled crossings (e.g. pedestrians, drivers)** • **Experiences of people with disabilities** • **All types/methods of research or publication, including grey literature, apart from dissertations, books, or publications without findings** • **Outcomes relating to user experiences, attitudes, perceived safety, barriers or facilitators to crossing use**	• **Controlled or signalled crossings** • **Railway, or other crossings, that do not involve roads** • **Dissertations/theses/books (due to typical length, and resource limitations)** • **Publications or reports where an English language translation was not available** • **Publications not available through open access or via standard library access** • **Studies with data from under-developed road and pedestrian systems** • **Protocols/publications/conference proceedings without full findings**

4.2 Findings

4.2.1 Outline

Following all screening procedures 85 studies were found that fulfilled the inclusion criteria and had been published since 2010. See the full report in Appendix A for a summary of the search and screening process, and the tabulation of included studies.

4.2.2 Discussion of Findings

The review highlighted some of the challenges facing both pedestrians and drivers/vehicles when using or approaching zebra crossings, focussing on those that are uncontrolled by traffic lights, and provides evidence to help improve safety and the perception of safety, as detailed below.

Safety measures

Driver and pedestrian experiences and attitudes have helped to illustrate some of the factors that have impacted on the safety of zebra crossing use. According to Burlo et al (2018), a conflict may exist between pedestrians who have little knowledge of traffic rules and are confident in their right to cross the road without paying sufficient attention to traffic, and

drivers who only pay attention to pedestrian presence or absence, and neglect the need to reduce speed before a pedestrian crossing. In contrast, there is also evidence that some pedestrians are not confident that drivers will stop, or are unsure about who has right of way, which may impact on their crossing behaviour (Høye et al, 2019). These uncertainties may contribute to accidents that happen at or near zebra crossings. Although pedestrian injuries at zebra crossings can be less severe than the injuries of those who cross elsewhere (Pfortmueller et al, 2014), addressing safety issues at zebra crossings is still of critical importance.

Within the included literature, pedestrians were shown to be at most risk when crossing distances were too lengthy, vehicles were going too fast, where there was a lack of sight distance, and at poorly lit or unlit crossings. Planners need the support of regulators to address some of these safety measures, according to Budzynski et al (2017).

Recommendations to improve safety within the examined literature included reducing road speeds and narrowing crossing distances to increase the probability of drivers yielding to pedestrians and lessening their route across the road (Schneider et al, 2018). Kovács (2013) suggest further research into middle island design parameters is necessary to support shorter crossing distances.

Physical adaptations aimed at reducing the speed of approaching vehicles included humps, speed cushions, elevated crossings, mid-crossing refuges, and narrow lanes (Zhao et al, 2019; Branzi et al, 2018; Budzynski et al, 2017; Gitelman et al, 2017; Sucha et al, 2017). Rumble strips were also considered one of the most effective roadside safety treatments (Erginbas et al, 2019), and further research is needed to investigate their use for zebra crossing approaches.

Drivers may be aware of pedestrians' right of way, but need an incentive to comply, according to Malenje et al (2019). Awareness education or enforcement programmes can provide the necessary incentives: for example, driver survey responses to enforcement and awareness programmes (Van Houten et al, 2013) confirmed that elements of the program played a role in producing changes in driver behaviour. Active signage systems (such as overhead flashing lights on approach to crossings) have been shown to reduce vehicle approach speeds and have a positive impact on drivers' behaviour (Figueroa-Medina et al, 2020; Olszewski et al 2020; Olszewski et al, 2015; Lacoste et al, 2014). The effectiveness of crossing illumination has been such that the city of Rome has decided to extend innovative lighting measures to other crosswalks across the city in order to strengthen the correlation between speed reduction and lighting levels (Patella et al, 2020). This is particularly important, given Italy's place as having one of the highest annual road traffic fatality rates in Western Europe (55 per million inhabitants, compared to 27 per million in the UK: European Transport Safety Council, 2019).

Education for road users

In addition to the measures noted above, was the impact of driver and pedestrian education. The importance of training for pedestrians and drivers, to encourage pedestrians to confidently assert their right-of-way at uncontrolled crosswalks, was emphasised as a potential means of improving their safe passage at crossings (Schneider et al, 2018). Drivers were certainly shown to increase their yielding in the presence of assertive pedestrians (Shaon et al, 2018; Schroeder et al, 2011). Driver education with regard to avoiding distractions (e.g. phone conversations), and links with the risk of failing to brake in sufficient

time at crossings, appeared to be especially relevant for younger drivers (Haque & Washington, 2015). Interventions that include pedestrian and/or driver community education programs may therefore help by improving awareness. Tom & Granie (2011) suggest that there is a responsibility for pedestrians to adjust their behaviour in response to vehicular traffic, and also for drivers to adjust their behaviour towards pedestrians. Gaining awareness of the issues involved may improve understanding of how changes in behaviour can help.

Communication

Communication between driver/vehicle and pedestrians was considered to be an essential part of traffic negotiation, which can help to resolve ambiguous situations on the road, and thereby lessen risk (Amini et al, 2019). When pedestrians signal that they are about to cross, by raising their hand, for example, motorists were shown to be more likely to yield to them.

Direct eye contact between pedestrian and driver was shown to be used by approximately 40% of road users (Amini et al, 2019). However, this may not be a strategy open to blind and partially sighted people or health conditions such as Autism Spectrum Disorder (ASD). In such cases hand signs may be more appropriate as opposed to eye contact. It may be that physical gestures can be enhanced by combining them with other interventions such as enforcement or engineering changes, as detailed above, to raise baseline yielding levels (Crowley-Koch et al, 2011).

Also related to communication between vehicles and pedestrians were the issues raised in the literature regarding pedestrians and autonomous vehicles (AVs). While several studies have claimed the need for explicit external human-machine interfaces (eHMI) such as lights or displays to replace the lack of eye contact with, and explicit gestures from, drivers, Moore et al (2019) argue that this need is not thoroughly understood, and is potentially unnecessary. However, insight into pedestrians' crossing decisions while interacting with AVs shows the communication signals pedestrians expect to receive, and the application of current communication methods, may be crucial for successful deployment of such technologies, according to Amini et al (2019). The interfaces between AVs and pedestrians suggested in the literature (e.g. Bazilinskyy et al, 2019; Jayaraman et al, 2019; Habibovic et al, 2018) provide AV intent information that can reduce uncertainty and promote trust in AVs. This may contribute to improved perceived safety for pedestrians, and general acceptance of AVs, although AVs' interactions with pedestrians still cannot be viewed as risk free (Razmi Rad, 2020), and further research is on-going.

Within the studies it was suggested that pedestrians should be trained in the use of hand gestures to indicate intent to cross, and drivers should be trained to properly interpret and respond (Zhuang & Wu, 2014). However, it might be helpful if a common sign were to be agreed and developed to allow universal widespread use. Certainly attempts could be encouraged to find and implement effective speed management solutions to force drivers to slow down in the area of pedestrian crossings – places where vulnerable road users may become exposed to higher risk (Ziolkowski, 2019), as will be discussed in the next section.

Protecting vulnerable pedestrians

The included literature examined potential support for several different groups of vulnerable pedestrians. For example, emerging technologies that can assist people who are blind and partially sighted. These advances are especially important, given previous experimental analysis that found that blind and partially sighted people may wait three times longer than sighted pedestrians before crossing a road, with 6% of attempts being considered actively

dangerous (Guth et al, 2005); other research concluded that, in the past, blind and partially sighted people might not even try to find a zebra crossing (Schroeder et al, 2007). Recent technological advances may therefore be all the more welcome.

Navigation systems to help blind and partially sighted people have been making significant progress in recent years (Real & Araujo, 2019). That said, other developments may be causing different problems. For example, hybrid and electric vehicles (EV) , with their quieter operating systems may pose greater difficulties for blind and partially sighted people , who rely to a greater extent on auditory information; such issues may increase as numbers of these cars also increase, and further research will be necessary to understand and provide potential solutions to avoid escalating risk for pedestrians who are blind and partially sighted or deaf people and those with hearing loss (Emerson et al, 2011).

With regard to people with cognitive impairments, such as dementia, it is important that health care professionals and caregivers take their experiences of problematic traffic situations into account when providing support (Brorsson et al, 2016). For example, emphasising how to use a zebra crossing safely, if walking independently. Certainly within the examined literature pedestrians displayed safer road crossing behaviours at a zebra crossing than in other scenarios, such as shared zones, where safe crossing points may be more difficult for vulnerable pedestrians to identify. According to Cowan et al (2018) further awareness education and environmental adaptations are required to make shared zones safe for all pedestrians.

In addition to people with specific disabilities is the need to consider other vulnerable road users such as children. Results have suggested that younger school-aged children may have yet to master safe crossing behaviour, and further education and training may be required (Jiang et al, 2020; Li et al, 2013). It may also be necessary to consider children when designing crossing facilities near schools, for example.

In addition to pedestrians, cyclists may be more vulnerable, especially in relation to overtaking large vehicles, such as buses. Within the included literature, zebra crossings on bus stop bypass cycle paths were shown to improve pedestrian and cyclist safety, while not significantly slowing cyclists' progress (Greenshields and Davidson, 2018; Greenshields et al, 2018). The use of such measures, especially in built up areas, is therefore liable to assist all road users.

Accessible road crossings for pedestrians of all abilities is an important part of 'walkability' (Bonnaccorsi et al, 2020; Singh & Gupta, 2010), and is consistent with Scotland's Accessible Travel Framework (Scottish Government, 2019), and Roads for All guidance (Scottish Government, 2013).

4.2.3 Conclusions

Measures to mitigate the risks to pedestrians, increase driver awareness, and increase the road safety behaviour of both at zebra crossings, have been detailed within the studies. These measures included:

<u>Physical features and technology</u>

- Improved signage, lighting and markings
- Raised crossings or raised approaches to crossings

- Shorter crossings
- Use of rumble strips on road crossing approaches
- Design of shared zones, with marked crossings that take account of users with disabilities
- Measures to assist people with visual or hearing disabilities; for example, zebra crossing recognition technology, technology to assist with the recognition of quieter hybrid vehicles
- Automated vehicle communication systems
- Zebra crossings across bus bypass cycle lanes.

Regulation

- Lower speed limits on approaches to crossings, augmented by physical speed reducing measures, such as rumble strips and road humps
- Measures that ensure a shorter wait time for pedestrians
- Increased use of enforcement measures such as e-police cameras.

Education and awareness

- Improved driver and pedestrian awareness training
- Education to reduce potential bias and discrimination by drivers
- Agreed hand gestures to indicate intention of drivers or pedestrians may be helpful; for example, universally understood hand gestures (with alternatives for those less physically able); intention signage built into automated vehicles where no driver is present
- Increased road crossing awareness and training for primary aged school children.

5. Online Questionnaire

5.1 Methodology

A questionnaire was developed to ascertain the views of the public towards zebra crossings and on what improvements could be made to them. The questionnaire was open to anyone to take part, but it was considered that the views of people with disabilities were of particular interest. This was reflected in the questionnaire asking respondents whether or not they had a physical or mental health condition. This allowed the responses of those answering they did have a condition to be analysed in comparison to the rest of the participants to identify any differences.

In setting up the questionnaire, a website under the domain www.zebracrossingresearch.com' was created using the WordPress platform. The website provided some context as to what a zebra crossing is, who is undertaking the research and why it is important to hear the views of users of zebra crossings, in order to investigate any improvements that can be made to them. The survey was embedded into the website home page using the Crowd Signal platform, which was also used to collect and analyse the data. There was also a Word Document version and Easy Read version (developed by Disability Equality Scotland) of the survey available upon request, the latter of which is available to view in Appendix B. A specific survey email was set up in order to accommodate those who required any extra assistance with completing the survey, or for any general queries.

The website link for the survey was distributed to networks of representative organisations who were then able to share the website link wider to their members, contacts, and through their social media and communication channels.

The website and survey link were available publicly and therefore received responses from various locations, however the majority of responses were from those within the UK.

The survey was launched on 22nd December 2020 and closed on 12th February 2021, finishing with a total of 920 respondents. The survey consisted of 14 questions, five of which were demographic based. The remaining nine questions ranged from multiple choice answer options, a five-point scale-based answer option and a comment box answer option. The questions and their results are discussed in the Results section of this document.

When analysing the questions it was considered that presenting the results of the demographic questions before the rest of the survey questions provides a better narrative in giving context as to who is answering the survey, before presenting the results of the other survey questions.

5.2 Statistical Assessment Methodology

Following the close of the online survey the data was downloaded in .csv format and analysed in Microsoft Excel. To identify any other contributing factors, the data was then interrogated to produce sub-data sets that could be used to control for certain characteristics of the participants. The options were available in combination and included:

- Gender
- Age
- Disability.

The data was manually interrogated in three separate ways to identify where there appeared to be differences in answers. These areas were then used to generate null hypotheses in the form of the following:

1. “That each question was answered randomly, and each answer has the same probability of being answered”

2. “That men answered this question the same way women answered this question”

3. “That people with a disability answered the same way people without a disability answered this question”.

Tests of homogeneity are then performed on the null hypotheses to understand if variations in results between the answers has arisen by chance. For this the Chi-Squared test is tested against a p-value of 0.05 which is used to prove significance at the 95% confidence level. The p-value is reported for each conclusion to each hypothesis and a p-value less than 0.05 (typically ≤ 0.05) is statistically significant. It indicates strong evidence against the null hypothesis, as there is less than a 5% probability the null hypothesis is correct. Therefore, we reject the null hypothesis, and accept the alternative hypothesis.

The Chi-Square test calculates the value of X^2 using Equation 1 and compares this to the Chi-Squared data table value found by referencing the degrees of freedom (calculated using Equation 2) and a p-value of 0.05. If the calculated X^2 value is greater than the data table value, then it falls in the rejection region for the null hypothesis and therefore an association is likely.

Equation 1: The Chi-Square test

$$\boldsymbol{X^2}=\sum\frac{(observedvalue-expectedvalue)2}{expectedvalue}$$

Expected Value *is calculated on the assumption that both groups are equally likely to fall into the expected category.*

Equation 2: Calculating the degrees of freedom for a dataset, where:

$$\boldsymbol{Degrees\ of\ Freedom}=(\boldsymbol{r-1})\times(\boldsymbol{k-1})$$

$\boldsymbol{r}$ *is the number of columns in the data table*
$\boldsymbol{k}$ *is the number of rows in the data table*

The Chi-Squared test is only used where no cells have a value of 0.

5.3 Results

A minimum sample size of 384 was originally chosen as it was calculated, using the Cochran formula, that this would be sufficient to ensure there was 95% confidence that the survey data accurately represents the population with a 5% margin of error. In total, 914 responses were received to the online questionnaire, which exceeded the target sample size of 384 responses.

It was not possible to calculate the significance of answers broken down and interrogated further by individual disabilities due to the smaller sample sizes, however comment was

made on the results, where possible. These are highlighted in tables and corresponding text from Table 7 onwards.

5.3.1 Demographic Profile of Respondents

Table 2 to Table 6 below represent the respondents' answers with regards to gender, age, and disability. These categories were assessed against national proportions to assess if the survey respondents are representative of the population and highlights any demographic trends. As the survey considered responses across the UK, Scottish, English and Welsh census data is referenced.

5.3.2 Gender

Table 2 – Respondents' gender

Gender	Count	Percent	Scotland Census 2011 Percentage	England and Wales Census 2011 Percentage
Female	466	52%	52%	51%
Male	408	45%	48%	48%
Other	2	0.2%		
Prefer not to say	27	3%		

Table 2 above shows that there is an even split between male and female respondents, with slightly more females answering (52%) than males (45%). When compared to the Census 2011 percentage, the gender split of respondents to the survey is representative of the population.

5.3.3 Age

Table 3 – Respondents' age

Age	Count	Percent	UK ONS Percentage	UK ONS Percentage (Under 18 removed)
Under 18	4	0.4%	23%	
18-30	90	10%	13%	17%
31-50	349	39%	26%	34%
51-70	382	42%	24%	32%
71 or over	58	6%	13%	17%
Prefer not to say	21	2%		

Table 3 shows the age range split of respondents to the survey compared to the UK Office of National Statistics (ONS) age split. Under 18s were removed in the UK ONS for comparison with the survey due to the low number of under 18-year olds responding to the survey. The survey results follow the general trend of the UK ONS, with age brackets 31-50 and 51-70 having the highest percentage. There were slightly under half of the expected proportion of respondents in the 71 or over bracket, which could be due to this age group being less likely to being active online and therefore more likely to not have access to the online survey.

5.3.4 Disability

Table 4 – Do you have a physical or mental health condition or illness lasting or expected to last 12 months or more?

	Count	Percent	Scottish Census 2011	ONS 2011 England and Wales	House of Commons Library 2020 (16-64)
Yes	194	21%	20%	18%	19%
No	656	72%			
Prefer not to say	57	6%			

Table 4 looks at those who have a physical or mental health condition lasting, or expected to last, 12 months or more. As 21% respondents answered with 'Yes', it is representative of the total population in Scotland according to the Scottish Census 2011. When compared to

England and Wales ONS and the House of Commons Library 2020, the percentage of survey respondents is slightly higher but still representative.

Table 5 - Does your condition or illness reduce your ability to carry-out day-to-day activities?

	Count	Percent
Yes, a lot	71	37%
Yes, a little	92	47%
Not at all	23	12%
Prefer not to say	8	4%

Table 5 above highlights if those with a physical or mental condition are affected by this daily. The largest proportion of respondents (47%) answered saying their illness affects them ‘a little’ in carrying out day-to-day activities, while 37% of respondents say it affects their abilities a lot. Only 12% answered with ‘Not at all’.

Table 6 - Does this condition or illness affect you in any of the following areas?

	Count	Percent
Vision	61	20%
Hearing	36	12%
Mobility and Dexterity	98	32%
Learning, Understanding or Memory	23	8%
Mental Health	54	18%
Other	27	9%
Prefer not to say	7	2%

Table 6 above indicates in which areas people’s condition or illness affects them. The most common area answered is in Mobility and Dexterity (32%), followed by Vision (20%), Mental Health (18%), Hearing (12%) and lastly Learning, Understanding or Memory (8%) whilst, 9% of people chose ‘Other’ while 2% chose ‘Prefer not to say’. Respondents were able to select more than one option if necessary.

5.3.5 Survey Question Analysis

Table 7 to Table 20 consider Questions 1 to 8 in turn. The responses were assessed separately for significance using the chi-squared test with the null hypothesis “that each question was answered randomly, and each answer has the same probability of being answered”. Each question scored under 0.05 which means at the 95% confidence level, the questions were not answered randomly. For questions 1, 2, 4 and 6, there was found to be

no difference in the way that women answered this question compared to men at the 95% confidence level. Question 6 also showed no statistical significance at the 95% confidence level between the way people with a disability answered this question compared to people without a disability.

Further breakdown of the results by individual disability are shown in accompanying tables. The tables show the total count of those who answered with a disability as well as the total count of each individual disability. The percentages alongside the individual disability count represents the percentage of the total count for each disability type. In some instances, the count of the individual disabilities will exceed the total count, this is due to ability of participants to select more than one disability.

Q1 – Which of these statements best describes how you use zebra crossings?

Table 7 – Answers to the question: Which of these statements best describes how you use zebra crossings?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
I use them whenever they are on convenient routes for my journeys	791	87%	151	79%
I use them if I have to but try to find other options for crossing	88	10%	25	13%
I will go out of my way to avoid using them	20	2%	11	6%
I have never used a zebra crossing	7	0.8%	4	2%

The results indicate that most people (87%) use zebra crossings when they are on convenient routes for their journey, while 10% will use them if they have to but will find other options for crossing. 2% will go out of their way to avoid using them.

This question was assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 which means at the 95% confidence level we can say that people with a disability answered this question differently those without a disability. People with a disability were more likely to have never used a zebra crossing (2%) or go out of their way to avoid using them (6%).

The table below shows that generally the answer by each disability group was similar to the total percentage. The proportion of people with a learning disability answering that they use zebra crossings but try to find alternatives was double (26%) that of the total percentage (13%) but the number of respondents was too small (6) to be significant.

Table 8– Breakdown of answers to question 1 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
I use them whenever they are on convenient routes for my journeys	151 (79%)	40 (66%)	27 (75%)	75 (77%)	15 (65%)	42 (78%)
I use them if I have to but try to find other options for crossing	25 (13%)	12 (20%)	4 (11%)	15 (15%)	6 (26%)	8 (15%)
I will go out of my way to avoid using them	11 (6%)	5 (8%)	3 (8%)	4 (4%)	1 (4%)	3 (6%)
I have never used a zebra crossing	4 (2%)	4 (7%)	2 (6%)	3 (3%)	1 (4%)	1 (2%)

Q2 – If you have never, or hardly ever, used a zebra crossing, why is this?

Table 8 – Answers to the question: If you have never, or hardly ever, used a zebra crossing, why is this?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
There are no zebra crossings on the routes that I use	174	63%	34	47%
I do not feel comfortable using zebra crossings	101	37%	39	53%

Although the most common answer (63%) is that there are no zebra crossings on the routes that people use, 37% of people do not feel comfortable using zebra crossings. Reasons of which are explored in the following questions.

This question was assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 which means at the 95% confidence level we can say that people with a disability answered this question differently than those without a disability. As the table shows, 53% of people with a disability were likely to not feel comfortable using a zebra crossing, compared to 47% of people with a disability who stated there are no zebra crossings on the routes they use. Each disability group answered this question in a similar way. The table below illustrates this.

Table 10 – Breakdown of answers to question 2 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
There are no zebra crossings on the routes that I use	39 (53%)	19 (61%)	6 (60%)	22 (58%)	7 (54%)	15 (54%)
I do not feel comfortable using zebra crossings	34 (47%)	12 (39%)	4 (40%)	16 (42%)	6 (46%)	13 (46%)

Q3 – On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)?

Table 11 – Answers to the question: On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
1	83	9%	29	15%
2	113	12%	33	17%
3	246	27%	58	30%
4	244	27%	40	21%
5	219	24%	32	17%

The majority of people are somewhere between 3 and 4 on the scale, both indicating 27% of responses. 24% of people feel very comfortable using zebra crossings while 9% do not feel comfortable at all.

This question was assessed using chi-squared for “that men answered this question the same way women answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that women answered this question differently to men. Women tended to score lower than men scoring mainly 3 out of 5 whereas men scored mainly 4 and 5 out of 5.

This question was also assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that people with a disability answered this question differently those without a disability. People with a disability tended to be less comfortable using a zebra crossing than people with no disability. Only 7% of those with a disability felt comfortable using the crossing compared to 24% of the total respondents. While only 9% of total respondents were uncomfortable using zebra crossings, 15% of disabled users felt uncomfortable using zebra crossings.

Table 12 – Breakdown of answers to question 3 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
1	29 (15%)	16 (27%)	7 (20%)	16 (17%)	5 (22%)	6 (12%)
2	33 (17%)	10 (17%)	10 (29%)	15 (15%)	4 (17%)	10 (19%)
3	58 (30%)	16 (27%)	7 (20%)	29 (30%)	7 (30%)	22 (40%)
4	40 (21%)	11 (18%)	9 (26%)	20 (20%)	3 (14%)	9 (16%)
5	32 (17%)	7 (11%)	2 (5%)	17 (18%)	4 (17%)	7 (13%)

Those with vision and learning, understanding and memory disabilities tended to answer between 1 and 3, i.e. they were less comfortable using a zebra crossing. Those with mental health and mobility and dexterity disabilities answered mainly 3 out of 5. Deaf people and those with hearing loss had scores that were more evenly spread ranging between mainly 1 and 4 out of 5. Deaf people and those with hearing loss displayed the lowest proportion of 5 out of 5 in comparison to the other disability groups.

Q4 – If you sometimes feel uncomfortable using zebra crossings, why might this be?

Table 13 – Answers to the question: If you sometimes feel uncomfortable using zebra crossings, why might this be?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
I find it difficult to locate the crossing	29	4%	18	9%
I find it difficult to know whether the traffic has stopped before I start to cross	411	56%	97	51%
I find it difficult to follow the route across	8	1%	5	3%
Other option	283	39%	74	39%

The majority of people find it difficult to know whether traffic has stopped before crossing (56%). Respondents also had the opportunity to leave comments which highlighted some other key issues that are outlined below. The comments were grouped into themes, some of which are presented below in order of frequency with examples of comments beneath them.

- **Vehicles do not stop (42%)**
    - “I often find drivers do not stop to allow me and my guide dog safe crossing so am left standing at the pavement edge waiting for the road to clear of traffic, which offers me no benefit in terms of my safety...zebra crossings should be a safer option that crossing the road without any form of ‘defined’ crossing point”
    - “Many drivers fail to stop. It’s hard to feel confident starting to cross with uncertain behaviour of approaching traffic”.
- **Hard to judge cars stopping (26%)**
    - “Don’t completely trust that a vehicle won’t just sail through without seeing me”
    - “Sometimes it gives a false sense of security. I think cars are still far enough away, they see me and are slowing down to let me cross (e.g. there is one just after a roundabout) but they don’t and just blast through”.
- **Driver behaviour change needed (6%) and Impatient drivers (5%)**
    - “Nervous about road rage from motorists who are cross about being stopped”
    - “Concerned about reckless/stupid/malignant/unobservant drivers”.

- **Location of crossing (4%)**
    - “Location of crossings can make it impossible for drivers to see the pedestrians”
    - “Not comfortable using the crossing in my village due to its location, located just after a bend on the road, drivers are coming around the bend blind”.

Other themes included the suggestion that there should be an increase in education and training around the rules and regulations of a zebra crossing for both pedestrians and road users. Some people feel uncomfortable using zebra crossings due to poor visibility of them due to lack of well-maintained road markings and lights. Further comments included they are uncomfortable using zebra crossings due to their own personal health issues or when walking with children.

This question was assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that people with a disability answered this question differently to those without a disability. People with a disability were more likely to find it more difficult to locate the crossing than people without a disability. There is a higher proportion of individuals with a visual disability (22%) that stated they find it difficult to locate the crossing compared with other disabilities, which is not unexpected. The table below illustrates this.

Table 14– Breakdown of answers to question 4 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
I find it difficult to locate the crossing	18 (9%)	16 (22%)	3 (8%)	8 (8%)	3 (11%)	4 (7%)
I find it difficult to know whether the traffic has stopped before I start to cross	97 (51%)	36 (49%)	22 (59%)	47 (49%)	13 (48%)	29 (51%)
I find it difficult to follow the route across	5 (3%)	5 (7%)	0 (0%)	0 (0%)	1 (4%)	1 (2%)
Other option	74 (39%)	16 (22%)	12 (32%)	41 (43%)	10 (37%)	23 (40%)

Q5 – Do you sometimes drive a car or other road vehicle?

Table 15 – Answers to the question: Do you sometimes drive a car or other road vehicle?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
Yes	749	82%	105	55%
No	159	18%	86	45%

The majority of respondents (82%) answered with ‘Yes’, they do drive a car or other road vehicle while 18% answered with ‘No’.

This question was assessed using chi-squared for “that men answered this question the same way women answered this question”. The p-value scored below 0.05 and therefore at

the 95% confidence level we can say that women answered this question differently to men. Women were more likely not to drive a car or any other road vehicle than men.

This question was also assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that people with a disability answered this question differently those without a disability. People with a disability were more likely to not drive a car or other road vehicle than those without a disability, however a slight majority of those with a disability answered ‘Yes’ to driving a car (55%). Blind and partially sighted people had a higher proportion answering “No” than those with other disabilities. The table below illustrates that people defined with a visual disability are far less likely to drive, as would be expected.

Table 16 – Breakdown of answers to question 5 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
Yes	105 (55%)	8 (13%)	17 (47%)	58 (60%)	13 (57%)	32 (59%)
No	86 (45%)	53 (87%)	19 (53%)	39 (40%)	10 (43%)	22 (41%)

Q6 – As a driver, have you ever witnessed any of the situations below?

Table 17 – Answers to the question: As a driver, have you ever witnessed any of the situations below?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
As a driver, it is sometimes difficult to see pedestrians approaching or on the crossings	311	20%	47	20%
Pedestrians sometimes step out very quickly, and it could be difficult to stop in time	338	22%	54	23%
Drivers and pedestrians sometimes seem unsure as to who has right of way on a zebra crossing	252	16%	38	17%
Other drivers fail to give way to pedestrians waiting to cross	603	39%	86	37%
I have never witnessed any unsafe practice at zebra crossings	33	2%	5	2%

The most common scenario witnessed by drivers is other drivers failing to give way to pedestrians waiting to cross. However, 22% of the total respondents answered that they had witnessed pedestrians stepping out very quickly, making it difficult to stop in time. This was closely followed with 20% of total respondents agreeing that as a driver it sometimes difficult to see pedestrians approaching or on the crossings, causing a conflict. When broken down further into individual disabilities, the most common scenario witnessed by drivers was the same, however the second most common scenario witnessed was drivers and pedestrians sometimes seem unsure as to who has right of way on a zebra crossing. The table below highlights these findings.

Table 18 – Breakdown of answers to question 6 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
As a driver, it is sometimes difficult to see pedestrians approaching or on the crossings	47 (20%)	4 (19%)	12 (29%)	22 (18%)	6 (18%)	17 (23%)
Pedestrians sometimes step out very quickly, and it could be difficult to stop in time	54 (23%)	6 (29%)	9 (22%)	26 (22%)	11 (33%)	22 (29%)
Drivers and pedestrians sometimes seem unsure as to who has right of way on a zebra crossing	38 (17%)	4 (19%)	8 (20%)	20 (17%)	6 (18%)	9 (12%)
Other drivers fail to give way to pedestrians waiting to cross	86 (37%)	6 (29%)	12 (29%)	47 (40%)	10 (30%)	27 (36%)
I have never witnessed any unsafe practice at Zebra crossings	5 (2%)	1 (5%)	0 (0%)	4 (3%)	0 (0%)	0 (0%)

Q7 – As a cyclist or pedestrian have you experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing?

Table 19 – Answers to the question: As a cyclist or pedestrian have you experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
Yes	336	46%	62	60%
No	402	54%	42	40%

Although the majority of total respondents (54%) answered saying they had not witnessed a potentially dangerous situation involving a cycle at a zebra crossing, 46% answered with 'Yes' and were asked to provide a description in a comment box. On the other hand, those with disabilities answered the majority 'Yes' (60% that they had witnessed a dangerous situation, while 40% answered with 'No'. The comments were grouped into themes and are outlined below in bold in order of frequency of theme, with examples of comments beneath.

- **Cyclists do not stop (32%)**
    - "I am a wheelchair user and have been hit by a cyclist while I was on the crossing. Cyclists don't stop and I have had a couple of near misses also"
    - "Some cyclists will cycle round pedestrians crossing rather than stop"
    - "As a pedestrian I have had numerous occasions where cyclists have kept going while I have been in the middle of crossing with my children".
- **Cyclists 'pick and choose' when to use the road or crossing (13%)**
    - "Cyclist going down road then turning to go across the zebra crossing like a pedestrian"
    - "I have witnessed a cyclist who was on the road and as he approached the crossing, mounted the pavement and immediately used the zebra crossing to cross the road. The cars approaching had to brake very suddenly".
- **Pedestrian error/failing to look (5%)**
    - "Whilst cycling towards a crossing, a pedestrian with their back to me, walking along the pavement, suddenly turned, and stepped onto the crossing with one foot, causing me to brake and swerve suddenly. Two incidents could have taken place, either lose control or collide with the pedestrian for not waiting for traffic (including cyclist) to stop and give way to them"
    - "People cross too quickly and, although it may be their right of way, they still need to check that it is safe to proceed before just proceeding"

  - “Some pedestrians do not seem to think that they should stop and check traffic before crossing and walk up and step onto the crossing without any consideration for oncoming traffic”.

- **Cyclists undertaking/overtaking cars that have stopped (4%)**

  - “On a bike I stopped at a zebra Crossing to let a pedestrian past and the car behind me overtook me while the pedestrian was still on the crossing”

  - “A cyclist cut through on the inside of the stopped car and nearly knocked into the pedestrian”.

Other key themes from the comments included witnessing conflicts between pedestrians and cyclists as there is uncertainty of who has right of way. This is also linked to comments surrounding a lack of signalling from both pedestrians and cyclists.

This question was assessed using chi-squared for “that men answered this question the same way women answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that women answered this question differently to men. Women had not experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing as much as men.

This question was also assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that people with a disability answered this question differently those without a disability. People with a disability were more likely to have experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing. When looking at each disability type, people with a learning, understanding or memory disability were more likely to answer yes to this question (83%) than not (17%) than other groups but the number of respondents in this disability type was small. This is illustrated in the table below.

Table 20 – Breakdown of answers to question 7 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
Y	62 (60%)	5 (63%)	11 (65%)	33 (57%)	10 (83%)	21 (68%)
N	42 (40%)	3 (38%)	6 (35%)	25 (43%)	2 (17%)	10 (32%)

Q8 – We are seeking ideas for how zebra crossing could be improved, which of the following measures would you consider to be most effective to improve zebra crossings?

Table 21 – Answers to the question: We are seeking ideas for how zebra crossing could be improved, which of the following measures would you consider to be most effective to improve zebra crossings?

	Count (All Users)	Percent (All Users)	Count (Disabled)	Percent (Disabled)
Provide audible indicators to inform pedestrians when traffic has stopped, and it is safe to cross	291	20%	90	28%
Provide visual indicators to inform pedestrians when traffic has stopped, and it is safe to cross	175	12%	47	15%
Provide tactile indicators, such as the rotating tactile cones on signalised crossings, to inform pedestrians when traffic has stopped, and it is safe to cross	106	7%	39	12%
Provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down	468	32%	77	24%
Increase training / information available for drivers, cyclists and pedestrians on the use of zebra crossings	348	24%	57	18%
None of the above	78	5%	14	4%

The most common answer (32%) was to provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down, the second most common answer (24%) was to increase training and information available for drivers, cyclists and pedestrians on the use of zebra crossings. 20% answered with the suggestion to provide audible indicators, while 12% answered with the suggestion to provide visual indicators. Only 5% of respondents answered with none of the above.

This question was assessed using chi-squared for “that men answered this question the same way women answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that women answered this question differently to men. Women were more likely to want audible indicators to inform pedestrians when traffic has stopped, and it is safe to cross and less likely to want an increase in training/information available for drivers, cyclist and pedestrians on the use of zebra crossings.

This question was also assessed using chi-squared for “that people with a disability answered the same way people without a disability answered this question”. The p-value scored below 0.05 and therefore at the 95% confidence level we can say that people with a disability answered this question differently those without a disability. People with a disability were more likely to want audible (28%) or visual (15%) indicators to inform pedestrians when traffic has stopped and it is safe to cross, and are less likely to want an increase in training/information available for drivers, cyclist and pedestrians on the use of zebra crossings (18%). People with disabilities are also more likely to want tactile indicators. The table below shows that people with a visual disability are more likely to want audible and tactile indicators to inform pedestrians when traffic has stopped (38&), however a very low proportion of people with mobile and dexterity disabilities wanted tactile indicators. There were no other discernible differences between the disability types.

Table 20 – Breakdown of answers to question 8 by disability

	Total Disabled (Count/ Percent)	Vision (Count/ Percent)	Hearing (Count/ Percent)	Mobility/ Dexterity (Count/ Percent)	Learning (Count/ Percent)	Mental Health (Count/ Percent)
Provide audible indicators to inform pedestrians when traffic has stopped, and it is safe to cross	90 (28%)	42 (38%)	18 (30%)	46 (28%)	13 (33%)	27 (30%)
Provide visual indicators to inform pedestrians when traffic has stopped, and it is safe to cross	47 (15%)	12 (11%)	10 (16%)	27 (16%)	8 (20%)	12 (13%)
Provide tactile indicators, such as the rotating tactile cones on signalised crossings, to inform pedestrians when traffic has stopped, and it is safe to cross	39 (12%)	24 (22%)	8 (13%)	9 (5%)	5 (13%)	10 (11%)
Provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down	77 (24%)	16 (15%)	13 (21%)	42 (26%)	10 (25%)	25 (28%)
Increase training / information available for drivers, cyclists and pedestrians on the use of zebra crossings	57 (18%)	12 (11%)	10 (16%)	31 (19%)	2 (5%)	12 (13%)
None of the above	14 (4%)	4 (4%)	2 (3%)	9 (5%)	2 (5%)	4 (4%)

Q9 – If you have ideas for other options to improve zebra crossings, please state them below

Comments for this question were grouped into themes to highlight key ideas for improving zebra crossings. The themes are outlined below in order of frequency, with extracts from comments added to give a flavour of the responses. A full list of the comments is in Appendix C.

- **Improve Visibility and Lighting (13%)**
    - “zebra crossings should be visible to road users for around 60 - 100 metres either side so people with mobility issues, hearing, visual and learning impairments can see oncoming traffic and oncoming traffic can see them. Sometimes I have to wait for cars to come and then stop because its unsafe otherwise in case they don't see me”
    - “Design them so they are obvious and prominent. Often crossings are partially hidden by parked vehicles, and wide sections of carriageway remain to be crossed”
    - “I think increased lighting on the crossing and on approach to the crossing would be beneficial as it is difficult to see people approaching the crossings at night”.
- **Replace type of crossing (12%)**
    - “Consider replacing zebras with other safer types of crossing”
    - “The small ones in car parks etc are often safer due to slower traffic and shorter road crossings - I use these with confidence, however I think the other ones should have traffic lights”
    - “I would like to see zebra crossings phased out. Traffic light-controlled crossings are much safer. Once the light turns red and the green man comes on there is no confusion as to who has the right of way. With zebra crossings there is always an element of doubt if someone intending to cross or not”.
- **Increase training/awareness of rules (9%)**
    - “I think that many drivers are unfamiliar with the requirement to stop and give way to pedestrians who have started crossing. This is an issue of driver education”
    - “Drivers need awareness training that wherever a zebra crossing exists, pedestrians have priority and they must stop. Too often I have found zebra crossings in hospitals or shopping centres that drivers totally ignore and drive straight across even though they can easily see me and my guide dog at the pavement edge waiting for them to stop”
    - “Educate pedestrians how to use them would be good start - the number who don't look, or cross while on their phones not watching the traffic is unbelievable”.

- **Stricter enforcement (including CCTV) on road users and pedestrians (9%)**
    - “Put cameras on them so drivers can be fined for dangerous driving if they fail to stop”
    - “Cameras used to fine or prosecute drivers who do not suitably stop or slow down or who overtake at crossings or park on our too close to the crossing”
    - “Fine drivers who don't stop at them when pedestrians need to cross. Lack of enforcement against driving crime is the key danger to pedestrians in Scotland”.

Other key themes that were highlighted in the comments included design features such as raising the crossings to be situated on a raised table as well as change the type of tactile paving to indicate to users the type of crossing it is. The integration of apps to connect to the crossing was a suggestion alongside ensuring zebra crossings are integrated into GPS systems.

5.3.6 Summary of Findings

The total number of respondents was representative of the population in terms of gender and disability proportions. The age trends of the survey followed the national average in general, with the exception of the over 75 age group which was underrepresented. The underrepresentation of the over 75 age groups was most likely due to this age group being less likely to be active online.

The majority of the respondents (87%) used zebra crossings when they were on a convenient route for their journey with only 2% going out of their way to avoid them. However, people with disabilities were more likely to have never used a zebra crossing or go out of their way to avoid using them. There was no clear difference in the way this question was answered by each disability group.

The main reason for hardly ever using a zebra crossing was that there were no zebra crossings on the routes that the respondents use (63%). People with a disability were more likely to not feel comfortable using zebra crossings. Each disability group answered this question in a similar way.

The majority of the respondents were generally comfortable using zebra crossing with only 21% expressing a score of 1 or 2 when asked ‘On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)? People with a disability tended to be less comfortable than people with no disability. There was no discernible difference in the way this question was answered by each disability group.

When expressing discomfort when using a zebra crossing, the majority of people find it difficult to know whether traffic has stopped before crossing (56%). When asked to comment on key issues on why people may feel uncomfortable using crossings, the most common theme was that ‘vehicles do not stop’ (42%). The most common comment was that ‘it is hard to judge that cars are stopping’ (26%). People with a disability answered this question in a similar way to all users.

People with a disability were more likely to find it difficult to locate the crossing than people without a disability. There was a higher proportion of blind and partially sighted people that stated they find it difficult to locate the crossing compared with other disabilities.

The most common problem witnessed by drivers is other drivers failing to give way to pedestrians waiting to cross. However, 22% of respondents answered that they had witnessed pedestrians stepping out very quickly, making it difficult to stop in time. This was closely followed with 20% of people agreeing that as a driver it is sometimes difficult to see pedestrians approaching or on the crossings, causing a conflict.

46% of respondents had witnessed a potentially dangerous situation whilst using the crossing as a pedestrian or cyclist. When asked to comment, respondents reported that the most common occurrence was ‘cyclists do not stop’ (32%). People with a disability were more likely to have experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing. There was no discernible difference in the way this question was answered by each disability group.

When asked how zebra crossings could be improved, the most common suggestions were: ‘provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down’ (32%), ‘increase training / information available for drivers, cyclists and pedestrians on the use of zebra crossings’ (24%) and ‘provide audible indicators’ (20%). People with a disability were more likely to want audible and visual indicators to inform pedestrians when traffic has stopped, and it is safe to cross and less likely to want an increase in training/information available for drivers, cyclist and pedestrians on the use of zebra crossings. People with disabilities are also more likely to want tactile indicators. Blind and partially sighted people are more likely to want audible and tactile indicators to inform pedestrians when traffic has stopped, however a very low proportion of people with mobile and dexterity disabilities wanted tactile indicators.

When asked to provide ideas other than those suggested in the questionnaire suggestions included: ‘improve visibility and lighting’ (13%), ‘replace the type of crossing’ (12%), ‘increase training/awareness of rules’ (9%) and stricter enforcement (9%).

Other key themes that were highlighted in the comments included design features such as raising the crossings to be situated on a raised table as well as change the type of tactile paving to indicate to users the type of crossing it is. The integration of apps to connect to the crossing was a suggestion alongside ensuring zebra crossings are integrated into GPS systems.

5.3.7 Conclusions

The main conclusions for the online questionnaire are:

- The survey was representative of the population in terms of gender and disability proportions
- The age trends of the survey followed the national average in general, with the exception of the over 75 age group which was underrepresented
- The majority of respondents would use zebra crossings if it was convenient to do so
- The majority of respondents felt comfortable using a zebra crossing

- People with a disability were more likely to not feel comfortable using zebra crossings. There were no discernible differences within the respondents who stated they had a disability
- Women tended to report a lower level of comfort when using zebra crossings but were less likely to have witnessed dangerous behaviour
- The main reason that people felt uncomfortable when using zebra crossings was the inability to tell if the vehicle had stopped or was stopping
- People with a disability were more likely to find it difficult to locate the crossing than people without a disability. There is a higher proportion of blind and partially sighted people that stated they find it difficult to locate the crossing compared with other disabilities
- The most common dangerous scenario witnessed by drivers is other drivers failing to give way to pedestrians waiting to cross
- 46% of respondents had witnessed a potentially dangerous situation as a pedestrian or cyclist. The most common observation was that cyclists fail to stop at the crossing
- People with a disability were more likely to have experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing
- The most common suggestions to improve zebra crossings were:
    - provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down
    - increase training / information available for drivers, cyclists and pedestrians on the use of zebra crossings
    - provide audible indicators.
- People with disabilities were more likely to want indicators that traffic had stopped or is stopping
- There are a range of further suggestions to improve zebra crossings including:
    - Improve lighting/ visibility
    - Replace the type of crossing
    - Stricter enforcement
    - Raise the crossing
    - Amend tactile paving
    - Introduce apps connected to the crossing.

6. Consultation with Local Authorities

6.1 Methodology

Transport Scotland no longer supports the use of zebra crossings because they are unsuitable for blind and partially sighted pedestrians. However, many local authorities still have zebra crossings on their road networks. Relevant transport officers at each of Scotland's local authorities were contacted by email asking them to complete a brief questionnaire about their opinions on the safety and appropriateness of zebra crossings. They were also asked what improvements could make them safer. The questions can be found in Table below.

Table 21 - Questions sent to Local Authorities

Questions sent to Local Authorities
1. What is your authority's current policy in relation to zebra crossings? a. Happy to retain existing crossing and consider installation of new ones where appropriate b. Not installing new zebra crossings, but no active policy of removal of existing ones c. Working to remove all zebra crossings d. We have no zebra crossings in our area.
2. Which of the following statements best accords with your personal opinions about zebra crossings in Scotland? a. Zebras are appropriate solutions on our roads (subject to traffic speed, volume, and visibility considerations) b. Zebras have a reasonable road safety record, but they can be exclusive, particularly for people with mobility difficulties or sensory impairments c. Zebras are exclusive and cause safety risks, and should no longer be in use on Scotland's roads.
3. If zebra crossings continued to be widely used on Scotland's roads, are there design improvements that could help make them safer, or accessible to a wider range of people? If so, what?
4. Are you aware of international practice (good or bad) or experiments that should be considered as part of our research into opportunities to improve their design?

6.2 Results

In total, 15 local authorities responded, however it is important to note that for some local authorities, more than one representative responded.

Question 1

When asked what their authority's current policy is in relation to zebra crossings, 11 out of the 15 responses state they are happy to retain existing crossings and consider the installation of new ones where appropriate whilst the other four stated they are not installing new zebra crossings, but no active policy of removal of existing ones.

Question 2

When asked which of the following statements best accords with your personal opinions about crossings in Scotland, 9 out of the 15 responses were 'a. zebras are appropriate solutions on our roads (subject to traffic speed, volume and visibility considerations)' and 8 out of the 15 responses answered with 'b. zebras have a reasonable road safety record, but they can be exclusive, particularly for people with mobility difficulties or sensory impairments.' (Some authorities answered with both).

Question 3

The common themes for design improvements are highlighted in bold below, with more detailed answers and examples beneath them.

- **Replace or alter Belisha Beacons**
    - Option for automatic vehicle actuated or user actuated beacons
    - Consideration should be given to permitting zebra crossings to be installed without the beacons, i.e. by virtue of road markings only and perhaps a non-illuminated upright sign
    - Belisha Beacons are very expensive therefore replace with retroreflective signage
    - Belisha Beacons could be solar powered to improve efficiency and flexibility.

- **Indicators to differentiate the type of crossing**
    - Change to tactile paving requirements to differentiate between zebra and traffic signal control
    - Change beacon post requirements to include standard tactile feature to identify crossing type
    - Provision of low cost audible and tactile indicators for users to indicate that traffic has stopped
    - Braille could be added to the post to let people know what type of crossing it is
    - Specific arrangement of tactile paving

  - They could be altered to be in keeping with signal-controlled crossings by utilising either visual, audible or movement signals (tactile cones) to indicate to pedestrians when it is safe to cross
  - Possible addition of audible features, perhaps app activated, to assist blind and partially sighted people taking crossing opportunities
  - Enhanced advance signing.

- **Raise crossing**
  - Could be situated on raised junctions and areas which would improve accessibility and temper speeds
  - Raise the crossing surface to footway level (i.e. flat-topped hump), serving to reduce traffic speed and improve pedestrian safety and comfort
  - Install zebras on raised tables or placed them between pairs of speed cushions. The raised table is more effective as the driver has to slow down in order to negotiate the ramp (if suitably constructed) which also focuses the driver's attention on any crossing movements. When the speed cushions are placed in advance of the crossing, driver attention seems to be more focused on the physical obstacle of the cushion ramp than on the crossing point
  - Ensuring low approach speeds (20mph) through traffic calming, such as placing zebra crossings on raised humps, and ensuring a high quality and level of street lighting both at and on the approached to any crossing will help minimise the normal safety risks.

- **Stricter compliance and training**
  - Increase penalties for non-compliance
  - Decriminalise enforcement of failure to stop and permit enforcement by CCTV
  - Driver education regarding requirement to stop for pedestrians intending to cross
  - More of an education issue as drivers, and to a lesser extent pedestrians, are now more used to traffic lights informing them who has priority, and some forget that at zebras it is pedestrians who have priority.

- **Increase frequency of zebra crossings**
  - More widespread use would make road users more comfortable and confident in their use
  - All changes should be driven by a reduction of installation cost as the more they are used, the more users expect them and will behave appropriately.

- **Other**
    - Develop design guidance to reinforce use at priority junctions, for example two main road crossings and one side road at T-junctions as used in other countries in Europe
    - Develop guidance to move away from the 85% speed limit criteria within design guidance and give more weighting to forward visibility
    - Zebra crossings function better at site where the footway has been widened/carriageway narrowed to allow for reduced traffic speed, improved inter-visibility between drivers and pedestrians and shorter crossing distances for pedestrians.

Question 4

In terms of international practice, good or bad, the responses were mixed with no particular theme being prominent.

One response highlights that it is not the design of the crossing itself but road user competence. There is a suggestion of a public information campaign based on upcoming Highway Code changes would help to improve the understanding and use of zebra crossings. Any consideration to remove zebra crossings as a design option will need to recognise the likely result will be fewer crossing facilities and a net detriment to pedestrians. Further to the idea of road user competence, one comment suggests poor driver behaviour is down to lack of enforcement. European drivers tend to be more vigilant with zebra style crossings and UK policing needs to give traffic enforcement far greater priority to encourage better driver behaviour.

A further two comments align with some previous comments made in Question 3, suggesting that continental zebra type crossings without Belisha Beacons appear to be widespread and respected by drivers. It is also noted that in some villages in France drivers are presented with a sign which informs them of the number of zebra-style crossings they will encounter.

Retaining zebra crossings in urban centres was highlighted as good practice, rather than general residential areas as there is higher pedestrian activity all day. There are clear desire lines and plenty of commercial premises, so the approaching driver is more understanding of a pedestrians want to cross. This is followed up by a comment suggesting it is poor design to have zebra crossings outside schools as pedestrian activity is concentrated twice a day and only during term time. This means that during the majority of car journeys along these routes, drivers will not encounter sufficient pedestrian activity to make them expect to have to stop.

6.3 Summary of Findings

Most local authorities were in favour of keeping existing zebra crossings and are happy to install new ones where appropriate. No local authority expressed a wish to remove existing zebra crossings. However, they also highlight that zebra crossings can be exclusive to certain groups within the population and therefore more work needs to be done on their design and training and awareness around their correct, and safe, use.

A theme that was picked up both in the online survey and the local authority comments was the replacement of Belisha Beacons to allow for a cheaper alternative of the type of crossing

to be installed. This would in turn increase the frequency of zebra crossings on the network and therefore expose both road users and pedestrians to this type of crossing more often, allowing a greater understanding of how to use them safely. This suggestion was also highlighted in the survey when asked about good international practice.

The local authorities' respondents also suggested measures to improve zebra crossings that included:

- Changing tactile paving to indicate the difference with traffic signalled crossings
- Use of an audible feature to indicate that traffic has stopped
- Raised crossings
- Stricter compliance and enforcement
- Increase frequency of zebra crossings.

No particular themes emerged from the responses to the consideration of international best practice. There was a comment that better enforcement is needed in the UK in line with other European countries. There was also a comment that the removal of Belisha Beacons so that more 'European style' crossing can be installed. This would simplify and reduce the cost of installing zebra crossing would assist in providing a greater number of crossings resulting in increased familiarity with this type of crossing.

6.4 Conclusion

The following conclusions can be made from the consultation with local authorities:

- Many local authorities are happy with zebra crossings and would install new ones, where appropriate
- No local authority expressed a wish to remove existing zebra crossings
- There is a recognition that zebra crossings can be exclusive to certain groups within the population and therefore more work needs to be done on their design and training and awareness around their correct, and safe, use
- There was some desire to remove Belisha Beacons to simplify the design and so lead to more zebra type crossing being installed. This in turn would lead to a greater familiarity and understanding of zebra crossings, for all users.
- Suggestions to improve zebra crossings included:
    - Changing tactile paving to indicate the difference with traffic signalled crossings
    - Use of an audible feature to indicate that traffic has stopped
    - Raise crossings to the level of the footway
    - Stricter compliance and enforcement
    - Increase frequency of zebra crossings.

7. Summary

7.1 Overview and Methodology

Transport Scotland wish to explore issues that vulnerable users may experience with zebra crossings and propose possible solutions applying reasonable adjustments.

The study considers the use of zebra crossings by all users but pays particular attention to the needs of people with disabilities and their attitude to and experiences of zebra crossings.

The aims of the study were to:

- Improve road safety
- Influence current practice in the deployment of zebra crossings across Scotland on all road types
- Promote good practice.

The objectives of the research were:

- To appraise the current understanding of the effectiveness of zebra crossings
- To investigate users' attitude to zebra crossings
- Identify potential improvements to the design of zebra crossings for further investigation, primarily with regard to increasing perceptions of safety for users most at risk.

The study used three methods to gather information about the use of and attitudes to zebra crossings:

- Literature Review
- Online Questionnaire
- Consultation with local authorities.

7.2 Summary of Findings

The literature review summarised the findings from 85 studies which examined zebra crossings from the perspective of both drivers and pedestrians, including people with disabilities.

The review highlighted some of the challenges facing both pedestrians and drivers/vehicles when using or approaching zebra crossings.

The online questionnaire investigated the views of the public towards zebra crossings and to gather their views on what improvements could be made to the crossings. The total number of respondents to the online questionnaire was representative of the population in terms of gender and disability proportions. The age trends of the survey followed the national average in general, with the exception of the over 75 age group which was underrepresented. The underrepresentation of the over 75 age groups was most likely due to this age group being less likely to be active online.

The majority of the respondents (87%) used zebra crossings when they were on a convenient route for their journey with only 2% going out of their way to avoid them. However, people with a disability were more likely to have never used a zebra crossing or go out of their way to avoid using them. There was no clear difference in the way this question was answered by each disability group.

The main reason for hardly ever using a zebra crossing was that there were no zebra crossings on the routes that the respondents use (63%). People with a disability were more likely to not feel comfortable using zebra crossings. Each disability group answered this question in a similar way.

The majority of the respondents were generally comfortable using zebra crossing with only 21% expressing a score of 1 or 2 when asked ‘On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)? People with a disability tended to be less comfortable than people with no disability.

When expressing discomfort when using a zebra crossing, the majority of people find it difficult to know whether traffic has stopped before crossing (56%). When asked to comment on key issues on why people may feel uncomfortable using crossings, the most common theme was that ‘vehicles do not stop’ (42%). The most common comment was that ‘it is hard to judge that cars are stopping’ (26%).

People with a disability were more likely to find it difficult to locate the crossing than people without a disability. There is a higher proportion of individuals with vision impairments that stated they find it difficult to locate the crossing compared with other disabilities. Deaf people and those with a hearing loss were in the highest proportion of those finding it difficult to know if the traffic has stopped before they started to cross.

People with a disability were more likely to not drive a car or other road vehicle than those without a disability.

The most common scenario witnessed by drivers is other drivers failing to give way to pedestrians waiting to cross. However, 22% of respondents answered that they had witnessed pedestrians stepping out very quickly, making it difficult to stop in time. This was closely followed with 20% of people agreeing that as a driver it sometimes difficult to see pedestrians approaching or on the crossings, causing a conflict.

46% of respondents had witnessed a potentially dangerous situation as a pedestrian or cyclist. When asked to comment, respondents reported that the most common occurrence was ‘cyclists do not stop’ (32%). People with a disability were more likely to have experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing.

Most local authorities were in favour of keeping existing zebra crossings and are happy to install new ones where appropriate. No local authority expressed a wish to remove existing zebra crossings. However, they also highlight that zebra crossings can be exclusive to certain groups within the population and therefore more work needs to be done on their design and training and awareness around their correct, and safe, use.

People who are partially sighted are more likely to want audible and tactile indicators to inform pedestrians when traffic has stopped, however a very low proportion of people with mobility and dexterity disabilities wanted tactile indicators.

When asked to provide ideas other than those suggested in the questionnaire suggestions included: ‘improve visibility and lighting’ (13%), ‘replace the type of crossing’ (12%), ‘increase training/awareness of rules’ (9%) and ‘stricter enforcement’ (9%).

An idea that was suggested both in the online survey and the local authority comments was the replacement of Belisha Beacons to allow for a cheaper alternative of the type of crossing to be installed. This would in turn increase the frequency of zebra crossings on the network and therefore expose both road users and pedestrians to this type of crossing more often, allowing a greater understanding of how to use them safely. This suggestion was also highlighted in the local authority survey when asked about good international practice.

The study identified measures to improve zebra crossings from the literature review, online questionnaire respondents and local authority officers. The most common themes included:

- Changing tactile paving to indicate the difference with traffic signalled crossings
- Use of an audible feature to indicate that traffic has stopped (such as rumble strips)
- Raised crossings
- Stricter compliance and enforcement
- Shorter crossings
- Increase frequency of zebra crossings
- Automated vehicle communication systems
- Increased use of enforcement measures such as e-police cameras.
- Improved driver and pedestrian awareness training
- Agreed hand gestures to indicate intention of drivers or pedestrians may be helpful.

7.3 Review limitations

As with all literature reviews, robust and systematic searching and screening can still fail to locate all relevant material. A detailed protocol, as agreed between interested parties at the start of this review, has served to mitigate such limitations.

Due to differing terminology used across studies it was not always possible to differentiate between uncontrolled zebra crossings (or crosswalks/mid-block crossings), and those controlled by traffic signals. Additional time therefore was needed to read full text papers to ascertain this.

While limited research from the UK was located, the volume of recent relevant research that was accessed did indicate that the topic is of continued interest across many countries and communities.

The number of responses to the online questionnaire for certain disability groups was relatively low, particularly deaf people and those with a hearing loss. Feedback on the questionnaire has highlighted that it may be biased against people who use British Sign

Language (BSL) as their first language and not English. Consequently, some people would find it difficult to engage with the questionnaire.

There are also inherent issues with using an online questionnaire as they rely primarily on access to online facilities and a certain level of technology awareness. Some user groups such as older people and people with cognitive disability may be disproportionately represented.

The questionnaire and the consultation with local authorities considered ‘traditional’ zebra crossings (i.e. those across traffic lanes). zebra crossings across cycle lanes (e.g. across cycle lanes adjacent to bus stops) were not considered in detail.

7.4 Conclusions

The study investigated the attitudes of users and practitioner towards zebra crossings which was largely favourable. There were, however, a number of concerns identified on how they operate.

People with disabilities were more likely feel uncomfortable using zebra crossings. The report highlighted a number of issues that people with disabilities experience when using zebra crossings. Although the majority of those in the middle age ranges felt very comfortable using zebra crossings, there were still a considerable amount who were not comfortable therefore highlighting that it is not just older people that may struggle with zebra crossings.

A wide range of potential improvements, including physical design adaptations as well as stricter compliance measures and increased training, were identified that may improve the safety of zebra crossings and make them more appropriate to the needs of all users.

7.5 Next Steps

The findings of this study should be explored further with the aim of moving towards the objective of identifying improvements to zebra crossings, primarily with regard to increasing perceptions of safety for users most at risk

The next steps to meet this objective would include:

1. Explore the findings of the online questionnaire in more detail with regard to how people with disabilities perceive and experience zebra crossings

2. Investigate further the views of those groups who may not have had equal access to the online questionnaire, primarily older people, deaf people and those with hearing loss

3. Explore how people with disabilities consider that zebra crossings may be improved using their own suggestions together with those identified in the literature review and those put forward by local authority officers in this report.

These can be done by:

1. A series of focus groups, with distinct disability groups

2. A site survey at existing zebra crossings.

The focus groups and site surveys would conclude the most important issues that need to be addressed to improve zebra crossings. This will enable the options for improvement to be considered in detail.

Appendix A. Literature Review

THE UNIVERSITY of EDINBURGH

A review of pedestrian and driver experiences of Zebra crossings, with particular reference to users with disabilities

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February 2021

Executive summary

During the year 2020-2021 increasing numbers of people have been walking and cycling outdoors as a result of the restrictions created by the Coronavirus pandemic. In Scotland, there has been a commitment to promoting health and wellbeing through such activities, while making it safer for people to do so. As part of this plan, proposed changes to The Highway Code also intend to improve safety, particularly for children, older adults, disabled people, and cyclists. These proposed revisions will create a hierarchy of road users that would see drivers shoulder more of the responsibility for avoiding accidents with pedestrians or cyclists.

Pedestrians may engage in risk-taking behaviour when crossing the road, especially if crossing the road is difficult or waiting time to cross is lengthy. This risk-taking behaviour can extend to the use of Zebra crossings, predisposing pedestrians to accidents, despite the fact that they are a pedestrian right-of-way. For example, if pedestrians realise that drivers do not always observe their precedence, they may attempt hazardous crossings, with consequent safety issues. These factors may be even more important for children, older pedestrians and people with disabilities, given their greater vulnerability.
Pedestrians with hearing or visual impairment, for example, may find crossing particularly difficult if they are unable to see or hear vehicles approaching, or are unaware that they have stopped. There is therefore a need to increase our understanding of driver and pedestrian attitudes and experiences of using Zebra crossings, particularly relating to people with disabilities.

We conducted a scoping review of literature to examine the attitudes and experiences of road users in relation to Zebra crossings, and their perceived safety, with particular reference to people with disabilities. Studies were included if they related to Zebra, non-signalled, crossings. In order to obtain information relating to more recent transport and traffic circumstances, work produced or published within the last 10 years was included in the final screening (i.e. 2010-2020).

A total of 85 papers were included in the analysis. Findings were grouped into three main themes: *functional and technical adaptations*, *user behaviours*, and *issues facing pedestrians with health or mobility limitations*. Within these categories, design adjustments to Zebra crossings were noted that could improve their safety, and the visibility of pedestrians using them. These included more visible advance warning signs, improved lighting, raised crossings, and physical road adaptations such as rumble strips or speed humps to ensure vehicles reduced their speed on the approach to a crossing.

There was evidence that increased road user education may help drivers to appreciate their responsibility towards pedestrians, and help pedestrians to be more confident in asserting their right of way when using a Zebra crossing. This may include the use of agreed universal hand signalling to allow both pedestrians and drivers to understand that a pedestrian

intends to cross, and external signage on automated vehicles to improve pedestrian confidence.

With regard to pedestrians with disabilities, there is a need to improve understanding of the difficulties people may have, and incorporate design features that support people with disabilities into Zebra crossing design, such as those which reduce driver speed on the approach to crossings. These measures can enhance the quality and comfort of crossing the road for all pedestrians. Improved assistive technologies, such as crossing locators, can also help to make environments more user-friendly and walkable, thus improving independence for people with disabilities.

The review therefore identified many considerations and adaptations to Zebra crossings that can enhance their safety and usability. Improving street environments, and making neighbourhoods safer for all users, will help encourage more people to walk in their local area with subsequent benefits to health and wellbeing, beyond the immediate impact of fewer pedestrian accidents while crossing the road.

Introduction

In Scotland, there has been a commitment to promoting health and wellbeing through activities such as walking, while making it safer for people to do so within their local communities (Scottish Government, 2020). As part of this plan, proposed changes to The Highway Code also intend to improve safety, particularly for children, older adults, disabled people, and cyclists (Dept. for Transport (DfT), 2020).

Crossing the road is one situation where pedestrians may be at particular risk (DfT, 2018). Zebra style crossings were introduced in the UK by the Road Traffic Act of 1934 in order to provide designated crossing points, and facilitate road safety (UK Government, 1943). Following a few isolated initial experiments, Zebra crossings were established nationally in the 1950s. In the UK, these crossings are non-signalised, and drivers are legally required to stop (Anciaes et al, 2020); they are characterised by longitudinal stripes on the road, parallel to the flow of the traffic, with an alternate light and dark colour. UK Zebra crossings are also marked with flashing amber beacons on black and white posts on each side of the road.

Despite guidance to make Zebra crossing positioning and use as safe as possible, pedestrians may still be at risk of injury when crossing the road at such sites. Available statistics show nine UK fatalities and 1090 injuries (of all severities) over the year 2017-2018 (DfT, 2018). In contrast, crossings under human control (e.g. with a school traffic warden) show four fatalities and 239 injuries in the UK during the same period of time (DfT, 2018).

It is not clear from these figures what factors, if any, influenced these accidents. It is known that pedestrians may engage in risk-taking behaviour when crossing the road (Hashemiparast et al, 2020; Narváez et al, 2019), and that this risk-taking behaviour can extend to the use of Zebra crossings, despite the fact that they are a pedestrian right-of-way (Ojo et al, 2019). However, if pedestrians realise that drivers do not always observe their precedence, they may attempt hazardous crossings, with consequent risk (Pecchini & Giuliani, 2015). These factors may be even more important for disabled people, given their greater vulnerability (Pecchini & Giuliani, 2015).

Zebra crossings form part of the ‘street-connectivity’ deemed so important for encouraging physical activity in local neighbourhoods, as detailed in the review of reviews by Bonnaccorsi et al (2020); whilst this meta-review did not focus specifically on road crossings, it nevertheless emphasised the need for user friendly streets and ‘walkability’.
Items considered to improve neighbourhood walkability include: sidewalks, Zebra-striped crosswalks, decorative sidewalks, pedestrian signals, and dividing walls (Jensen, 2013).

In order to investigate walkability and pedestrian road crossing safety further, there is a need to increase our understanding of driver and pedestrian attitudes to, and experiences of, Zebra crossings. Pedestrians with disabilities, such as hearing or visual restrictions, may find crossing particularly difficult, especially if unable to see or hear approaching vehicles

clearly (Frazila & Zukhruf, 2018). This may be of particular relevance given the increasing number of electric or hybrid vehicles, which produce less engine noise.
We therefore aimed to conduct a review of literature to examine the attitudes and experiences of drivers and pedestrians using Zebra crossings, and their perceived safety, with particular reference to people with disabilities. In other countries, such as the United States, Zebra crossings may be controlled by traffic signals. However, this review focused specifically on uncontrolled or non-signalled Zebra crossings, due to the unique nature of the decisions and choices open to pedestrians and drivers at such settings.

Methods

Review category

In order to capture a broad range of evidence from a number of perspectives, a scoping review was carried out, using the methodological framework of Levac et al (2010), resulting in an evidence summary.

Review team

The review was carried out by researchers at the Scottish Collaboration for Public Health Research and Policy (SCPHRP), University of Edinburgh, with systematic and scoping review expertise. The review was carried out in collaboration with Jacobs, a business specialising in built environments.

Time scales/timeline

The review was conducted between October and December 2020, with the findings report being finalised during January 2021.

Key words/MeSH terms

Key words relating to Zebra crossings (e.g. marked crossings, non-signalled crossings, crosswalks, Womat crossings, Tiger crossings etc) were combined with user group terms (e.g. drivers, pedestrians, walkers, foot-travellers, etc), with particular reference to vulnerable people, such as those with disabilities (e.g. wheelchair users, those with incapacity or restricted ability, etc). Boolean strategies were used to ensure the most relevant work was accessed; for example: driver OR pedestrian OR foot-traveller OR walker OR wheelchair user AND Zebra crossing OR crosswalk OR non-signalled crossing etc.

In this report, we use a range of terminology, as described by the individual authors, to report their findings, especially in the way crossings are described.

Types of study method

Qualitative, quantitative, and grey literature/reports were open for inclusion. However, due to resource constraints we excluded dissertations and books; conference proceedings without full findings were also excluded.

Databases

Selected databases were searched, including Web of Science, Scopus, TransportXtra, ICE Virtual library (Institute of Civil Engineers), and National Transportation Library. In addition, reference lists of relevant documents were screened, and websites of key organisations searched (e.g. Dept for Transport research database; Forum of European Road Safety Research Institutes (FERSI); International Federation of Pedestrians (IFP); International Transport Forum at the OECD (Organisation for Economic Co-operation and Development)) to ensure a wide range of relevant literature, including 'grey' or unpublished reports, was accessed.

Inclusion dates

Initial searches focussed on the period from 1980 onwards. However, due to the large volume of potentially relevant information (> 1800 papers), and in order to obtain information relating to more recent transport and traffic circumstances, work produced or published within the last 10 years was included in the final screening (i.e. 2010-2020).

Geographical perimeters

In order to obtain an international perspective, papers and reports from a broad range of developed countries were included. We excluded data from developing countries, with emerging road and pedestrian systems, due to their limited relevance to UK systems.

Inclusion/exclusion criteria

Inclusion and exclusion criteria are summarised in Table 1 below.

Table 1: Summary of review inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Zebra or uncontrolled road crossings • User attitudes/experiences of Zebra or non-signalled crossings (e.g. pedestrians, drivers) • Experiences of people with disabilities • All types/methods of research or publication, including grey literature, apart from dissertations, books, or publications without findings • Outcomes relating to user experiences, attitudes, perceived safety, barriers or facilitators to crossing use	• Controlled or signalled crossings • Railway, or other crossings, that do not involve roads • Dissertations/theses/books (due to typical length, and resource limitations) • Publications or reports where an English language translation was not available • Publications not available through open access or via standard library access • Studies with data from under-developed road and pedestrian systems • Protocols/publications/conference proceedings without full findings

Screening and selection methods

Following the identification and removal of duplicates, titles and abstracts of identified papers were screened using the broad inclusion criteria of Zebra crossings and their users. All papers that appeared to fulfil these initial criteria proceeded to full-paper screening using the specific inclusion/exclusion criteria noted above. Three reviewers (JP, KT, TH) screened papers independently using Covidence™ software, with included papers being agreed by any two reviewers, and conflicts being decided on by a third reviewer.
A flow diagram (PRISMA diagram) detailing and summarising the selection process and giving numbers of inclusions and exclusions at each stage (and exclusion reasons) is presented in Appendix 1.

Data extraction and assessment

Data from individual studies or reports were extracted, summarised, and tabulated in order to present information from the broad range of studies in the most succinct manner (see further details in the findings section).

Analysis methods

A thematic analysis of all included data and evidence was conducted using a mind mapping approach (Buzan, 1974) to plot associations and links between individual findings. In particular, the included studies and reports were examined to identify any factors relating to the use of Zebra crossings by vulnerable people, such as barriers or facilitators that might either help or hinder usage.

Definitions

For clarity, the following definitions describe terms used in the included literature, with references indicating the source of the definition:

Traffic Conflict is defined as an event between traffic participants, in which an evasive manoeuver needs to be taken by one of them to avoid a collision (Parker & Zegeer, 1989).
Jaywalking is a term used to describe the action of crossing a road with no regard to pedestrian traffic regulations (Thompson, 2014).
Traffic Interaction is defined as situations in which the traffic participants adapt their behaviours according to one another (Cloutier et al, 2017), as well as interpreting the environmental context, surrounding traffic, and responses to one's own behaviour (Lehsing & Feldstein, 2017).
Pedestrian Gap Acceptance refers to the time or space gap between vehicle and pedestrian, and can be determined based on the speed of oncoming vehicles, as well as distance from the pedestrian crossing (Nor et al, 2017).
Time-To-Collision is the time between approaching road users and the potential collision point, and can be used to describe the severity of conflict events (Kaparias et al, 2013).
Time-To-Arrival can be used to evaluate the time gap between approaching vehicles and a position/person/or specific place (Tresilian, 1995).
Yielding behaviour refers to drivers stopping to give way to pedestrians (Anciaes et al, 2020).
e-police refers to the use of enforcement cameras at crossings or junctions (Malenje et al, 2019).

Findings

Following all screening procedures 85 studies were found that fulfilled the inclusion criteria, and had been published since 2010. See Appendix 1 for a summary of the search and screening process, and the tabulation of included studies in Appendix 2. Full citations for all included studies are provided below the main reference list.

Studies came from a wide range of 22 countries, indicating international interest in the topic. The largest number of studies were conducted in the USA (n=19), Italy (n=15), and China (n=12). There were four UK based studies. The tabulation of studies in Appendix 2 contains details of the country where each study was conducted, the focus of their research, and their findings.

Using the mapping approach detailed above, three main areas of interest emerged: *functional and technical adaptations*, *user behaviours*, and *issues facing pedestrians with health or mobility limitations*. These topics are discussed further below.

Due to multiple topics being covered within some individual papers, they may be cited in more than one section.

Functional and technical adaptations

The functional adaptations detailed in individual studies largely related to improved Zebra crossing safety, mainly for pedestrians, but also for drivers. Factors that increased visibility, either of/for approaching vehicles, or of pedestrians waiting to cross, included improved road lighting, greater use of road signage (static/fixed or variable), pavement markings or lighting, and technological pedestrian identification systems.

Although the focus of this review was on Zebra crossings uncontrolled by traffic lights, there was some evidence that other types of alert system could increase safety: drivers were shown to slow down and yield more frequently in the presence of e-police (Malenge et al, 2019), stereo or 3D effect Zebra markings (Bian et al, 2020; Burlov & Gomazou, 2018), or rapid-flashing warning beacons (Al-Kaisy et al, 2018); overhead warning signs or flashing lights were also shown to significantly increase driver awareness (Olszewski et al, 2020; Olszewski et al, 2015; Lacoste et al, 2014), and in conjunction with raised refuges and speed limits could result in high driver yielding rates (up to 96%, according to Lacoste et al, 2014). Advanced yielding markers for drivers approaching crossings, including a line with white triangles 20-50 feet before the crossing, and a sign for drivers to yield, resulted in drivers being more likely to look for pedestrians obscured by vehicles near the crosswalk (Samuel et al, 2013). Indeed, the results show that a stop sign controlled crosswalk can better protect pedestrians compared to a crossing location with neither sign nor pavement treatment (Fu et al, 2018).

A combination of median refuge islands and ‘‘yield here to pedestrians” flashing vertical signs on pedestrian crossings was found to have a positive effect on driver visual attention, and reduced driving speed (Vignali et al, 2019); Zebra markings and median refuge islands were found to be the most glanced-at elements by drivers within the road environment, seen by 93.75% and 56.25% respectively (Vignali et al, 2020).
In further relation to refuge islands was the concept of reduced crossing length, to avoid pedestrians having to cross several lanes of traffic once they had started to cross (Zhao et al, 2019; Budzynski et al, 2017). Indeed, the far lanes of multi-lane crossings recorded a higher percentage of serious conflicts than the near lanes (Zhang et al, 2018; Almodfer et al, 2016). In addition to reduced crossing length, curb extensions were effective at reducing driver speed when approaching a zebra crossing, and resulted in the lowest number of instances in which a driver did not yield for pedestrians (Bella & Silvestri, 2015).

Regarding effects on accident likelihood, pedestrian warning beacons led to the largest reduction of pedestrian crash risk (55% reduction), followed by rectangular rapid flashing beacons (47% reduction), refuge islands (32% decrease), and advance yielding signs (25% reduction) (Zegeer et al, 2017). Road narrowing at crossings and refuge islands were

successful in helping pedestrians cross safely, because both the length of the pedestrian route was shorter and speed of cars slower (Kovács, 2013). Measures not shown to be effective were zigzag lines on the approach to a crossing, which were not well understood by many road users (Mutabazi et al, 2010).

During night driving conditions, an integrated lighting and warning system, with both orange flashing beacons and flashing in-curb LED lighting, was shown to be highly effective in increasing yielding compliance to pedestrians (Costa et al, 2020), as was LED night time illumination of crossings (Patella et al, 2020). In addition, Horne et al (2020) investigated the potential for rumble strips to provide sound and vibration alerts to the driver, and found a sinusoidal design performed better than rounded rumble strips. Further research examining the benefits of installing rumble strips along roads to reduce collisions concluded that rumble strips were 'one of the highest benefit-to-cost roadside safety treatments' (Erginbas et al, 2019:2).

With regard to other road engineering treatments, the most effective treatment (i.e. maximum speed reduction and improved safety) was found to be a raised pedestrian crossing with associated speed humps in studies by Branzi et al (2018) and Gitelman et al (2017), with drivers being better able to see pedestrians in advance. A benefits-costs evaluation demonstrated modest speed reductions which could lessen the probability of pedestrian fatality (Branzi, 2018). Also in relation to the improved visibility of pedestrians at crossings, was the need to avoid parked cars in the vicinity (Liu & Wang, 2013; Yannis et al, 2013), although there was limited emphasis of this issue within the review studies.

According to Bak & Kiec (2012) decisions on the type of pedestrian crossing to be installed (with or without a signal or refuge island) should be made after the pedestrian level of service has been considered, since the type of crossing has little impact on the progression of traffic, and thus traffic flow should not be decisive factor when implementing a crossing.

With regard to other technology, Bella et al (2017) investigated Advanced Driving Assistance Systems (ADAS) for pedestrian detection, which provide a visual-audio message to drivers as they approach crossings. This had a positive effect, especially on more aggressive/faster drivers, resulting in less abrupt braking that began further in advance, compared to that adopted in the ADAS absence condition (Bella et al, 2017).

Several papers examined automated vehicle (AV) technology; for example an automated vehicle interaction principle (AVIP), which communicated vehicles' intent to pedestrians, was studied by Habibovic et al (2018). There was some agreement that such functional adaptations to AVs, to provide a means of replacing information normally obtained from drivers via non-verbal cues, were helpful in places such as at pedestrian crossings (Jayaraman et al, 2019; Habibovic et al, 2018). These functional adaptations are discussed further below, in relation to user behaviours.

Concerning the technicalities of the placement of crossings, while pedestrians may look favourably on frequently spaced crossings (Kruszyna, 2013), inter-crosswalk spacing of less than 25-50 meters does not appear to add any benefit, according to Knoop & Daganzo (2018). Presti et al (2011) also highlighted the need for more rational positioning of crossings. Certainly, compared to a "cross anywhere" scenario, the addition of crosswalks was found to be beneficial for reducing crossing times because pedestrians may have a tendency to speed up on formal crossings (Knoop & Daganzo, 2018).

User behaviours

The attitudes of drivers formed a major part of the findings, as did the concerns of pedestrians. As might be expected, driver and pedestrian risk taking was felt to impact negatively on safety, whereas increased awareness of legislation, and enforcement programmes had a beneficial effect. For example, programmes that emphasised pedestrians' right of way on crossings resulted in a steady increase in the yielding behaviour of drivers (Van Houten et al, 2013), as did enforcement cameras (or e-police) (Malenje et al, 2019). At crosswalks where drivers were forced to proceed slower, a pronounced tendency to comply with pedestrian right-of-way was noted.

An overall reduction in vehicle speed may enhance quality and comfort of pedestrians, and was shown to be beneficial in a number of studies (e.g. Sucha et al, 2017; Pecchini & Giuliani, 2015; Schroeder et al, 2011). A Zebra crossing was found to encourage more pedestrians to use the facility as a crossing point (Havard & Willis, 2012), as well as improving perceptions of crossing. However, factors that prevented pedestrians taking the direct (and safest) route across a Zebra crossing were noted as: trying to cross quickly, avoiding collision with other groups of pedestrians, and avoiding traffic that might have failed to stop (Jamil et al, 2015). In such situations, pedestrians may be more likely to walk outside the crossing area or jaywalk. In addition, when pedestrian waiting time was too long, pedestrians were more liable to cross in risky situations (Almodfer et al, 2016; Kovács, 2013).

With regard to cyclists, and their perceptions of Zebra crossings, there was some reference to bus stop bypasses within two studies in the included literature (Greenshields and Davidson, 2018; Greenshields et al, 2018). A bus stop bypass is routed behind a bus stop to allow cyclists to avoid overtaking stopped buses, and thereby increase safety. However, as a result, the paths of cyclists and the paths of pedestrians entering or leaving buses are more likely to cross. The introduction of Zebra crossings over the cycle track at such locations was found to increase awareness that pedestrians have priority to cross, as well as increasing the likelihood of pedestrians using the designated crossing. In addition, pedestrians felt safer, and cyclists were more likely to slow down and be vigilant to the presence of pedestrians (Greenshields and Davidson, 2018). The Zebra crossings did not affect cyclist speed, but higher levels of pedestrian-cyclist interactions were influenced by pedestrian

inattentiveness, features that constrained pedestrian/cyclist movements, and reduced visibility (Greenshields et al, 2018).

An increased emphasis on legislation and enforcement was shown to be beneficial, especially when considering the attitude of some drivers as dominant road users. For example, Swan et al (2014) used the phrase 'rock star syndrome' to describe the type of driver who expects to drive right up to, and park immediately in front of, their destination. At the other end of the scale, designated crossing points were considered to be less stressful for drivers than a 'cross anywhere' system that championed pedestrians' right of way, due to the need for targeted rather than constant driver vigilance required by the latter (Daganzo et al, 2017). Installing a Zebra crossing was shown to significantly enhance the road-crossing experience of pedestrians and therefore improve their walking journey more broadly (Havard & Willis, 2012).

The need for drivers to be aware of their reaction time, as well as the braking period and ability of their individual vehicle to decelerate was noted in the study by Fu et al (2017). Distracted drivers (e.g. by mobile phone conversations) were found to be more inclined to brake more abruptly when approaching a crossing than non-distracted drivers (Haque & Washington, 2015); braking was also observed to be more aggressive for drivers with provisional licenses compared to drivers with a full license in this same study. Such factors may lead to uncertainty about crossing use for pedestrians (Zhang et al, 2020). That said, drivers were found to be better able to predict pedestrian behaviour at Zebra crossings than if they crossed elsewhere (e.g. jaywalking: Bella & Nobili, 2020), and may also be more liable to yield to pedestrians if they are on a legal crossing; the yield rate was found to be about 80%, compared to a decision not to yield when facing a jaywalker in almost 50% of interactions (Bella and Nobli, 2020). Drivers were also more inclined to yield to assertive pedestrians who, for example, walked briskly when approaching a crosswalk (Shaon et al, 2018; Schroeder et al, 2011). Pedestrians were shown to assign priority to vehicles if drivers had no deceleration intention or even increased speed (Wang et al, 2016); pedestrians therefore need to make their crossing intention clear to the driver, so they can cross effectively, according to Wang et al (2016).

With regard to vehicle type, Klatt et al (2016) reported that pedestrians started to cross later at a Zebra crossing when a friendly-looking low-power car was approaching, compared to a dominant-looking high-power car. However, this was only the case if the cars were relatively large in size. Paradoxically, the speed of smaller cars was estimated to be higher compared to large cars (size-speed bias). This study by Klatt et al (2016) is one of the only studies to examine car design and their elicited behavioural-level responses.

In addition to issues relating to car design, were responses to automated vehicles. Automated vehicle (AV) intention signalling to pedestrians was shown to increase pedestrian feelings of safety when using a crossing in front of an AV (Habibovic et al, 2018). This may be necessary, given that pedestrians who recognized an approaching car as an AV

reported a lower intention to cross in front of such a vehicle (Velasco et al, 2019). Not all pedestrians responded in the same way when interacting with AVs: those with higher knowledge about AV technology tended to trust the capability of the vehicle to detect them and were more likely to base their behaviour on a communication signal displayed on the exterior of the vehicle (Razmi Rad et al, 2020). However, results from the study by Moore et al (2019) found that such external communication signals were not always necessary or helpful. This may conflict with data that found that in >90% of cases pedestrians gaze at drivers of approaching cars prior to crossing on non-signalized crosswalks, in order to gain insight into their intent (Rasouli et al, 2017).

It was of concern that within the included studies racial discrimination could be seen as evident in the reduced yielding behaviour of some drivers towards certain ethnic groups (Schneider et al, 2018; Kahn et al, 2017; Goddard et al, 2015). These studies showed that black men were the least likely to be yielded to, whereas white women were the most likely to be yielded to. This was further evidenced by the fact that racial minorities were shown to be disproportionately represented in traffic fatalities (Goddard et al, 2015), and that black participants felt that other pedestrians treated them differently based on their race, and infringed on their space on crosswalks (Kahn et al, 2017). Gender bias in relation to yielding behaviour was also reported in research from the Gulf States (Muley et al, 2019). In addition, differences in gender responses to traffic were noted in the study by Tom & Granie (2011); these differences were found to be linked to different motivations to comply with temporal rules and social factors influencing women's behaviour at crossings.

With regard to the effect of physical pedestrian prompts on motorist yielding behaviour, such as a raised hand or extended arm, these were investigated by Emerson et al (2015), Zhuang & Wu (2014), and Crowley-Koch et al (2011). All studies found that when pedestrians used a manual signal in such a way, motorists were more likely to slow down and yield. However, it should be borne in mind that these gestures may not be feasible for people with health or mobility limitations, as will be discussed in the next section.

Issues facing pedestrians with health or mobility limitations

A number of included studies examined crossing issues from the perspective of people with disabilities (n=12), or being older and less able (n=4). Physical accessibility of crossings, crossing speed, recognition of crossings, and awareness of the presence of cars for people with disabilities were all examined, as detailed below.

The ability to transverse a crossing in a timely manner may be particularly relevant for older pedestrians and those with physical limitations (Forde & Daniel, 2017; Zhao et al, 2016; Goh et al, 2012). According to Pecchini & Giuliani (2015) design recommendations to facilitate crossing for people with disabilities are largely focused on technical aspects such as pedestrian walking speed and visibility problems. Other concerns, such as crossing apprehension, are usually neglected but may nevertheless lessen the autonomy and security

of pedestrians with disabilities. Pecchini & Giuliani (2015) noted that at crossings where drivers were forced to proceed at slower speeds (by speed limit signage, or physical speed humps, for example) a greater tendency to comply with pedestrian right-of-way was observed, which provided enhanced security for pedestrians with disabilities. The study by Pecchini & Giuliani (2015) was the only one to stress the difficulties faced by people who use wheelchairs, noting that street-crossing was particularly arduous, and their waiting times were the highest of all their study participants.

General age-related impairments were investigated by a number of studies (e.g. Al Bargi et al, 2020; Gorrini et al, 2018; Gorrini et al, 2016; Alverini et al, 2012). Results showed a significant difference in the crossing behaviour of elderly pedestrians compared with younger pedestrians (Gorrini et al, 2018; Gorrini et al, 2016). Difficulties were mainly related to crossing speed and head pitches - the proportion of time pedestrians point their heads down (rather than towards the traffic) when crossing a road, with associated potential lack of attention to traffic (Alverini et al, 2012). In addition, was the possible effect of fear of falling among older pedestrians, which was found to be associated with slow walking, less attention to traffic and more attention to the pavement and their footsteps (Alverini et al, 2012).
However, it is worth mentioning that it was not only older and pedestrians with disabilities who had concerns about crossing the road; children were also reported to often feel overwhelmed because of the difficulty of judging when and how to cross the street (Li et al, 2013), and lacked sufficient left/right scanning of oncoming traffic on zebra crossings (Jiang et al, 2020).

In a situation where a former Zebra crossing was removed, vulnerable pedestrians were shown to choose different crossing strategies: for example, waiting for a driver to give way to them rather than waiting for a safe gap to pass, and requiring a much more cooperative approach from drivers than other pedestrians (Sucha, 2018). The greatest impact (negative) from this crossing removal was shown to be on children, the elderly, and people with disabilities.

People with specific types of disability were examined in a number of studies, and their results are reported below.

Visual impairment

For pedestrians with vision impairments the availability and recognition of Zebra crossings was particularly important, and was examined in seven of the included studies (Frazila & Zukhruf, 2018; Mascetti et al, 2016; Emerson et al, 2015; Ahmetovic et al, 2014; Hassan, 2012; Bourquin et al, 2011; Emerson et al, 2011).
The presence of road and pavement damage (e.g. potholes) was noted as potentially making their journeys increasingly difficult (Frazila & Zukhruf, 2018). However, there were advances in technology that may support visually impaired people during road crossing, thereby

potentially improving their safe outdoor independence. For example, *ZebraLocalizer*™ is a mobile application that detects Zebra crossings and guides the user to safely cross, and *ZebraRecognizer*™ is an algorithm that improves the detection of Zebra crossings (Mascetti et al, 2016; Ahmetovic et al, 2014). Experimental evaluation, conducted in different illumination conditions (sun, rain and night) showed that ZebraRecognizer had zero false positives, and hence did not erroneously report a crossing for a pedestrian with vision impairment, according to the authors (Ahmetovic et al, 2014).
With regard to more traditional aids to mobility for people with vision impairment, results indicated the presence of a white cane led to significantly greater yielding by drivers, although there was shown to be a slight tendency for drivers to be less likely to yield at later times in the day (Bourquin et al, 2011). In contrast, other measures such as wearing an orange vest or waving a red flag had little or no effect, other than perhaps raising false expectations of safety (Bourquin et al, 2011). In other research involving visually impaired pedestrians, holding a cane resulted in a 60% increase in driver yielding, while holding up a hand resulted in a 60-80% increase; taking a step onto the roadway showed the largest increase: 80-100%, whereas a head turn or gaze proved to decrease yielding rates in some cases (Emerson et al, 2015).

Participants with visual impairments had particular difficulty detecting hybrid cars which were approaching crossings (Emerson et al, 2011); this resulted in crossing decisions more often taking place when there were only small gaps, with inherent greater risk. These effects were especially evident at speeds below 20 mph (when hybrid engines may be more difficult to hear), and the authors concluded that further research is needed to yield insight into hybrid cars and their impact on people with visual impairment (Emerson et al, 2011). Hassan (2012) reported that people with total sight loss might benefit from training to improve their ability to detect and interpret vehicular gap times, since they were found to be the least accurate (compared to people with normal and partial vision), due to having to rely on hearing only to detect cars approaching crossings.

Hearing impairment

While many older pedestrians may have hearing difficulties, none of the included studies reported on this specifically. However, in the study by Pecchini & Giulliani (2015) individuals with hearing impairments were shown to display 'unexpected versatility' at navigating their way through an urban environment, and were considered to fare better than pedestrians with other disabilities. The review did not find any studies that reported on findings from people with both hearing and visual impairment (e.g. deaf-blind).

People with intellectual/cognitive disability or autism spectrum disorder

Within the included studies, four examined issues facing people with intellectual or cognitive disability, or autism spectrum disorders (Earl et al, 2019 & 2018; Cowan et al, 2018; Brorsson et al, 2016)

The studies by Earl et al (2019, 2018) investigated the development of shared zones, from the perspective of people with intellectual disability, where there is an absence of traditional markers that segregate the road and footpath. Negotiation of a shared zone relies on an individual's ability to perceive, assess, and respond to environmental cues, which may be a concern for some users with intellectual disability. In particular, Earl et al (2018) considered a shared zone which included multiple Zebra crossings; they recommended that the implementation of shared zones should not be made unless they offer pedestrians what they perceive to be a safe urban environment, and they do not create perceived barriers to community participation, particularly for those with disabilities.

Also with regard to shared zones, Cowan et al (2018) investigated the fixation patterns of those with and without Autism Spectrum Disorder (ASD), and how this might influence their approach to shared zones and Zebra crossings. Whilst the key aim of the paper was to investigate the interactions of those with ASD in shared zones, the results also indicated that those with ASD did not make eye contact with drivers at Zebra crossings. This is backed up by the diagnostic criteria for ASD, which includes a deficit in social interaction and non-verbal communication. However, Cowan et al (2018) found that pedestrians in general were more likely to look at traffic relevant objects at Zebra crossings, than they were in shared zones. This appears to indicate a greater awareness of the traffic environment at a Zebra crossing, and could result in safer road crossing behaviours, in comparison to shared zones without designated crossings.

With regard to community dwelling people with cognitive disability, such as dementia, only one study referred to their use of Zebra crossings (Brorsson et al, 2016). For those participants with dementia, who also used a walking frame, this was found to contribute to problems at crossings, since the frame used up more space and could impede other pedestrians. Solutions for avoiding problematic situations with regard to traffic and crossing the road for people with dementia, included using traffic lights as reminders, following the flow of other pedestrians at a Zebra crossing, and being more generally cautious (Brorsson et al, 2016). Zebra crossings were therefore shown to be of benefit to enhancing community independence for some people with disabilities, in a variety of situations.

Discussion

This review has summarised the findings from 85 studies which examined zebra crossings from the perspective of both drivers and pedestrians, including people with disabilities. It has incorporated advances in technology that have occurred in recent years, such as the introduction of hybrid and automated vehicles, as well as assistive technological advances for people with disabilities. The review has highlighted some of the challenges facing both pedestrians and drivers/vehicles when using or approaching Zebra crossings, focussing on

those that are uncontrolled by traffic lights, and provides evidence to help improve safety, as detailed below.

Safety measures

Driver and pedestrian experiences and attitudes have helped to illustrate some of the factors that have impacted on the safety of Zebra crossing use. According to Burlo et al (2018) a conflict may exist between pedestrians who have little knowledge of traffic rules and are confident in their right to cross the road without paying sufficient attention to traffic, and drivers who only pay attention to pedestrian presence or absence, and neglect the need to reduce speed before a pedestrian crossing. In contrast, there is also evidence that some pedestrians are not confident that drivers will stop, or are unsure about who has right of way, which may impact on their crossing behaviour (Høye et al, 2019). These uncertainties may contribute to accidents that happen at or near Zebra crossings. Although pedestrian injuries at Zebra crossings can be less severe than the injuries of those who cross elsewhere (Pfortmueller et al, 2014), addressing safety issues at Zebra crossings is still of critical importance.

Within the included literature, pedestrians were shown to be at most risk when crossing distances were too lengthy, vehicles were going too fast, where there was a lack of sight distance, and at poorly lit or unlit crossings. Planners need the support of regulators to address some of these safety measures, according to Budzynski et al (2017).

Recommendations to improve safety within the examined literature included reducing roadway speeds and narrowing roadway crossing distances to increase the probability of drivers yielding to pedestrians, and lessening their route across the road (Schneider et al, 2018). Kovács (2013) suggest further research into middle island design parameters is necessary to support shorter crossing distances.

Physical adaptations aimed at reducing the speed of approaching vehicles included humps, speed cushions, elevated crossings, mid-crossing refuges, and narrow lanes (e.g. Zhao et al, 2019; Branzi et al, 2018; Budzynski et al, 2017; Gitelman et al, 2017; Sucha et al, 2017). Rumble strips were also considered one of the most effective roadside safety treatments (Erginbas et al, 2019), and further research is needed to investigate their use for Zebra crossing approaches.

Drivers may be aware of pedestrians' right of way, but need an incentive to comply, according to Malenje et al (2019). Awareness education or enforcement programmes can provide the necessary incentives: for example, driver survey responses to enforcement and awareness programmes (Van Houten et al, 2013) confirmed that elements of the program played a role in producing changes in driver behaviour. Active signage systems (such as overhead flashing lights on approach to crossings) have been shown to reduce vehicle approach speeds and have a positive impact on drivers' behaviour (e.g. Figueroa-Medina et al, 2020; Olszewski et al 2020; Olszewski et al, 2015; Lacoste et al, 2014). The effectiveness of crossing illumination has been such that the city of Rome has decided to extend

innovative lighting measures to other crosswalks across the city in order to strengthen the correlation between speed reduction and lighting levels (Patella et al, 2020). This is particularly important, given Italy's place as having one of the highest annual road traffic fatality rates in Western Europe (55 per million inhabitants, compared to 27 per million in the UK: European Transport Safety Council, 2019).

Education for road users

In addition to the measures noted above, was the impact of driver and pedestrian education. The importance of training for pedestrians and drivers, to encourage pedestrians to confidently assert their right-of-way at uncontrolled crosswalks, was emphasised as a potential means of improving their safe passage at crossings (Schneider et al, 2018). Drivers were certainly shown to increase their yielding in the presence of assertive pedestrians (e.g. Shaon et al, 2018; Schroeder et al, 2011). Driver education with regard to avoiding distractions (e.g. phone conversations), and links with the risk of failing to brake in sufficient time at crossings, appeared to be especially relevant for younger drivers (Haque & Washington, 2015). Interventions that include pedestrian and/or driver community education programs may therefore help by improving awareness. Tom & Granie (2011) suggest that there is a responsibility for pedestrians to adjust their behaviour in response to vehicular traffic, and also for drivers to adjust their behaviour towards pedestrians. Gaining awareness of the issues involved may improve understanding of how changes in behaviour can help.

Communication

With further regard to safety, was communication between driver/vehicle and pedestrians. Such interaction was considered to be an essential part of traffic negotiation, which can help to resolve ambiguous situations on the road, and thereby lessen risk (Amini et al, 2019). When pedestrians signal that they are about to cross, by raising their hand, for example, motorists were shown to be more likely to yield to them.
Direct gaze between pedestrian and driver was shown to be used by approximately 40% of road users (Amini et al, 2019). However, this may not be a strategy open to those with visual impairments or health conditions such as ASD. In such cases hand signs may be more appropriate. It may be that physical gestures can be enhanced by combining them with other interventions such as enforcement or engineering changes, as detailed above, to raise baseline yielding levels (Crowley-Koch et al, 2011).

Also related to communication between vehicles and pedestrians, were the issues raised in the literature regarding pedestrians and AVs. While several studies have claimed the need for explicit external human-machine interfaces (eHMI) such as lights or displays to replace the lack of eye contact with, and explicit gestures from, drivers, Moore et al (2019) argue that this need is not thoroughly understood, and is potentially unnecessary. However, insight into pedestrians' crossing decisions while interacting with AVs, the communication

signals pedestrians expect to receive, and the application of current communication methods, may be crucial for successful deployment of such technologies, according to Amini et al (2019). The interfaces between AVs and pedestrians suggested in the literature (e.g. Bazilinskyy et al, 2019; Jayaraman et al, 2019; Habibovic et al, 2018) provide AV intent information that can reduce uncertainty and promote trust in AVs. This may contribute to improved perceived safety for pedestrians, and general acceptance of AVs, although AVs interactions with pedestrians still cannot be viewed as risk free (Razmi Rad, 2020), and further research is on-going.

Within the studies it was suggested that pedestrians be trained in the use of hand gestures to indicate intent to cross, and drivers be trained to properly interpret and respond (Zhuang & Wu, 2014). However, it might be helpful if a common sign were to be agreed and developed to allow universal widespread use. Certainly attempts could be encouraged to find and implement effective speed management solutions to force drivers to slow down in the area of pedestrian crossings – places where vulnerable road users may become exposed to higher risk (Ziolkowski, 2019), as will be discussed in the next section.

Protecting vulnerable pedestrians

The included literature examined potential support for several different groups of vulnerable pedestrians. For example, emerging technologies that can assist people with limited or no vision. These advances are especially important, given previous experimental analysis that found that blind people may wait three times longer than sighted pedestrians before crossing a road, with 6% of attempts being considered actively dangerous (Guth et al, 2005); other research concluded that, in the past, blind people might not even try to find a Zebra crossing (Schroeder et al, 2007). Recent technological advances may therefore be all the more welcome.

Navigation systems to help pedestrians with visual impairment have been making significant progress in recent years (Real & Araujo, 2019). That said, other developments may be causing different problems. For example, hybrid cars, with their quieter operating systems may pose greater difficulties for people with visual impairments, who rely to a greater extent on auditory information; such issues may increase as numbers of these cars also increase, and further research will be necessary to understand and provide potential solutions to avoid escalating risk for pedestrians with visual or hearing impairment (Emerson et al, 2011).

With regard to people with cognitive impairments, such as dementia, it is important that health care professionals and caregivers take their experiences of problematic traffic situations into account when providing support (Brorsson et al, 2016). For example, emphasising how to use a Zebra crossing safely, if walking independently. Certainly within the examined literature pedestrians displayed safer road crossing behaviours at a Zebra crossing than in other scenarios, such shared zones, where safe crossing points may be

more difficult for vulnerable pedestrians to identify. According to Cowan et al (2018) further awareness education and environmental adaptations are required to make shared zones safe for all pedestrians.

In addition to people with specific disabilities, is the need to consider other vulnerable road users such as children. Results have suggested that younger school aged children may have yet to master safe crossing behaviour, and further education and training may be required (Jiang et al, 2020; Li et al, 2013). It may also be necessary to consider children when designing crossing facilities near schools, for example.

In addition to pedestrians, cycle users may be more vulnerable, especially in relation to overtaking large vehicles, such as buses. Within the included literature, Zebra crossings at bus stop bypass cycle paths were shown to improve pedestrian and cyclist safety, while not significantly slowing cyclists' progress (Greenshields and Davidson, 2018; Greenshields et al, 2018). The use of such measures, especially in built up areas, is therefore liable to assist all road users.

Accessible road crossings for pedestrians of all abilities is an important part of 'walkability' (Bonnaccorsi et al, 2020; Singh & Gupta, 2010), and is consistent with Scotland's Accessible Travel Framework (Scottish Government, 2019), and Roads for All guidance (Scottish Government, 2013).

Conclusions

Measures to mitigate the risks to pedestrians, increase driver awareness, and increase the road safety behaviour of both at Zebra crossings, have been detailed within the studies. These measures included:

Physical features and technology

- Improved signage, lighting and markings
- Raised crossings or raised approaches to crossings
- Shorter crossings (e.g. through curb extensions), and crossings which do not transvers multiple lanes
- Use of rumble strips on road crossing approaches
- Design of shared zones, with marked crossings that take account of users with disabilities
- Measures to assist people with visual or hearing disabilities; for example Zebra crossing recognition technology, technology to assist with the recognition of quieter hybrid vehicles
- Automated vehicle communication systems
- Zebra crossings across bus bypass cycle lanes

Regulation

- Lower speed limits on approaches to crossings, augmented by physical speed reducing measures, such as rumble strips and road humps
- Measures that ensure a shorter wait time for pedestrians
- Increased use of enforcement measures such as e-police cameras

Education and awareness

- Improved driver and pedestrian awareness training
- Education to reduce potential bias and discrimination of drivers
- Agreed hand gestures to indicate intention of drivers or pedestrians may be helpful; for example universally understood hand gestures (with alternatives for those less physically able); intention signage built into automated vehicles where no driver is present
- Increased road crossing awareness and training for primary aged school children

Future work

Suggestions for future work would include using the recommendations for education and training to develop or improve awareness interventions. A more focussed approach to support for pedestrians with disabilities could include examining technological advances that are in the process of being developed (prototype stage) at design schools across Scotland, and supporting wider testing and trials.

Review limitations

As with all literature reviews, robust and systematic searching and screening can still fail to locate all relevant material. A detailed protocol, as agreed between interested parties at the start of this review, has served to mitigate such limitations.
Due to differing terminology used across studies it was not always possible to differentiate between uncontrolled Zebra crossings (or crosswalks/mid-block crossings), and those controlled by traffic signals. Additional time therefore needed to be spent reading full text papers to ascertain this.
While limited research from the UK was located, the volume of recent relevant research that was accessed did indicate that the topic is of continued interest across many countries and communities.

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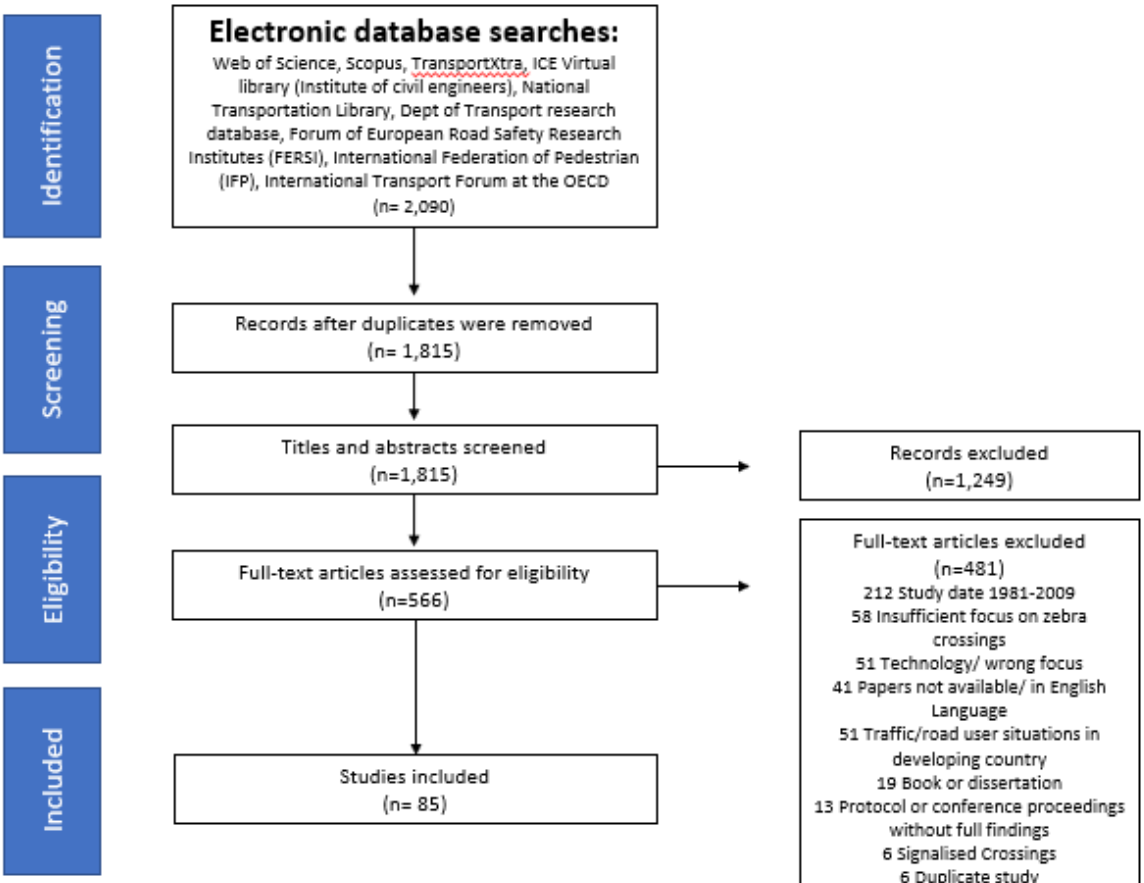
Appendix 1: PRISMA diagram



Appendix 2: Table of included studies

Lead Author Date Country	Population	Study method/ Aim or area of interest	Findings	Conclusions of authors
Ahmetovic 2014 Italy	Visually impaired pedestrians	To study the ZebraRecognizer algorithm that improves the detection of Zebra crossings for people with vision impairment. The algorithm makes use of data from cameras and accelerometers to rectify the extracted features. This enhances the process of feature aggregation and validation of candidate Zebra crossings.	ZebraRecognizer makes it possible to compute the relative distance between the user and the Zebra crossing in meters. Second, the grouping and validation criteria are much more effective, hence improving the accuracy of recognition. These improvements rectify the ground plane hence removing the projection distortion of the extracted features. ZebraRecognizer is 3 time faster than a previous solution.	Lower computation time results in a better responsiveness for the user, and lower power consumption. Higher recall ensures that more crossings are correctly recognized.
Al Bargi 2020 Malaysia	Pedestrians using pedestrian crossings	To study the utilization of Zebra crossings and work on a sustainable pedestrian Zebra crossing utilization index model taking guidance from pedestrian and Zebra characteristics. Data from observation in 9 urban streets was collected.	The results show that among the different variables, vehicle speed, pedestrian age and gender, and presence of baggage were discovered to be significant and had a direct effect on the probability of pedestrians' utilisation decision.	The results shed new light on pedestrians' decision towards Zebra crossing use. This study should improve understanding, improve pedestrians' crossing behaviours.
Al-Kaisy 2018 USA	Pedestrians and cyclists at uncontrolled mid-block crossing locations	To examine motorist's voluntary yielding behaviour to cycles at uncontrolled mid-block crossings with light emitting diode (LED) rectangular rapid flashing beacon (RRFBs) warning devices. Video data used to investigate voluntary yielding to pedestrians and cyclists on approach to crossing.	The study found that the waiting position of the crosswalk user, the presence of children and elderly, the number of pedestrians, and the peak period were all factors that impacted the yielding behaviour of drivers. Visibility of the crosswalk to motorists is very important for selection of crosswalk location.	Study recommends the use of a push button RRFB devices to be situated as close as practically possible to the roadway to allow for increased device activation and voluntary yielding by motorists.

Almodfer 2016 China	Pedestrians and drivers at crossings	To assess the lane-based distribution of the pedestrian-vehicle conflict using video data to capture the behaviours of pedestrians at an non-signalised marked crossing. To study effects of waiting times on lane-based pedestrian vehicle conflict, as well as the variability of pedestrian walking speeds under different conditions of lane-based pedestrian conflicts.	Shorter waiting times and smaller waiting areas were associated with more lane-based pedestrian-vehicle conflict. There was no relationship found between pedestrian walking speed and lane-based pedestrian-vehicle conflict. Conflicts were not distributed evenly over the four lanes: the far lanes recorded a higher percentage of serious conflicts than the near lanes. When pedestrian waiting time went beyond 30s, pedestrians crossed in very risky situations.	Pedestrian walking speeds need further analysis to better understand influencing factors. Difficulty exploring psychological aspects from videos, means future work should explore cognitive processes of pedestrians' road crossing behaviours.
Almodfer 2017 China	Pedestrians at road crossings	To identify whether lanes and crossing stages influence pedestrian crossing speeds; to describe and model the variance in pedestrian crossing speeds; to provide knowledge regarding pedestrian running behaviour; to provide microscopic pedestrian simulation models.	A relationship between pedestrian walking speed and lanes was found, however running seemed to be independent of this factor. Pedestrians prefer to change their walking speed frequently whilst crossing. 27.27% of pedestrians ran after finishing the first stage of the crossing, and 15.53% of pedestrians ran at the first stage of the crossing. The results showed that most pedestrians prefer to run at one stage.	Findings can help develop guidelines for drivers to best predict when and where pedestrians tend to run. Experimental work in pedestrian simulation models should consider the change and distribution in speed.
Amini 2019 Germany	Cars with human drivers, and automated vehicles (AVs), and pedestrians at crossings	To understand the effectual communication techniques and factors influencing pedestrian negotiation with drivers at crossings; to assist the design of emerging technologies such as AVs and automated driving systems (ADS). Literature review.	The reviewed literature showed that road users adopt crossing strategies by considering a broad range of factors knowingly (e.g. estimation of time and distance gap) or unknowingly (e.g. influence of age or gender), while they employ different communication techniques to ease the interaction when needed. This shows the complexity of vehicle–pedestrian interactions.	Insight into pedestrians' crossing decisions while interacting with AVs, communication signals pedestrians expect to receive, and applicability of communication methods is crucial for design of AVs and successful deployment of such technologies.
Anciaes	Drivers at courtesy crossing	To investigate factors which encourage driver yielding behaviour	All courtesy crossing design elements (stripes, coloured or textured surface, narrowing, humps)	Yielding was most likely to happen under conditions

2020 UK		at courtesy crossings: Zebra crossings, crossings with non-Zebra stripes, colour or textured treatment of crossing etc. Analysis of video data of interactions between drivers and pedestrians; before and after analysis at one crossing, where stripes were introduced some years after implementation of the crossing.	significantly increased yielding. At the site of before and after stripes were introduced there were marked increases in the % of cars stopping after the introduction – 96.4% after vs 15.9% before in the first line, and 97.5% vs 24.4% in the opposite direction.	of Zebra crossings in comparison to courtesy crossing elements.
Aprilnico 2019 Indonesia	Pedestrians using Zebra crossings	To analyse the risk level of pedestrian when crossing the intersection leg (using Pedestrian Risk Index (PRI). The concept of TCT (Traffic Conflict Technique) is adopted and a designed group of pedestrians are observed while crossing the street at a Zebra crossing and without a Zebra crossing, individually and in groups.	Data extracted include time and distance to accidents, crossing directions, and speed. Results indicate that compared to the existence of Zebra crossing and crossing direction, the number of pedestrians in group significantly determines the risk level. The number of conflicts for the single pedestrian is higher compared to the group. This may be due to visibility.	Pedestrian risk probability is increased as vehicle speed increases and longitudinal distance between vehicle and crossing decreases. Zebra cross usage and crossing in a group can lead to a lower pedestrian risk.
Avineri 2012 Israel	Adult pedestrians at two sites: signalised and non-signalised crosswalks	To explore crossing speed and head pitches (proportion of time pedestrians have head down (rather than towards the traffic) when crossing) to indicate (lack of) attention to cross-traffic. To explore fear of falling (FOF) among pedestrians, associated with slow walking, less attention to traffic/more attention to pavement and footsteps. Video/field observation and survey.	Age and gender had the most significant effects on crossing speed, and FOF had a significant effect on the proportion of downward head pitches during crossing. Crossing speed was largely explained by age and gender, whereas the proportion of downward head pitches while crossing can be explained by gender and FOF (which by itself might be associated with old age).	By understanding the specific needs of vulnerable pedestrians, and their behaviour in the crossing of roads, crosswalks could be better planned and designed to improve their safety.
Bak 2012	Drivers approaching different kinds of crossings	To examine the impact of various kind of midblock crossings on road capacity. Zebra crossings, crossings with refuge median island, and	There was a strong influence of regulations and pedestrian crossing types on drivers' behaviour. Comparison of the different types of road crossing showed that Zebra crossings (the least	Legal regulation and the number of drivers yielding to pedestrians may influence road capacity,

Germany		signalised crossings were analysed. The evaluation was conducted through a simulation model built in to VISSILVI and calibrated with the results from research results on pedestrians and driver behaviour.	safe) had the smallest impact on road capacity; when pedestrian traffic volume is over 200 per hour, the type of crossing has no impact on the progression of traffic and thus should not be decisive factor when implementing a crossing.	but type of pedestrian crossing should be made after pedestrian and vehicle level of the service have been considered.
Bazilinskyy 2019 Netherlands	Pedestrians and automated vehicles	To study external human-machine interfaces (eHMIs): firstly asking respondents about clarity of 28 images, videos and patent drawings of eHMIs. Secondly a survey examined the effect of textual messages ('Walk', 'Don't walk', 'Will stop', 'Won't stop') and colour (green, red, and white) on whether pedestrians felt safe to cross in front of automotive vehicles.	Results showed that textual eHMIs were the most effective. Among non-textual eHMIs, Zebra crossings were thought to be the most clear, whereas light-based eHMIs were regarded as unclear. From the second survey, textual eHMIs were more persuasive than colour-only eHMIs. The eHMI that was received most positively was 'Yes' to Walk in Green font. This indicates that egocentric texts work best.	Textual based eHMIs work best and are regarded as the clearest, which creates a dilemma as textual-based eHMIs are associated with practical issues of liability, legibility and technical feasibility.
Bella 2015 Italy	Drivers and pedestrians at Zebra crossings	To analyse driver's behaviour when approaching a Zebra crossing relating to pedestrian-vehicle interaction and with respect to safety measures; to compare different safety measures implemented at Zebra crossings and identify the most effective (curb extension, parking restrictions, and advanced yield markings) against no treatment, using a driving simulator.	The treatment conditions were effective in reducing speed. The analysis of the variables showed that there was significant main effect for the safety measures and for pedestrian conditions (if a pedestrian was present at the crossing or not). Curb extensions were identified as the most effective safety measure that reduced drivers' speeding behaviour when approaching a Zebra crossing.	Results confirmed that 80% of respondents felt that curb extensions were effective at reducing speeding when approaching a Zebra crossing, with lowest number of instances in which a driver did not yield for pedestrians.
Bella 2017 Italy	Driver-pedestrian interactions at pedestrian crossings	To analyse drivers' behaviour while approaching pedestrian crossings under different driver–pedestrian interaction conditions; to assess the effectiveness of Advanced Driving Assistance Systems (ADASs) for	Pedestrian absence, pedestrian presence with ADAS and pedestrian presence without ADAS were examined. 369 driver speed profiles were plotted from 150m before each pedestrian crossroad. ADAS affected the driver behaviour in the interaction conditions with Time-To-Zebra	Effect of ADAS was similar for urban and suburban roads, resulting in less abrupt braking that began in advance compared to that adopted in ADAS

		pedestrian detection. Urban roads, suburban roads and rural roads used in a fixed-base driving simulator. Several driver-pedestrian interactions were implemented in addition to the pedestrian absence. The simulated ADAS provided a visual-audio message.	arrive < 4 s (TTZarr* < 4 s), which return aggressive drivers behaviours. No effect was observed for the averagely cautious (4 s < TTZarr* ≤ 6 s) and very cautious drivers (TTZarr* > 6 s).	absence condition. For rural roads, lower minimum speeds reached nearer the pedestrian crossing and an advanced safer end of braking manoeuver.
Bella 2020 Italy	Drivers approaching Zebra crossings	To study driver's behaviour and interaction with pedestrians at/outside (jaywalker) Zebra crossings. Participant vehicles were instrumented with video cameras and global positioning system (GPS). Data involved driver's speed profiles on approach to the crossing; illegal crossings; driver yielding rates/types; relationship between speed and distance of vehicle from conflict point at decision point; time left for vehicle to get to conflict point when pedestrian reaches the curb.	The main results highlighted that the average yield rate to jaywalkers was lower than that to pedestrians at permissible crossings; the average deceleration rates were higher in the case of illegal crossing and driver yielding decision point to jaywalkers was closer to the conflict point. The results showed that the driver has a greater tendency to yield to pedestrian if the latter was on the legal crossing (the yield rate was about equal to 80%), while he/she decided not to yield facing a jaywalker in almost half of the interactions.	The obtained results provide the basis for modelling interactions between pedestrians crossing at and outside of crosswalks and approaching drivers in a micro-simulation environment.
Bian 2020 China	Drivers utilising a driving simulator	To evaluate the effectiveness of new-designed crosswalk markings (NCMC) vs standard designed crosswalk markings at intersections when vehicle-pedestrian interactions occur. NCMC are 3D Zebras crossing markings. A driving simulator was used to assess effectiveness at intersections.	Average speed at NCMC was significantly lower than at standard intersections when pedestrians were present. There was no difference when pedestrians weren't present. Drivers thought conspicuity of NCMC better than standard, and can arouse drivers vigilance to risk better. The warning effect of the NCMC was better than standard. NCMC was more likely to cause drivers to be nervous. Drivers speed control awareness was better under NCMC	The 3D crossing markings had a positive effect on driver behaviour.

Bourquin 2011 USA	Pedestrians with visual impairments	To examine the influences of a white cane, wearing an orange vest, or waving a red flag, and whether these increased the likelihood of drivers yielding for pedestrians who walked toward their path in such a manner that a collision would occur if neither driver nor pedestrian stopped at an uncontrolled crossing. Data on the type of vehicle, speed, and yielding status of each vehicle was collected.	Results show the presence of a white cane led to significantly greater yielding by drivers. There may be a slight tendency for drivers to be less likely to yield at later times in the day. Wearing an orange vest or waving a flag may have little or no effect during the day, other than perhaps raising false expectations of safety.	Study did not examine conditions that influence drivers' yielding at night. Some evidence that pedestrians' conspicuity with retroreflective materials improves drivers' recognition of pedestrians at night, but simply adding a vest over clothing was not effective.
Branzi 2018 Italy	Drivers and their response to pedestrian crossing configurations	A driving simulator study designed to evaluate drivers' behaviour in response to different configurations of pedestrian crossings located on urban collector roads. Participants drove a test route while data on their reaction time and manoeuvers were collected.	Statistically significant difference shown as a function of engineering treatments: most effective treatment (max. speed reduction) was pedestrian crossing located on speed humps with sinusoidal profile and coloured surface. Drivers were better able to see pedestrians who crossed, and consequent driving manoeuvers were more effective. Benefits-costs evaluation showed a modest speed reduction which could reduce probability of pedestrian fatality.	Driving simulators offer a safe environment in which to test driver response while approaching pedestrian crossings, exploiting the important contribution that virtual reality techniques may offer while studying driver road interactions.

Brorsson 2016 Sweden	Pedestrians with dementia	Use of photo/film to identify how people with dementia would understand, interpret and act on problematic situations using Zebra crossings based on their previous experiences. Grounded theory approach. Film sequences from five Zebra crossings analysed and used as triggers for two focus group interviews. Three individual interviews also performed.	The core category, the hazard of meeting problematic traffic situations when only one layer at a time can be kept in focus, showed how a problematic situation consisted of different layers. First category: adding layers of problematic traffic situations to each other, was characterized by the informants' creation of a problematic situation as a whole. Different layers described in subcategories of street layout and Zebra crossings, weather conditions, vehicles and crowding of pedestrians. Second category: actions used to meet different layers of problematic traffic situations, was characterized by avoiding problematic situations, using traffic lights as reminders and security precautions, following the flow at the Zebra crossing, and being cautious.	As community-dwelling people with dementia are commonly pedestrians, it is important that health care professionals and caregivers take their experiences and management of problematic traffic situations into account when providing support.
Budzynski 2017 Poland	Pedestrians and drivers at crossings	Study of pedestrian and pedestrian-related driver behaviour at crosswalks. Pilot projects in areas with average levels and very high levels of pedestrian risk; measuring speed of cars 100m before crossing with no pedestrians, or pedestrian waiting to cross, or pedestrian on the crosswalk. Pedestrian behaviour assessed by measuring distance between pedestrian and road, while waiting to cross, and whether pedestrian looked at traffic before/during crossing.	Location of crossing and type of crossing can influence pedestrian and driving behaviour. Pedestrians are at most risk when crossings are too long, vehicles going too fast, lack of proper sight distance, and poorly lit or unlit crossings. Defective infrastructure was due to planners, designers, contractors and maintenance services not receiving support from regulation for pedestrian traffic. Road Traffic Law is not restrictive enough with regard to pedestrian safety. Polish design regulations allow long pedestrian crossing up to four lanes in one direction or three lanes in two directions	Pedestrian crossings should be kept at a maximum of three lanes. The pedestrian-driver relationship and their behaviours must be monitored on an on-going basis and pedestrian crossing must be assessed for safety, in order to improve pedestrian safety.

Burlov 2018 Russia	Drivers and 3D Zebra markings	To examine the use of a “3D Zebra crossing” (i.e. the use of “stereo” effect on the Zebra markings on a crossing) and its estimated effect on safety index. To calculate this, synthesis-based system control was employed.	Stereoscopic effects allow greater visibility of the crossing to drivers, regardless of the presence of a pedestrian on the crossing. This helps to reduce driver speed, and thereby increases pedestrian safety and reduces the chance of accidents.	One method of reducing the average speed of vehicles is through the construction of roads with additional elements such as 3D marking of crossings.
Costa 2020 Italy	Drivers approaching Zebra crossings at night	To assess drivers’ yielding behaviour to pedestrians at night in different crosswalk lighting: (a) baseline standard road lighting; (b) enhanced LED lighting from 70 to 120 lx; (c) flashing orange beacons on top of backlit crossing sign; (d) in-curb LED strips on the curb sides with steady light emission; (e) in-curb LED strips with flashing light emission; (d) all previous devices activated with in-curb LED strips in steady mode; (e) all previous devices activated with in-curb LED strips in flashing mode.	For every condition 100 trials were recorded with a staged pedestrian in a standardized crossing with a vehicle approaching. A significant increase for yielding compliance was recorded from standard road lighting to enhanced dedicated lighting (19–38.21%), and from enhanced dedicated lighting to the seventh condition with the flashing beacons and the flashing in-curb LED strips activated (38.21–63.56%).	Overall it is possible to conclude that the integrated lighting-warning system, in the modality with both the orange flashing beacons and the flashing in-curb LED lighting, is highly effective in increasing yielding compliance to pedestrians during night time conditions.
Cowan 2018 Australia	Pedestrians with and without autism spectrum disorder (ASD)	To utilize eye-tracking technology to understand how pedestrians navigate a shared zone and any potential challenges for individuals with impairments. To determine fixations and fixation duration on traffic relevant objects, non-traffic relevant objects, and eye contact, in 40 individuals with and without ASD in a shared zone and a Zebra crossing. It was assumed that individuals with ASD would make less eye contact in	3287 fixations across the shared zone and Zebra crossing were analysed for areas of interest that were traffic relevant, non-traffic relevant, eye contact, and fixation duration. Individuals with ASD did not display any difference in eye contact in shared zone and Zebra crossing when compared to the controls. All pedestrians were more likely to look at traffic relevant objects at the Zebra crossing compared to the shared zone. Individuals with ASD had a shorter fixation duration compared to the control group, indicating people with ASD may either process	Shared zones have benefits for traffic movement and environmental quality, but pedestrians displayed safer road crossing behaviours at a Zebra crossing than in a shared zone; more education and environmental adaptations are required to make shared zones safe

		the shared zone compared to those without.	information quickly, or not process it for long enough.	for all pedestrians.
Crowley- Koch 2011 USA	Drivers at Zebra-style crosswalks	To examine the effects of two pedestrian prompts, a raised hand and extended arm, on motorist yielding at uncontrolled crosswalks.	The two prompts were effective at increasing yielding. When pedestrians signal that they are about to cross, motorists are more likely to yield to them. The results of these procedures might be enhanced by combining them with other interventions such as enforcement or engineering changes (e.g. signs, lights), which have also been shown to raise baseline yielding levels.	Future interventions might include adding pedestrian behaviour training to driver education courses, prompting and reinforcing children's signalling, and implementing community education programs.
Domenichini 2019 Italy	Drivers at pedestrian crossings	To use a driving simulator to assess how the psychological characteristics of drivers can impact different kinds of traffic calming measures at pedestrian crossings, using Human Factors principles. Participants drove a virtual urban route to collect data on performance at 5 different crossings (different perceptual and physical treatments). Prior to the experiment, participants undertook psychological tests that categorised them into three categories (careful, worried, at risk).	Participants responded differently to the engineering treatments. Careful drivers had the safest driving behaviour and low anxiety levels; they respected speed limits at Zebra crossings and had more homogenous driving behaviour. Worried drivers presented higher anxiety levels, and made a greater number of mistakes than careful drivers; they had lower speeds and decelerated at crossings, irrespective of the equipment. Risky drivers had lower anxiety levels than worried drivers, and committed more deliberate traffic violations. They drove at the highest speeds, exceeding speed limits in traffic calming zones.	Results from this study conclude that the driving environment (pedestrian crossings), Human Factors approach, with which traffic calming measures can be arranged, can be effective, despite different psychological sub-groups responding differently.
Earl 2018 Australia	3 groups: typically developing adults; adults with mild to moderate intellectual disability; adults with high-functioning autism	To identify and explore the viewpoints of pedestrians, with and without cognitive impairments as they pertain to shared zones, using Q method, which does not rely on participants' verbal or written communication skills. Participants could be included in the study	62 participants from the three groups completed the Q sort. Two viewpoints revealed: one was defined by "confident users" while viewpoint two was defined by users who "know what [they] are doing but drivers might not". Overall, participants in the study would not avoid shared zones. Pedestrians with intellectual disability were, however, not well represented by either	The implementation of a shared zone should be assessed on a case-by-case basis and should not be made unless they actually offer pedestrians what they perceive to be a safe urban environment

	or Asperger's Syndrome	regardless of their verbal communication ability as long as they were able to comprehend basic spoken English. The method is built on statements that constitute a Q sort pack; statements were paired with pictures, in order to enhance meaning and facilitate interpretation.	viewpoint, suggesting that shared zones may pose a potential barrier to participation for this group. A number of concerns regarding driver behaviour were exposed through viewpoint two, namely obeying the rules and stopping for pedestrians.	accessible for all, so as not to deter foot traffic and create a potential perceived barrier to community participation.
Earl 2019 Australia	Adults with intellectual disability (ID), and controls without	To investigate the visual strategies of adults with ID and controls who wore head mounted eye trackers in a Shared Zone and at a Zebra crossing (as a contrast traffic environment). 4750 valid fixations were analysed.	Participants with ID fixated on traffic relevant objects at a rate of 68 percent of the control participants. Males with ID were 9 (4.4–18.7) times more likely to fixate on non-traffic relevant objects compared with traffic relevant objects, much higher odds than that of females with ID 1.8 (0.4–1.7). Zebra crossings drew pedestrians' visual attention to the traffic environment, with both groups more likely to look at traffic relevant objects on/at the Zebra crossing (66%: 34%).	Future implementation of shared zones needs to be carefully considered in relation to the safety of road users with ID and their capacity to identify and assess salient environmental information.
Emerson 2011 USA	Pedestrians with visual impairments crossing the road	To analyse the crossing decisions of pedestrians with visual impairments at uncontrolled crossings and a light controlled intersection. Focus on hybrid cars, which may impact on these pedestrians' ability to detect them.	At uncontrolled crossings, participants struggled the most to detect hybrids cars, and crossing decisions more often took place in small gaps. These effects were only seen when speeds were below 20 mph. Parallel surges of traffic at light controlled intersections were the most difficult to detect when consisting of only one type of hybrid.	The results suggest that there is a need for more controlled studies of vehicle characteristics effecting the crossing decisions of pedestrians with visual impairment.
Emerson 2015 USA	Blind pedestrians at uncontrolled and signalised crossings	To study the impact of common pedestrian behaviours (head turning, holding a cane, taking a step, holding out their hand, exaggerated cane movements, and standing without a cane) on the yielding rates of drivers.	Yielding rates were increased as follows: Holding a cane (60% increase), holding up a hand (between 60 to 80% increase), and taking a step onto the roadway (80 to 100% increase). In some cases, a head turn or gaze proved to decrease yielding rates.	Practical implications for Orientation and Mobility instruction: visually impaired pedestrians do not need to be concerned about head movement or gaze impacting drivers

				yielding behaviour.
Forde 2017 USA	Pedestrians in all age groups at pedestrian crossings	To examine measured free-flow pedestrian walking speeds on un-signalized midblock crosswalks by age group.	Teen and middle age pedestrians walk at approximately the same speeds. Young adults walk fastest when crossing at crosswalks on urban street segments. Elderly or physically disabled pedestrians walk slowest. About 85% of all pedestrians walk at speeds greater than 1.24 m/s.	Results have implications for those less able to cross at speed
Frazila 2018 Indonesia	Blind pedestrians	To explore physical attributes of walkability environment and provide friendly pedestrian facilities for blind pedestrians. The research is based on the blind walker perspectives within the micro-level analysis that incorporates a smaller unit of measurement (i.e. the street-level physical attributes).	Results show the importance of providing several physical indicators to allow smooth flow for the blind walker: sufficient effective width, the existence of tactile pavement in good condition, the existence of Zebra crossing equipped by warning tactile indicators, and sidewalk pavements without potholes.	Results show that the blind walker has specific physical attributes, which need to be carefully handled in pedestrian facilities planning.
Fu 2018 Canada	Pedestrians at non-signalized crosswalks	To evaluate pedestrian safety and yielding of drivers. Distance required for yielding depends on vehicle speed, reaction time of driver and deceleration rate vehicle can achieve. Three types of non-signalized crossings: a painted crosswalk, an unprotected crosswalk (a crossing location with neither sign nor pavement treatment), and a crosswalk controlled by stop signs.	Results show the stop sign controlled crosswalk can better protect the pedestrians compared to the other two crosswalks in terms of driver compliance, overall yielding rates and crossing decisions the pedestrians make. The unprotected crosswalk performs inadequately for pedestrian safety as the yielding compliance is very low and the safety level, as measured by the vehicle yielding behaviour, is the lowest.	Results from the case study suggest that the proposed framework works well in describing pedestrian-vehicle interactions which helps in evaluating pedestrian safety at non-signalized crosswalk locations.
Gitelman 2017	Pedestrians and drivers using raised pedestrian crosswalks	To compare road use behaviours before/after installation of raised crosswalks (trapezoidal speed hump on crosswalk area). Study involved 8 sites and 16 crosswalks, with 15 cm	After the installation of the raised crosswalks a substantial decrease in traffic speeds when approaching the crosswalks was observed at most sites. At some crosswalks, drivers were more likely to yield to pedestrians, there were	Change in road user behaviours after installation of raised crosswalks was positive with improvement in

Israel		high trapezoidal hump combined with 8-10 cm circular humps, or 12 cm trapezoidal hump with 6-8 cm circular humps. Data included free-flow speed measurements and video-recordings.	fewer pedestrian-vehicle conflicts, and a bigger share of pedestrians crossing within the boundary. However, pedestrians' ability to keep to safe crossing behaviours was mixed.	safety. Raised crosswalks with preceding speed humps appear to be an effective way to promote pedestrian safety on busy urban roads.
Goddard 2015 USA	Drivers behaviour towards black and white pedestrians at crossings	To examine potential for drivers' racial bias to yielding behaviour with pedestrians, which may contribute to disproportionate safety outcomes for minorities. A controlled field experiment at an unsignalized midblock marked crosswalk. Six trained male research team participants (3 White, 3 Black) simulated an individual pedestrian crossing; trained observers catalogued the number of cars that passed and the time until a driver yielded.	Results (88 pedestrian trials, 173 driver-subjects) revealed that Black pedestrians were passed by twice as many cars and experienced wait times that were 32% longer than White pedestrians. The average of 2.02 drivers (SD = 2.39) that passed Black pedestrians without stopping was more than twice the average of .98 drivers (SD = 1.56) who passed White pedestrians without stopping. The ''time until yield'' measure varied significantly (F = 5.31, p =.024) by pedestrian race, with an average wait time for Black pedestrians (M = 9.79, SD = 5.67) that was 32% longer than for White pedestrians (M = 7.4 s, SD = 3.93).	Results support the hypothesis that minority pedestrians experience discriminatory treatment by drivers at crosswalks.
Gorrini 2016 Italy	Vehicle drivers and pedestrians at unsignalized intersection in neighbourhood with high level of elderly population	Video-recorded observation and analysis of pedestrian/vehicle interactions at an urban unsignalized intersection, characterised by a significant presence of elderly inhabitants (24% of population) and risky pedestrian-vehicle interactions, with previous evidence of high no. of elderly people involved in collisions.	Results show that both the average delay of vehicles (3.20 s/vehicle ± 2.73 sd) and the average delay of pedestrians (1.29 s/pedestrian ± .21 sd). Nearly all drivers found freedom of operation and no pedestrians crossed irregularly, with low risk-taking crossing behaviour. Crossing behaviour was based on three sequential phases (approaching, appraising, crossing), characterised by deceleration/acceleration trends. Time taken during each of these phases was significantly high for elderly adults than non-elderly.	The crossing behaviours of elderly people can be used to determine thresholds for use of traffic lights, and also there may be implications for driver-less car parameters.

Gorrini 2018 Italy	Older pedestrians	To support the extension/calibration of an existing model, a video-recorded naturalistic observation was executed in an area of Milan with a significant number of elderly inhabitants and a high number of road accidents involving pedestrians. Data analysis is focused on comparing results among two samples composed of adults and aged pedestrians.	Results included macroscopic and microscopic indicators of pedestrian-vehicle interactions at the observed non-signalized intersection, with reference to: (i) traffic volumes; (ii) Level of Service; (iii) drivers compliance to pedestrians' right of way on Zebra crossings; (iv) age-driven pedestrian crossing behaviour, focusing on motor skills (speeds and trajectories) and decision making (accepted time gap to cross). Crossing behaviour was characterized by three main phases: approaching, appraising (evaluation of the distance and speed of oncoming vehicles) and crossing.	Results showed a significant difference in the crossing behaviour of adult and elderly pedestrians. The research will support the development of a microscopic agent-based tool for simulating pedestrian-vehicle interactions at non-signalized crosswalks.
Greenshields & Davidson 2018 UK	Pedestrian and cyclists at bus stop bypass cycle tracks	A survey of pedestrian and cyclist behaviour and perception at uncontrolled crossings and Zebra crossings at cycle lane bus bypasses.	1)82% of cyclists and 73% of pedestrians recognize that pedestrians have priority at Zebra crossing over the cycle track. At uncontrolled crossing, 35% of pedestrians and 30% of cyclists thought pedestrians had priority. 2) With the Zebra crossing, 44% of pedestrians crossed the cycle track at the designated crossing whereas 36% did at the uncontrolled crossing. 3) A small increase in number of people noticing the crossing after Zebra introduced. 4) Belisha beacons had little impact on user perceptions.	Proportion of pedestrians feeling "safe" or "very safe" increased from 58% to 68 when Zebra crossings introduced. Cyclists at some sites changed the way they rode after introduction of Zebra crossing, such as slowing down and watching for pedestrians.
Greenshields 2018 UK	Pedestrian and cyclists at bus stop bypass cycle tracks	Video observation of pedestrian and cyclist behaviour and perception at uncontrolled crossings and Zebra crossings at bus stop bypass cycle tracks.	Pedestrian-cyclist interactions increased by 15% with introduction of Zebra crossing. At both types of crossings, over 90% of cyclists passed through with no pedestrian interactions. Pedestrians using a crossing increased from 39% at uncontrolled crossings to 53% at Zebra crossings. The proportion of cyclists giving way at the Zebra crossings compared to the	Zebra crossings did not affect cyclist speed. Higher level pedestrian-cyclist interactions were influenced by pedestrian inattentiveness, features that constrained pedestrian/cyclist

			uncontrolled crossings increased from 33% to 40%. About 90% of cyclists chose to use the bypass rather than the main carriageway.	movements or reduced visibility.
Habibovic 2018 Sweden	Pedestrians and automated vehicles (AVs)	Investigation of interactions between pedestrians and AVs. An external vehicle interface called automated vehicle interaction principle (AVIP) that communicated vehicles' mode and intent to pedestrians was developed. First experiment was carried out at a Zebra crossing with nine pedestrians. Second experiment involved a parking lot with a more detailed assessment of pedestrians' perceived safety with an AV, both with/without the interface.	The pedestrians stated that they felt significantly less safe when they encountered the AV without the interface, compared to the conventional vehicle and the AV with the interface. This suggests that the interface could contribute to a positive experience and improved perceived safety in pedestrian encounters with AVs – something that might be important for general acceptance of AVs.	Taking the two experiments together, it can be concluded that pedestrians may need support to experience safe interactions with AVs. They may need means to replace information obtained from drivers via non-verbal cues in low-speed situations where negotiations are needed.
Haque 2015 Australia	Young drivers (18-26yrs) and mobile phone use	To compare breaking behaviour of young drivers distracted by mobile phone conversations, or not, with focus on braking behaviour in response to a pedestrian at a Zebra crossing. Driving simulator used in three conditions: baseline (no phone conversation), hands-free, and handheld. Participants completed a questionnaire related to demographics, driving history, their use of mobile phone when driving, and general mobile phone usage.	Factors found to significantly influence the breaking task were: vehicle dynamics variables, e.g. initial speed and maximum deceleration, phone condition, licence type, history of crash involvement, and self-reported experiences of using mobile phone whilst driving. Distracted drivers more inclined to reduce their average speed quicker and more abruptly than non-distracted drivers. This excessive breaking may be a type of risk compensation. The braking was more aggressive for drivers with provisional licenses compared to drivers with full license.	A decline in the ability to detect peripheral traffic events due to being distracted have significant safety concerns that will undoubtedly persist unless mitigated.
Hassan 2012	Normal sighted, blind and visually impaired pedestrians	To determine the accuracy of participants at making decisions to cross the road using visual and/or auditory information. Participants	Normal sighted and visually impaired individuals were found to be accurate in crossing decision using the visual and auditory information together, and only visual information. The only	Data suggests that visually impaired individuals are capable of making accurate/reliable crossing

USA	crossing the road	were required to rate different vehicular gaps under 3 sensory conditions: 1) visual plus auditory information 2) visual information only 3) auditory information only. Accuracy/reliability of decision-making was measured based on the different sensory conditions.	condition where all participants were accurate was the auditory information. Blind participants were the least accurate among the 3 groups using hearing only. All participants overestimated the vehicular gap when relying solely on auditory information.	decisions. Blind individuals might benefit from training to improve their ability to detect and interpret vehicular gap times.
Havard 2012 Edinburgh UK	Pedestrians using a Zebra crossing and drivers yielding	To assess pedestrian road crossing, and driving behaviour, and perceptions of the walking environment before and after a Zebra crossing was installed. Study site assessed 14 months before Zebra crossing installed, and six weeks after. Video observation used to measure delay, walking and crossing speeds, and trajectories. Household survey for self-reported behaviours and perceptions of the crossing and wider pedestrian environment.	No effect of installing the Zebra crossing on walking speed when approaching the crossing, but significant effect on walking speed when crossing the road. Speed in both halves of road was slower (before and after central refuge) after the Zebra crossing had been installed. Survey respondents felt safer, more confident, and less vulnerable after the installation of the Zebra, indicating crossing speed may be a positive indication of how positive people feel when crossing. More cars drove past pedestrians waiting to cross before installation of the Zebra, compared to after. After Zebra installation, participants' crossing patterns became significantly more narrowly focused around the zone containing the crossing.	People much more likely to use crossing, and wait less time before crossing after Zebra had been introduced. Perceptions of crossing after Zebra introduced much more positive than before. Zebra encourages most pedestrians to use the facility as a crossing point. Younger (>18yrs) and older (<65 yrs) people tended to find road crossing most challenging.
Jamil 2015 China	Pedestrians using crosswalks	Analysis of crossing behaviour at a non-signalized marked crosswalk. Pedestrians' crossing patterns in terms of entry/ exit and turning points were explored, and the reasons for curved patterns investigated.	Results indicated that the most influential factor that resulted in curved patterns were: (a) short or fast distance (b) avoiding collision with grouping pedestrian crossing together from the same or opposite direction (c) Avoiding traffic running straight on	Our findings have potential applications in the development of a pedestrians model, and may facilitate further research into pedestrian crossing behaviour.
Jayaraman	Pedestrians using road crossings	To verify a model of pedestrians' trust in AVs based on AV* driving	Results indicate that pedestrians' trust in AVs was influenced by AV driving behaviour as well as	Using an explicit communication interface

2019 USA	with approaching AVs	behaviour and traffic signal presence, a human–subject study was carried out with participants in a virtual reality environment. The study manipulated two factors: AV driving behaviour (defensive, normal, and aggressive) and the crosswalk type (signalized and unsignalized crossing).	the presence of a signal light. In addition, the impact of the AV's driving behaviour on trust in the AV depended on the presence of a signal light. There were also strong correlations between trust in AVs and certain observable trusting behaviours such as pedestrian gaze at certain areas/objects, pedestrian distance to collision, and pedestrian jaywalking time.	is one way to provide AV intent information that can reduce uncertainty and promote AV trust. The relative influence of AV explicit interface and traffic signals on pedestrian trust could be examined further.
Jensen 2013 Denmark	Pedestrians and cyclists	To quantify pedestrian and cyclist satisfaction with roundabouts, signalized and non-signalized intersections, mid-block crossings, and pedestrian bridges and tunnels (in short: crossings). Video clips and pedestrian and cyclist satisfaction data.	Variables such as type, width and height of pedestrian and bicycle facility, length of crossing, size of roundabout, width of roadway, traffic volume, waiting time and speed limit significantly influenced the level of satisfaction.	Results provide a measure of how well urban and rural crossings accommodate pedestrian and bicycle travel, and may be used to evaluate existing, new or redesigned crossings.
Jiang 2020 China	Primary school children crossing the road	To analyse the behaviour characteristics and visual attention distribution of children in primary schools when crossing the road. Children passed through an non-signalised intersection, an non-signalised T-section and signalised intersection. Cameras and eye trackers were used.	At the different types of intersections, children had more fixation points and fixation time directed towards the area directly in front of their body. Their eyes tended to face forward and lacked a sufficient left/right scan of the incoming traffic on the Zebra crossing. The most common unsafe behaviour was not observing the traffic environment. Frequency of the left/right observations was lowest at non-signalised T-sections.	Results suggest that primary school children have yet to master safe crossing behaviour at different intersections, suggesting the need for further road safety training. Findings provide information for research and road designers.
Kahn 2017 USA	Black pedestrians using crosswalks	To investigate socio-identity factors that impact on yielding behaviour of drivers at crosswalks: 1) pedestrian's race 2) pedestrian's gender 3) type of crosswalk (e.g. unmarked intersections vs marked intersections)	The results indicate that stopping rates were very low at unmarked crossings, and a few differences emerged based on the race and gender of the pedestrian. Drivers were less likely to yield to black and male pedestrians, and in the instances that they did they were more likely to	Discrimination on basis of race and gender will decrease the safety for certain groups of people. In order to reduce this disparity, marked crossing

		4) characteristics of driver (male vs female, white vs minority). Controlled field experiment in which black, white, male and female pedestrians crossed at unmarked and marked crossings whilst coders identified driver yielding behaviour. Focus groups were conducted with black and African American participants to understand their experiences and perspectives.	stop closer to black male and female pedestrians than their white counterparts. This outcome occurred regardless of the drivers' gender and race. The findings from the focus groups suggest that black participants felt that pedestrians treated them differently based on their race, and thus infringing on their space on the crosswalk. This was found to lead to increase stress and harm on their walking trips.	should include additional markings/measures to reduce the sense that yielding is discretionary and thus increase the rate driver yielding. Stricter enforcement of drivers' yielding will help drivers stop equally for pedestrians.
Klatt 2016 Switzerland	Pedestrians at crossings	To examine whether car design influences pedestrian road crossing behaviour. A virtual reality simulator with a Zebra crossing scenario was used in order to determine 1) whether the minimum distance for crossing is larger for cars with a more dominant appearance compared to those less dominant. 2) whether speeds of dominant cars are overestimated compared to more friendly-looking cars.	Pedestrians were more likely to cross later in front of friendlier looking cars than dominant high powered cars, but only if the cars were comparatively large in size. Size-speed bias was also shown, pedestrians perceived smaller cars had a higher speed than larger cars. From the centre island, pedestrians entered the road significantly later (i.e. closer to the approaching car) and left later when starting from the pavement. The speed of the cars from the centre island seemed to be substantially lower than when on the pavement.	Car design impacts on crossing behaviours of pedestrians, who tended to cross earlier in front of larger cars. The more powerful the car, the earlier pedestrians crossed. Results cannot be explained by speed bias, as participants perceived smaller/lower powered cars to be going faster than larger high powered.
Kovács 2013 Poland	Pedestrians using a Zebra crossing	To examine influence of pedestrians and cars on crossing movements at an non-signalised Zebra crossing. Video data of gap time and speed distribution. Parameters were used in simulations which informed the findings for study.	If the gap time is too big, pedestrians become impatient and will take additional risks. The bottleneck and negative island help pedestrians cross safely, speed of crossing is shorter and speed of car is slower.	Further research is necessary for middle island design parameters. Pedestrian waiting and movement analyses will be necessary for the middle island's design.
Knoop	Pedestrians using crosswalks	To examine effect of distances between crosswalks and road traffic	Overall, the closer the crosswalks, the better the flow. Inter-crosswalk spacing of less than	Study shows effect of a homogeneous road, with

2018 Netherlands		capacity to find a single formula/universal set of charts to describe the effect of pedestrian crosswalks on traffic flow. Several distances between pedestrian crossings are simulated, and a non-constant inter-crosswalk spacing is considered.	approximately 25-50 meters does not add any benefit. Compared to a "cross anywhere" scenario, the addition of crosswalks is beneficial to reduce crossing times because pedestrians speed up on crosswalks and they cross orthogonally.	equal pedestrian crossings, and homogeneous pedestrian crossing demand. Future research should include the effect of variations of pedestrian demand, and limiting the area of pedestrian crossing.
Kruszyna 2013 Poland	University students using pedestrian crossings	To analyse the relationship between the distance between pedestrian crossings in 21 places in the city of Wroclaw and the ratings of the distance by students.	Previous studies suggest distances smaller 160m between crossings were considered to be 'good' (acceptable), and distance greater than 275m were considered to be unacceptable (which is roughly the maximum length a crossing can be in Poland). However, this study suggests that distances greater than 200m were thought to be unacceptable by students in the city, and only distances smaller than 120m were defined as acceptable.	Distances evaluated are similar to those recommended by the literature, however the students' evaluations do not often occur in reality. May be a need to create new crossings, particularly in city centre of Wroclaw, where pedestrian traffic is more important.
Lacoste 2014 Canada	Pedestrians crossing at Zebra-style crossings, and driver yielding behaviour	To evaluate and compare the safety of pedestrians at crosswalks with side-mounted passive signs (GM1 systems) and crosswalks with overhead flashing devices (OF systems) by examining driver yielding. Collision analysis, environmental scan, and field investigations on driver yielding behaviour to evaluate the safety of pedestrians at crosswalks were carried out.	Results provide evidence of a significant difference in driver yielding behaviour and ultimately pedestrian safety at crosswalks with OF systems compared to crosswalks with GM1 systems, supporting the Transportation Association of Canada Pedestrian Crossing Control Guide's (PCC Guide) recommendation that OF systems be implemented on roadways with two lanes per direction and a raised refuge.	The PCC Guide also recommends raised refuges, 60 km/h speed limits where annual daily traffic volume is greater than 12,000. The study found that the highest driving yielding rate (96 percent) occurred at an OF crosswalk with those geometric and operational characteristics

Li 2013 China	Pedestrians approach to Zebra-style crossings	Analysis of characteristics of crossing behaviours (crossing speed, waiting time before crossing, running across the street, not looking before crossing) of three groups of pedestrians (adults, adult-child pairs, and children alone) at unsignalized mid-block crosswalks.	The results of 579 pedestrians show that: 1) pedestrians crossing speed on the second half of the crosswalk is systematically faster than the first half; 2) children's behaviours are influenced by adults and children rely on their parents; 3) children often feel overwhelmed because of the difficulty judging when and how to cross the street.	There is a need to consider children and design the crossing facilities where children may use. It is necessary to improve children's crossing skills.
Liu 2013 USA	Drivers and pedestrians at a marked but unsignalized pedestrian crossing (Ped-Xing)	To examine driver's field view, driver's perception-reaction, lighting condition, and parking restriction at a Ped-Xing for enhancing traffic operational safety. The size of the no parking zone by the Ped-Xing is determined exactly using equations derived from this framework.	This study sheds light on mid-block Ped-Xing installation, which should be discouraged if parking is permitted alongside a street. Furthermore, additional visibility improvement measures at the unsignalized Ped-Xings may be needed for enhancing safe traffic operations at the crossings.	Mid-block Ped-Xing installation not recommended if parking is allowed alongside and no safety counter-measures are provided to reduce the risk of pedestrian-vehicle collisions, in particular in multi-lane one-way streets.
Malenje 2019 China	Drivers approaching crosswalks	To investigate effect of macroscopic factors on vehicle yielding. Six environmental factors considered: temporal gap size, number of traffic lanes, number of waiting pedestrians, position of pedestrian on street kerb or median, traffic flow direction and presence of monitoring e-Police*. Video Six observed variables influencing vehicle yielding was collected from 13 uncontrolled crosswalk locations. A Logit model with a 95.9% accuracy was developed to describe vehicle yielding.	Results showed that 1. Vehicles were more likely to yield on roads with fewer lanes (less than 5 lanes) than roads with more than 4 lanes. 2. Vehicles were more likely to yield with larger gaps than smaller gaps. 3. There was a direct relationship between gap size and number of lanes where vehicles yielded with smaller gaps on single lanes compared to multiple lanes. An 8-lane road required at least 18s gap size to yield. 4. Vehicles were likely to yield if there were many waiting pedestrians than fewer. The probability was even higher if they waited at the median than at the kerb. 5. Drivers yielded more in the presence of e-Police.	Results could be an indicator that they were aware of the pedestrians' right of way but needed an incentive to comply. A future study could include modelling the interactions of both pedestrians and drivers behaviour at the midblock crosswalks considering competition between the two in using the road segment.

Mascetti 2016 Italy	Pedestrians with visual impairment or blindness	To evaluate ZebraRecognizer, a software module that recognizes Zebra crossings and removes projection distortion from the acquired image, hence improving the accuracy of the recognition which is crucial to effectively guide the user. ZebraRecognizer adopts a customized version of the EDLines algorithm.	ZebraRecognizer is accurate, efficient and it computes the quantified and accurate position of the Zebra crossing without incurring any false positives and with few false negatives. At the same time, ZebraRecognizer is efficient on mobile devices.	Plans to integrate ZebraX with iMove into an application to support independent mobility of people with visual impairment or blindness, and to extend the machine vision technique to recognize other elements such as traffic lights.
Moore 2019 USA	Pedestrians and AVs with/without external human-machine interfaces (eHMI)	Literature review on explicit (such as lights or displays) and implicit eHMI, and field study with a driverless vehicle that tested pedestrians' reactions in everyday traffic without explicit eHMI.	While some pedestrians were surprised by the vehicle, others did not notice its autonomous nature, and all crossed in front without explicit signalling.	Results suggest that pedestrians may not need explicit eHMI in routine interactions—the car's implicit eHMI (its motion) may suffice.
Muley 2019 Qatar	Drivers and pedestrians at at non-signalized marked crosswalks	To investigate driver and pedestrian behaviour at crosswalks located on channelized right-turn lanes. Video data from a typical working day.	Results indicated that waiting behaviour, gap acceptance, and crossing speed are complex phenomena and depend on both pedestrians' personal and crossing characteristics. Drivers' yielding behaviour linked to pedestrians' gender and adjacent land use. Low driver yielding rates indicate that significant improvements are required to enhance pedestrian safety. Gender had the most significant effect on crossing behaviour followed by distractions, crossing in a group or alone, and dressing style.	Findings will be useful for planners when designing crosswalks at new intersections and marked crosswalks on exclusive right-turn lanes. Results will be directly applicable to the Arabian Gulf countries.
Mutabazi 2010	Pedestrians and drivers	A literature review of the application and understanding of zigzag lines at pedestrian crossings.	Results suggest that the meaning of zigzag lines is not well understood by many road users and road safety stakeholders. Most Trinidadian and Australian drivers misunderstood the purpose of zigzag lines, as well as some researchers from the	Further education is needed, particularly for drivers, in order to promote pedestrian safety. Engineers need to

Trinidad and Tobago			US and Canada. The Trinidadian media, which is responsible for educating the public, also displayed a misunderstanding of zigzag lines at Zebra crossings.	focus more on treatments, to regulate speeds, as opposed to relying on zigzag lines.
Olszewski 2015 Poland	Pedestrians and drivers using Zebra-style crossings	To develop a method of assessing safety at non-signalised pedestrian road crossings using video image analysis. Pedestrian and vehicle traffic was recorded before and after installation of active signage systems SignFlash and Levelite. Speeds of approaching vehicles were measured and drivers' behaviour was classified using video analysis. Changes in the mean and standard deviation of vehicle spot speeds and changes in speed profiles of vehicles approaching the crossings were measured.	Both systems of active signage tested showed statistically significant improvements. The SignFlash system of pedestrian-activated yellow flashing beacons caused a decrease of the overall average speed of approaching vehicles by around 2.5 km/h. The decrease even higher for encounters with pedestrians: a speed reduction of 3.5 km/h during day and 2.7 km/h at night. Levelite system of flashing lights embedded in the pavement resulted in the average speed decrease of 5.4 km/h for continuous flashing and 1.9 km/h for pedestrian-activated flashing, measured for all vehicles. When pedestrians are waiting to cross: 3.3 km/h reduction during the day and 5.2 km/h reduction at night.	Results indicate that both SignFlash and Levelite active signage reduce mean vehicle approach speeds and have a positive impact on drivers' behaviour.
Olszewski 2020 Poland	Pedestrians and drivers at non-signalised Zebra crossings	To develop surrogate safety indicators, based on detection of pedestrian-vehicle conflicts. Pedestrian and vehicle traffic was filmed at two non-signalised pedestrian Zebra crossings over 40 days. Motion trajectories of vehicles and pedestrians were determined based on video processing. Variables examined were: pedestrian-vehicle passing distance, vehicle speed, abrupt braking (deceleration > 4m/s2).	Classification of encounters was based on interactions of pedestrians and vehicles i.e. drivers yielding to pedestrians, vehicles passing just in front of, or behind pedestrians. A Dangerous Encounter Index is proposed as a surrogate safety indicator for pedestrian crossings. It relates the occurrence of dangerous events to exposure, defined as the number of pedestrian-vehicle encounters. The proposed index shows that crossing two lanes involves more risk than crossing one lane, given similar traffic flow.	Some improvement of safety at both types of crossing was observed after active signage involving blinking lights had been introduced. The proposed method is a step towards automation of safety assessment.

Patella 2020 Italy	Drivers approach to Zebra crossings	To evaluating how illuminated crosswalks influence drivers' behaviour when approaching Zebra crossings at night. Speed measurements detected in an urban road segment of the city of Rome with a Telelaser instrument, both in LED-illuminated conditions and in non-illuminated conditions.	Results show a promising impact of the LED lighting system on pedestrian safety. Cars' mean speed decreased by 19.3% at the crosswalk section in illuminated conditions. Moreover, a positive effect on safety, in terms of mean speed reduction (−16.4%), was found even in the absence of pedestrians.	Rome has extended experimentation of the innovative LED system to other crosswalks, and the execution of luminance measurements to strengthen correlation between speed reduction and lighting levels.
Pecchini 2015 Italy	Pedestrians with impairments	To examine street crossing behaviour of people with different impairments and their interaction with drivers. A specific field surveys was carried out. People with different disabilities were requested to traverse the roadway using non-signalised crosswalks. Survival Analyses were then applied on gathered waiting times at the kerbside with the purpose of ascertaining the way disability status and other characteristics influence interaction between drivers and pedestrians.	Design recommendations for crosswalks are prevalently focused on technical aspects, but interaction between drivers and pedestrians is also a fundamental aspect for non-signalised crosswalks. At crosswalks where drivers were forced to proceed slower, a pronounced disposition to comply with pedestrian right-of-way was noted. An overall reduction of vehicle speed enhances quality and comfort of pedestrians. Street-crossing was particularly arduous for people in wheelchairs - their waiting times were the highest of participants. But individuals with hearing impairments revealed unexpected versatility in hostile urban environment.	A better knowledge of these criticalities is fundamental for achieving accessible urban areas, a goal that can be pursued by adopting a perspective not only centred on technical and physical aspects, but also on mental and physiological impediments to freedom of movement.
Presti 2011 Italy	Pedestrian crossings with and without traffic lights	To study pedestrian crossings regulated by traffic lights or free, and what factors affect planning/design to achieve optimal quality of service and high safety standards. Focus is on the design of pedestrian crossings and their location in the urban context, existing legislation to achieve	Results propose increased dimensions of pedestrian crossings from 2.50 m to 4.50 m, to modify the actual location of these using a more rational positioning through the length of the road; also inserting a stop line 5 meters before the pedestrian crossing with reflecting elements to have a dual function of visual and audio signal for drivers.	We can design a possible new layout of pedestrian crossings, according to analysis of the current configuration and its critical points and simulate different future scenarios to account for

		an optimization of the number of pedestrian crossings, the distance between them and traffic light cycle if present.		the dual role of the street inside/outside the district and in the whole urban network.
Rasouli 2017 Canada	Pedestrians and drivers at crosswalks	To study behaviours of traffic participants while crossing in various street configurations and weather conditions. Observations from approx. 240 hours of driving in the city, suburban and urban roads. Analysis data from the point of view of joint attention.	Analysis of types of non-verbal communication cues used at the point of crossing, their responses, and circumstances the crossing event takes place under revealed that in >90% of cases pedestrians gaze at approaching cars prior to crossing in non-signalized crosswalks. Crossing action depends on additional factors such as time to collision, explicit driver's reaction or structure of the crosswalk. Other forms of explicit communication such as nodding or hand gesture were observed in 15% of the cases.	To better assess the nature of communication it would be beneficial to record driver's data such as driver's gestures, eye movements and any reaction that involves changing the state of the vehicle.
Razmi Rad 2020 Netherlands	Pedestrians crossing in-front of an automated vehicle (AV)	To observe how the crossing behaviours of the pedestrians in-front of AVs is influenced by their personal characteristics. Data collected through a simulation experiment using Agent-Based Modelling techniques. Participants were also asked to fill out a survey about their regular crossing behaviour in traffic, and their risk perception and attitudes towards crossing the road. Data from this questionnaire were used to estimate violations, lapses and trust in AVs.	Communication between pedestrians and drivers was significantly effective in vehicle intention recognition. The time to collision, and pedestrian Zebra crossings were most influential factors in effecting the decision to cross. Accidents occurred as a result of misinterpretation of signals of the AV's, late decision making of the pedestrian, and a lack of enough stopping distance between the pedestrian and the AV. Those with higher knowledge of AV technology were more likely to behave differently and to trust the capabilities of the vehicles to detect them more, and base their behaviour on the communication signal.	Pedestrians with different personal characteristics responded differently when interacting with AVs. This means that AVs interacting with pedestrians cannot be viewed as accident free.
Samuel	Pedestrians and drivers at pedestrian	To investigate the effect of advanced yielding markers for drivers yielding to pedestrians at crossings, including	Results showed that when advanced yielding markings and warning signs were present drivers approaching the crosswalk were more likely to	Advanced yielding markers have potential to reduce crashes and

2013 USA	crossings	a line with white triangles 20-50 feet before the crossing, together with a sign for drivers to yield. An observational study involving a staged pedestrian using a crossing, and an in-vehicle field study on an open road.	scan the sides of the roadway in anticipation of a pedestrian. In addition to this, if the markings were coupled with adjacent vacant parking spaces, this would lead to higher rates of yielding as there was a clear line of sight.	increase awareness of pedestrians. Drivers were more likely to look for pedestrians obscured by vehicles near the crosswalks after yield markers were installed.
Schneider 2018 USA	Drivers at intersection pedestrian crossings	To observe driver yielding behaviour at uncontrolled intersections along two-lane arterial and collector roadways with posted speed limits of 25 or 30 mph during peak travel periods. A naturalistic observation.	Drivers yielded 60 times out of 364 when the pedestrian wished to cross (16% driver yielding rate). Yielding rates differed between intersections, ranging from a high of 60% to a low of 0%. Drivers were more likely to yield when the major roadway had a lower speed limit or less traffic; when the intersection had a shorter crossing distance or a bus stop; and when the pedestrian was white, standing in the street, or acting assertively. Intersections with no reported pedestrian crashes in the last 5 years had higher driver yielding rates than intersections with at least two reported pedestrian crashes.	Results support roadway design strategies such as reducing roadway speeds and narrowing roadway crossing distances to increase probability of driver yielding to pedestrians. Importance of educating pedestrians and drivers so that pedestrians can confidently assert their right-of-way at crosswalks.
Schroeder 2011 USA	Drivers at unsignalized pedestrian crosswalks	To explore factors influencing driver yielding behaviour at non-signalised pedestrian crossings. The hypothesis asserts that drivers have a choice whether or not to yield to a pedestrian. Yielding is thought to be based on observable and quantifiable parameters, including vehicle dynamics, attributes of pedestrian/driver, and events near/at the crosswalk.	Results indicate that drivers are more inclined to yield to assertive pedestrians, who walk briskly whilst approaching the crosswalk. The probability of yielding is reduced with higher speeds, with deceleration rates and if vehicles are traveling in platoons. The treatment effects were seen to increase the likelihood of drivers yielding, but it is dependent on whether the flashing beacon was activated by the pedestrian.	This research provides insights into the interaction between pedestrians and vehicles at non-signalised intersections, and is likely to influence future predictive models of driving yielding behaviours.
Schroeder	Drivers and pedestrians at	To examine interaction between pedestrians and vehicles at mid-block	The driver yielding model showed that higher speeds and increased deceleration rates resulted	To put more focus on the accommodation of

2014 USA	crossings	pedestrian crossings. Research models of pedestrian gap acceptance and driver yielding behaviour were developed based on data collected from an observational study of mid-block crossings in three different states (Florida, North Carolina and Alabama)	in lower rates of driver yielding. Yielding rates were also higher for female pedestrians, the presence of multiple pedestrians, adjacent yields, and low speed platoons. An increase in gap length was associated with an increased probability of pedestrians crossing. In the event of a lag, pedestrians were less likely to accept a lag as opposed to a gap in terms of seconds spent.	pedestrians, engineers need to assess the impact of different intersections on both pedestrians and the vehicle stream.
Shaon 2018 USA	Pedestrians crossing the road, and drivers yielding to them	To categorise pedestrian assertiveness when crossing the road into three levels and collect video crossing data of pedestrians at two non-signalised crossings, in order to explore the relationship between pedestrian assertiveness and driver yielding behaviour.	71% of pedestrian exhibiting high assertiveness (level 1) were yielded to by drivers. Driver yielding rates were 30% to pedestrians exhibiting moderate assertiveness, and 3% for pedestrians exhibiting low assertiveness. Results from a high visibility enforcement program showed significantly higher rates of driver yielding to pedestrians exhibiting a moderate level of assertiveness.	A moderate level of assertiveness is helpful for pedestrians. Study provides a framework for future analysis; further research is needed on pedestrian assertiveness and driver yielding behaviours.
Sucha 2017 Czech Republic	Pedestrians and drivers in urban areas	To describe pedestrian-driver encounters, communication, and decision strategies at marked but non-signalised crossings and the ways in which the parties involved experience and handle these encounters. A mixed-methods design was used: focus groups with pedestrians and drivers regarding their subjective views of the situations, on-site observations, camera recordings, speed measurements, the measurement of car and pedestrian densities, and brief on-site interviews with	Factors influencing pedestrians' wait/go behaviour were: car speed, car distance from the crossing, traffic density, whether cars were approaching from both directions, signs given by the driver (eye contact, waving a hand, flashing their lights), and the presence of other pedestrians. Factors influencing drivers' yield/go behaviour were: speed, traffic density, number of pedestrians waiting to cross, and pedestrians being distracted. A great proportion of drivers (36%) failed to yield to pedestrians at marked crossings. The probability of conflict situations increased with cars travelling at a higher speed, higher traffic density, and pedestrians being distracted by a different activity while crossing.	Improvements should include measures aimed at reducing the speed of approaching vehicles (e.g. humps, speed cushions, elevated crossings, early yield bars, and narrow lanes), to enhance yielding by motor vehicles. Also the education and training of drivers, to promote their understanding and appreciation of pedestrians' needs and motives.

		pedestrians.		
Sucha 2018 Czech Republic	Pedestrians at a former Zebra crossing	To investigate pedestrians' crossing behaviour, the role of habit and routine route choice, pedestrians' perceived safety and comfort, preferences, and waiting times. Data was collected and analysed using rapid on-site interviews with pedestrians, on-site observations and video recordings.	(N.B. At the request of the police all pedestrian crossings on a street in the Czech city of Olomouc were removed due to concerns about current formats not complying to regulations; this research was carried out after those removals to investigate impacts). The results indicate that vulnerable pedestrians choose different crossing strategies: waiting for a driver to give way to them rather than waiting for a safe gap to pass, and require a much more cooperative approach from drivers than other pedestrians. The greatest impact (negative) is on children, the elderly, and disabled persons (Vulnerable Road Users).	The removal of crossings reduced pedestrians' perceived safety and comfort, but their awareness was raised. While adult pedestrians can cope with the new situation relatively well and cross the road without major difficulties, the same does not apply to vulnerable road users.
Tom 2011 France	Pedestrians crossing at 2 signalised, and 2 non-signalised sites	To study the gender difference in rule compliance, and in gaze targets before and during crossing. A taxonomic observation grid, detailing 13 behavioural categories before, during and after crossing, was used to observe and crossing behaviours of 400 adult pedestrians.	Data was from an equal number of males and females. Gender differences are apparent in crossing behaviours. Males tend to be more independent of the rules than females. These differences were linked to different motivations to comply with temporal crossing rules and social factors in women's displays through their visual search strategy.	Findings support the idea that pedestrians' behaviour cannot always be assumed to be safe; responsibility is not only for pedestrians to adjust behaviour in response to traffic, but also for drivers to adjust behaviour towards pedestrians.
Van Houten 2013	Drivers approaching Zebra-style crosswalks	To examine the effects of a 1-year high-visibility pedestrian right-of-way enforcement program on yielding to pedestrians at uncontrolled crosswalks. Program included four 2-week enforcement waves supported by education and engineering	Five results: (a) enforcement led to slow steady increase in percentage of drivers yielding to pedestrians over the year; (b) program produced a large change in yielding over course of the year; (c) program produced higher levels of yielding to natural pedestrian crossing than to staged crossings; changes in both were highly	Slow steady increase in yielding behaviour over course of study provides evidence that high-visibility elements introduced in a stepwise manner contributed to

USA		components that increased the visibility of enforcement.	correlated; (d) effects of the program generalized to crosswalks that were not targeted for pedestrian right-of-way enforcement; (e) the amount of generalization to unenforced sites was inversely proportional to the distance from sites that received enforcement.	success of program. The awareness survey confirmed that different elements of the program played a role in change of driver behaviour.
Velasco 2019 Netherlands	Pedestrians crossing in front of Automated Vehicles (AVs)	To investigate how physical appearance of AVs and mounted human machine interface (eHMI) impacted pedestrian behaviour. To assess perceived realism of 360˚ videos of pedestrian crossing for research purposes. Virtual reality experiment. Crossing intentions, trust in automation and perceived behavioural control were recorded. Questionnaires, simulation sickness survey, and comparison with previous literature were carried out.	Pedestrians' intention to cross was increased in the presence of Zebra crossing and a large gap size between the pedestrian and vehicle. Participants intended to cross less often when the speed of the vehicles was lower. Participants who recognised a vehicle as an AV were on average less likely to cross. There was a strong positive relationship between perceived behavioural control and crossing intentions. There were varied levels of trust between those who recognised an AV and those who didn't; the researchers argued that this did not impact the pedestrians' crossing intentions.	There was correlation between familiarity with automated vehicles and higher levels of trust. Crossing intentions did not differ according to type of vehicle. Smartphone and 360 degrees video-based VR methods were useful for research purposes.
Vignali 2019 Italy	Drivers approaching Zebra crossings	To examine the effects of median refuge islands and ''Yield here to pedestrians" flashing vertical signs on pedestrian crossing; before–after analysis of speed and visual behaviour of drivers approaching crosswalks. Elements of pedestrian crossing that were more salient and how drivers' visual behaviour was related to speed were assessed analysing drivers' eye movements.	The intervention significantly increased the fixation time to the Zebra markings and the addition of the flashing light increased conspicuity and fixation time to the vertical sign. The median refuge island was glanced by 60.7% of the drivers. Distance of first-fixation of the crosswalk increased by 44.7%. Speed parameters were lower after the intervention, the effects on crosswalk visual attention were higher than on speed.	The results of this study have a higher external validity since they were obtained in a real setting. This study was performed on a relatively small sample and future studies could test the effects of a similar intervention on a large sample.

Vignali 2020 Italy	Pedestrians and drivers	To study the effect of visibility of crosswalks before and after the displacement of a Zebra crossing to an intersection, plus the installation of “yield here to pedestrians” signs and refuge islands. These effects were assessed by before-after analysis of speeds and visual behaviour of drivers approaching the crossing.	The intervention was shown to increase safety and visibility of pedestrians on the crosswalk. Zebra markings with median refuge islands were found to be the most glanced-at elements by drivers, seen by 93.75% and 56.25% respectively. This was followed by vertical “Yield here to pedestrian” signs.	
Wang 2016 China	Drivers and pedestrians at non-signalised pedestrians crossings	To examine the interrelationship between the speed of a vehicle and the onset of yielding while approaching a non-signalised crossings Video recordings of a two-lane branch road of speed and personal condition, and the interaction during the onset of yielding between vehicles and pedestrian.	Drivers are likely to begin the process of deceleration 30-37 metres before the crossing, from a speed of 40-50 km/h to a speed of 30-40 km/h 23-30 metres before the crossing. The average distance from the crossing was 25 metres. Results reveal two types of driver: cautious and reckless.	Pedestrians will assign priority to vehicles due to potential danger if drivers have no deceleration intention or even speed up instead. Pedestrians should make their crossing intention clear to the driver, so they can cross effectively.
Yannis 2013 Greece	Pedestrians using street crossings in busy urban area	To investigate pedestrians’ traffic gap acceptance for mid-block street crossing in urban areas. A field survey was carried out. Pedestrians’ decisions and traffic conditions were videotaped in terms of the size of traffic gaps rejected or accepted, waiting times and crossing attempts and vehicle speeds. A lognormal regression model was developed to examine pedestrian gap acceptance.	It was found that gap acceptance was better explained by the distance from the incoming vehicle, rather than its speed. Other significant effects included illegal parking, presence of other pedestrians and incoming vehicles’ size. A binary logistic regression model was developed to examine the effect of traffic gaps and other parameters on pedestrians’ decisions to cross the street or not. The results reveal that this decision is affected by the distance from the incoming vehicles and the waiting times of pedestrians.	Pedestrians’ individual characteristics were not significant in this research; only gender was found to affect gap acceptance: men appeared to take fewer risks than women and accepted larger gaps. Authorities can use results to devise strategies/policy to optimise pedestrian urban environments.

Zegeer 2017 USA	Drivers and pedestrians at crossings	To develop crash modification data for four treatment types: rectangular rapid flashing beacons, pedestrian hybrid beacons, pedestrian refuge islands, or advanced yield/stop markings. Data collected on characteristics, traffic, geometric, roadway variables, and crashes at each site. Crash effect data derived from cross sectional and before/after regression models.	Four of the treatment types analysed were associated with reductions in pedestrian crash risk, compared with the reductions at untreated sites: pedestrian hybrid beacons led to the largest reduction of pedestrian crash risk (55% reduction), followed by Rectangular Rapid Flashing Beacons (47% reduction), refuge islands (32% decrease), and Advance yielding (25% reduction).	Areas should identify specific safety problems at a location and consider countermeasures most likely to address problem. After implementation, crashes/ behaviour should be monitored to ensure countermeasure effectiveness.
Zhang 2019 China	Pedestrians crossing at midblock crosswalks	To evaluate pedestrian crossing behaviour (such as crossing mode, waiting time at roadside, path or speed change while crossing, crossing with others, etc) and safety at mid-block crosswalks with different numbers of vehicle lanes. Video surveys of pedestrian behaviour.	Pedestrian-vehicle conflicts increase with the number of vehicle lanes; pedestrians at two-way two-lane, four-lane and six-lane crosswalks experienced 0.117, 0.342 and 0.697 conflicts on average, respectively. At two-lane crosswalks, conflicts primarily occurred on lane 2; at four-lane crosswalks, conflicts primarily occurred on lanes 2 and 4; at six-lane crosswalks, conflicts primarily occurred on lanes 3, 5, and 6.	Pedestrian safety is significantly affected by number of vehicle lanes at mid-block crosswalks. Along with the increase of vehicle lanes, pedestrian-vehicle conflicts and accident risk rise accordingly.
Zhao 2016 China	Pedestrians at non-signalized crossings	To investigate the speed of pedestrians and factors that influence this pace at non-signalized mid-block street crossings. Field survey using video data.	Crossing speed is approx. 1–1.1 m/s; crossing time increases with age of pedestrian; gender had no influence on crossing time; crossing speed of pedestrian is quicker when time gap between pedestrian and oncoming vehicle is smaller. Survey found that it is typical for pedestrians to cross lane by lane; most time is spent crossing first lane, least time crossing middle lane.	Crossing speed is an important input to the design of pedestrian facilities, and can provide a basis for the design of pedestrian crossings.

Zhao 2019 China	Pedestrians at non-signalized crossings	To examine external factors (independent of pedestrian characteristics) that influence gap acceptance decisions at midblock non-signalized crosswalks.	Gap size, crossing distance, waiting time and pedestrian location, were found to be statistically significant in determining whether pedestrians will either accept or reject an available gap. Gap size and crossing distance had the highest effect on the pedestrian gap acceptance decision.	Crossing distance of more than 12m was found to be risky and required appropriate interventions such median island.
Zhuang 2014 China	Pedestrians at crosswalks	To study pedestrian gestures to inform drivers of their intent to cross (illustrations in paper): (1) right elbow bent with hands erect and palm facing left (R-bent-erect), (2) left elbow bent with hands level and palm facing left (L-bent-level), (3) left arm extended straight to left side with palm erect facing left (L-straight-erect), and (4) a 'T' gesture for "Time-out". In the experiment, pedestrians waiting at the roadside and displayed the gestures (baseline: no gesture) to 420 vehicles at 5 sites.	Four out of eleven gestures ('R-bent-erect', 'T gesture', 'L-bent level', and 'L-straight-erect') were judged by Chinese drivers as effective when evaluated for visibility, clarity and level of familiarity. Results showed that only the 'L-bent-level' gesture significantly increased the drivers' yielding rate: the vehicle yielding rate more than tripled compared to baseline condition. The L-bent-level gesture also resulted in a significant decrease in driving with unchanged speed (63.5–38.8%).	L-bent-level gesture had no significant side effects in terms of horn use or lane changing. Therefore, it is suggested that pedestrians be trained to use the gesture and drivers be trained to properly interpret and respond to it.

Ziolkowski 2019 Poland	Drivers approaching Zebra crossings	To investigate driver's speed while approaching pedestrian crossings located in mid-block areas, non-signalised intersections and roundabouts. Spot speed measurements in free flow traffic conditions were conducted using radar speed gun. Speed was recorded at 100m and 50m from the crossing and at the Zebra crossing itself. Driver's speed behaviour based on statistical analysis and dependent on type, localization and distance from pedestrian crossing was analysed and evaluated.	Drivers did not seem to consider pedestrian crossing areas of increased risk and caution that should encourage careful/slower driving. The only essential difference was observed along approaching sections to pedestrian crossings located at roundabouts, where individuals travelled at significantly reduced speed at the distance of 50m from the crossing and reduced speed to approx 40km/h – the lowest among those investigated, but still with high risk for pedestrians. Driver's speed behaviour recorded after dark, when the presence of pedestrians is considerably lower, was still high.	More attempts should be made to find and implement effective speed management solutions to force drivers to slow in the area of pedestrian crossings – places where vulnerable road users become exposed to high risk.

*e-Police are the CCTV cameras used by the traffic police to monitor traffic flow and occurrence of violations.

* AV = automated vehicle

Appendix B. Online Questionnaire and Easy Read

Zebra Crossing Research Survey

You are invited to take part in a survey

Transport Scotland and the Scottish Road Research Board are conducting research into people's experience and views on zebra crossings.

What is a zebra crossing?

A zebra crossing is a road crossing that gives priority to pedestrians. Zebra crossings do not have traffic signals, green men, push buttons, audible or tactile cone signals. They typically have flashing orange lights known as Belisha Beacons, black and white markings on the crossing and tactile paving on each side of the crossing. Once someone has indicated their intent to cross the road, motorists are obliged to stop.

Why this survey?

We wish to hear the views of users of zebra crossings and investigate any improvements that can be made to them based on their experiences and views. The research team is also investigating international best practice and emerging technologies.

The survey

We would be grateful if you can complete the short survey below. It will take approximately 5 minutes.

If you require any assistance with completing the survey, or would prefer to complete the survey over the phone, please contact: zebracrossingresearch@jacobs.com

1. Which of these statements best describes how you use zebra crossings?
    a. I use them whenever they are on convenient routes for my journeys
    b. I use them if I have to but try to find other options for crossing
    c. I will go out of my way to avoid using them
    d. I have never used a zebra crossing

Please state your answer:

2. If you have never, or hardly ever, used a zebra crossing, why is this?
    a. I do not feel comfortable using zebra crossings
    b. There are no zebra crossings on the routes that I use

Please state your answer:

3. On a scale of 1-5, how comfortable do you feel whilst using a zebra crossing (1 being not at all comfortable, 5 being very comfortable)?

Please state your answer:

4. If you sometimes feel uncomfortable using zebra crossings, why might that be? (Select more than one if applicable)
    a. I find it difficult to locate the crossing
    b. I find it difficult to know whether the traffic has stopped before I start to cross
    c. I find it difficult to follow the route across
    d. Other (please specify)

Please state your answer:

5. Do you sometimes drive a car or other road vehicle?
    a. Yes
    b. No

Please state your answer:

6. As a driver, have you ever witnessed any of the situations below? (Select more than one if applicable)
    a. As a driver, it is sometimes difficult to see pedestrians approaching or on the crossings
    b. Pedestrians sometimes step out very quickly, and it could be difficult to stop in time

c. Drivers and pedestrians sometimes seem unsure as to who has right of way on a zebra crossing
d. Other drivers fail to give way to pedestrians waiting to cross
e. I have never witnessed any unsafe practice at zebra crossings

Please state your answer:

7. As a cyclist or pedestrian have you experienced or witnessed a potentially dangerous situation involving a cycle at a zebra crossing?
    a. No
    b. Yes. If so, can you explain below:

Please state your answer:

8. We are seeking ideas for how zebra crossings could be improved. Which of the following measures would you consider to be most effective to improve zebra crossings? (Please select your top two choices)
    a. Provide audible indicators to inform pedestrians when traffic has stopped and it is safe to cross
    b. Provide visual indicators to inform pedestrians when traffic has stopped and it is safe to cross
    c. Provide tactile indicators, such as rotating tactile cones, to inform pedestrians when traffic has stopped and it is safe to cross
    d. Provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down
    e. Increase training / information available for drivers, cyclists and pedestrians on the use of zebra crossings
    f. None of the above

Please state your answer:

9. If you have ideas for other options to improve safety on zebra crossings, please state them below:

It is helpful for us to have some insight into who is responding to this survey. There are a few questions below concerning yourself, you are under no obligation to answer.

10. What is your gender?

    a. Male
    b. Female
    c. Other
    d. Prefer not to say

Please state your answer:

11. What is your age?
    a. Under 18
    b. 18-30
    c. 31-50
    d. 51-70
    e. 71 or over
    f. Prefer not to say

Please state your answer:

12. Do you have a physical or mental health condition or illness lasting or expected to last 12 months or more?
    a. Yes
    b. No
    c. Prefer not to say

Please state your answer:

13. Does your condition or illness reduce your ability to carry-out day-to-day activities?
    a. Yes, a lot
    b. Yes, a little
    c. Not at all
    d. Prefer not to say

Please state your answer:

14. Does this condition or illness affect you in any of the following areas? (Select more than one if applicable)
    a. Vision
    b. Hearing
    c. Mobility or Dexterity
    d. Learning, Understanding or Memory
    e. Mental health
    f. Other
    g. Prefer not to say

Please state your answer:

Thank you for completing the survey. We would be grateful if you could please email your answers back to: zebracrossingresearch@jacobs.com before 12th February 2021.

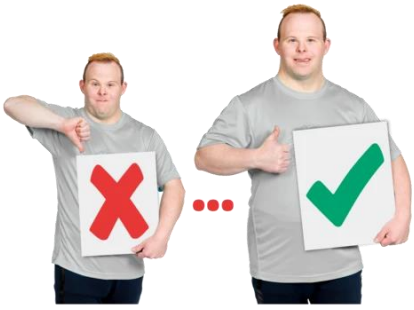
Zebra Crossing Survey

Transport Scotland and Scottish Road Research Board

Easy Read

 Prepared by Disability Equality Scotland

Transport Scotland and the Scottish Roads Research Board want to know what people think about using zebra crossings.



They want to look at ways to make zebra crossings better.

A zebra crossing lets people cross a road.

The traffic has to stop if someone is going to cross.

Zebra crossings have:

- no traffic lights
- no green men
- no push buttons
- no sound or touch signals

Zebra crossings normally have:

- Flashing orange lights called Belisha Beacons
- black and white stripes across the road
- tactile pavement each side for feeling under feet and wheels

If you need help with the survey questions, you can email zebracrossingresearch@jacobs.com

The survey closes on 12 February 2021.

1. Which 1 of these sentences is most true for you?

Click on 1 box to tick it. Click it again if you want to change your answer.

I use zebra crossings where they help me on my journey. ☐

I use zebra crossings if I have to but I prefer to find other ways to cross. ☐

I try hard not to use zebra crossings. ☐

I have never used a zebra crossing. ☐

If you ticked the box which says ‘I use zebra crossings where they help me on my journey’, please miss out Question 2.

2. Why do you prefer not to use zebra crossings?

Tick the sentence which is most true for you.

I don't feel comfortable using zebra crossings. ☐

There aren't any zebra crossings on my routes. ☐

3. How comfortable do you feel while you cross a zebra crossing?

Tick 1 box.

❌❌ I don't feel comfortable at all. ☐

- ✗ I don't feel very comfortable. ☐
- I have mixed feelings. ☐
- ✓ I feel quite comfortable. ☐
- ✓✓ I feel very comfortable. ☐

If you ticked 'I feel quite comfortable' or 'I feel very comfortable', please miss out Question 4.

4. Why do you feel uncomfortable using zebra crossings?

Tick the 1 sentence that is most true for you.

- I find it hard to find the zebra crossing. ☐
- I find it hard to know when the traffic has stopped. ☐
- I find it hard to follow the route across the road. ☐
- Another reason ☐

Please type it here……
……
……

5. Do you sometimes drive a car or another vehicle?

Tick 1 box.

✔ Yes ☐

✖ No ☐

If you ticked ‘No’ please miss out Question 6.

6. When you have been driving, have you seen any of these things happen?

Tick as many of the boxes as you want to.

It’s been hard to see walkers or wheelchair users near to or on the zebra crossing. ☐

Sometimes people step out quickly and it could be hard to stop in time. ☐

Sometimes no one seems to know who is allowed to move first. ☐

Other drivers don’t stop to let someone cross at a zebra crossing. ☐

I haven’t seen anything dangerous happen at a zebra crossing. ☐

7. If you are walking, wheeling or cycling, have you ever seen a dangerous situation happen with a bike at a zebra crossing?

Tick 1 box.

No ☐

Yes ☐

If you ticked ‘Yes’, please tell us more about it by typing below. The box will grow as you type.

8. We want to collect ideas for how to make zebra crossings safer.

Which 2 ideas do you think are the best?

Tick just 2 boxes.

- Have a sound signal to tell me it's safe to cross. ☐
- Have lit signs to show it's safe to cross. ☐
- Have touch signs, like tactile cones which move, to tell me it's safe to cross. ☐
- Have things like rumble strips to slow traffic down and give a sound to tell me traffic is coming towards the crossing. ☐
- Have more information for drivers, cyclists, walkers and wheelchair-users about zebra crossing safety. ☐
- None of these ideas. ☐

9. Have you got any other ideas about how to make zebra crossings safer?

Type your ideas below here. The box will grow as you type.

Questions about you

You don’t have to answer these next questions but it helps us if you do.

10. Are you:

Male ☐

Female ☐

Neither of these ☐

I don’t want to say ☐

11. What is your age?

17 years old or younger ☐

18 to 30 years old ☐

31 to 50 years old ☐

51 to 70 years old ☐

71 years old or older ☐

I don’t want to say ☐

12. Do you have a long-term health condition which has lasted more than 1 year?

This could be a mental health issue or a physical health illness or condition.

Tick 1 box.

✔ Yes ☐

✘ No ☐

I don’t want to say ☐

If you ticked ‘No’ or ‘I don’t want to say’, please miss out questions 13 and 14 and you have finished. Thank you.

13. Does your long-term condition or illness make it harder for you to do daily activities?

Tick 1 box.

- ✔✔ Yes, a lot harder ☐
- ✔ Yes, a bit harder ☐
- ✖ No, not at all ☐
- I don’t want to say ☐

14. Does your long-term condition or illness make any of these things harder for you?

Tick as many boxes as you want.

- Seeing ☐
- Hearing ☐
- Moving around or touching things ☐

Learning, remembering and understanding ☐

Mental health ☐

Something else ☐

I don’t want to say ☐

Please email your answers to

zebracrossingresearch@jacobs.com

This is the end of the survey. Thank you.

Appendix C. Comments to Improve Zebra Crossings

Result Details

Question 09

9. If you have ideas for other options to improve zebra crossings, please state them below:

Answers 438 48%

Skips 482 52%

248,587,806	Consider side road zebra crossings as used in other countries and some places in UK (eg stations and car parks) - without flashing lights and therefore much cheaper. These have been proposed in Manchester and cost c£300 as opposed to £30,000-£40,000. https://www.smarttransport.org.uk/case-studies/latest-case-studies/do-we-need-side-road-zebra-crossings	Thursday, Feb 11th 10:03AM
248,556,936	Better education for drivers.	Wednesday, Feb 10th 7:38AM
248,553,287	Small barriers clearly marking routes towards crossings so that motorists know pedsetrians in that area are intending to cross. They could usefully also stop pedestrians taking diagonal short cuts onto the crossing from crowded pavements.	Wednesday, Feb 10th 4:43AM
248,551,934	Better signage	Wednesday, Feb 10th 3:27AM
248,513,747	Speed calming technology should be placed near all zebra crossing, average speed cameras would be best in my opinion	Tuesday, Feb 9th 5:08AM
248,502,648	Mabay a speed but a little distance before to make drivers slow down would be a good idea as sometimes they are going to fast to stop but people still just walk out as they see they have right of way.	Monday, Feb 8th 4:28PM
248,499,649	In Spain there is road signage indicating who has priority the driver or the pedestrian	Monday, Feb 8th 2:41PM
248,463,678	Pedestrians don't need to be told that the traffic has chosen to stop for them, unless perhaps of they are visually impaired. Drivers require to stop when the crossing is in use. Please keep it simple and don't transfer responsibility for driving to pedestrians.	Sunday, Feb 7th 6:45AM
248,455,032	Remove and replace with a signalised crossing	Saturday, Feb 6th 12:52PM
248,452,272	Getting folk to use All crossings is difficult. In needs to be done through education when young and maybe more about it when drivers are under instruction.	Saturday, Feb 6th 9:00AM
248,420,216	Make them more visible and wider so drivers notice and pedestrians have more space away from traffic.	Thursday, Feb 4th 6:23PM
248,399,066	We are in a busy area and audible indicates would be more help for people with limited sight	Thursday, Feb 4th 7:07AM
248,398,386	I'm from Portugal, zebra crossings are everywhere and works well. However in Portugal the pedestrians are the most important in a road, they have priority always and that's how I think that should be as a pedestrian is the most vulnerable in a road environments. Cars should always stop at a crossing if there is someone waiting to cross, even if there are confused pedestrians that end up not crossing. It will need training but I think zebra crossings are the safest way forward.	Thursday, Feb 4th 6:28AM
248,396,700	better lighting at night if no street lighting near crossing flash device to alert drivers that someone is about to cross or waiting to cross	Thursday, Feb 4th 4:54AM
248,396,037	Put up cameras and catch bad drivers who do not stop to allow people to cross safely, there is only one near my home at the school but I feel we could have one or two more to allow safe crossing for children and the elderly in particular.	Thursday, Feb 4th 4:07AM
248,395,194	Ensure lights are maintained	Thursday, Feb 4th 3:12AM
248,394,929	Have all crossings controlled by lights	Thursday, Feb 4th 2:55AM
248,386,975	Sign on approach, like aware animals style.... aware zebra crossing coming up....	Wednesday, Feb 3rd 7:46PM
248,385,857	Drivers to pass a zebra crossing test as part of their driving tests	Wednesday, Feb 3rd 6:58PM
248,385,767	Flashing lights to let cars know what n advance	Wednesday, Feb 3rd 6:53PM
248,380,673	Give pedestrians more time to cross . Particularly in cities impatient drivers . As we age it takes longer to cross timings are to fast even for younger people. If you have a child pram . Or use a stick or pushing a wheelchair. Must do this for so many people.	Wednesday, Feb 3rd 3:00PM
248,378,647	In school areas put staggered fences at both sides to stop pedestrians (kids) from running straight onto zebra crossing, forcing them to slow down, increasing time for cars to stop and pedestrians (kids) to observe other traffic.	Wednesday, Feb 3rd 2:07PM
248,375,080	I feel most safe when they are raised like the platform speed tables. I think this makes them more visible to drivers as well as drivers HAVING to slow down to go over them.	Wednesday, Feb 3rd 12:43PM

248,374,581	Personally I don't like zebra crossing and think pelican crossing work better.	Wednesday, Feb 3rd 12:34PM
248,372,248	Always ..... better night time floodlighting	Wednesday, Feb 3rd 11:38AM
248,371,754	Educate drivers of any type of vehicle on the highway code	Wednesday, Feb 3rd 11:21AM
248,371,125	Replace with an alternative type of crossing.	Wednesday, Feb 3rd 11:05AM
248,370,942	None	Wednesday, Feb 3rd 11:06AM
248,370,802	Not all zebra crossings have the flashing lights on poles. Maybe make this as standard. Or a button to press when you're at kerb and the lights on top of poles will start to flash to remind drivers that they need to stop	Wednesday, Feb 3rd 11:04AM
248,368,404	Not sure	Wednesday, Feb 3rd 10:16AM
248,365,943	Raised sleeping policemen right across both lanes, and the middle of the road to encourage traffic to slow and stop	Wednesday, Feb 3rd 9:20AM
248,296,521	Humped zebra crossings where the crossing is more visible due to the vertical dimension, the hump reduces speeds on the approach to the crossing, and through the crossing. Being at footway level, there are no gradient issues at the transition between the crossing and adjacent footway which is an issue for buggies, prams, wheelchairs, those with mobility issues and during winters when ice has formed on the footway.	Monday, Feb 1st 11:55AM
248,295,745	replace with traffic lights + pedestrian sensor so it can tell when people are wanting to cross the road. i just don't think they are very safe :/	Monday, Feb 1st 11:35AM
248,283,576	None of the above would work other than in the short term. Replace all Zebra crossings with light controlled crossings. Drivers need to have a clear instruction to stop as some will always ignore anything they regard as a 'suggestion'.	Monday, Feb 1st 5:48AM
248,283,265	Similar to stop lines they should be mandatory to enforce some appropriate behaviour and place them on the apex of corners similar to placeent seen in Europe.	Monday, Feb 1st 5:35AM
248,251,301	Replace them with controlled crossings.	Sunday, Jan 31st 5:56AM
248,246,244	Paint GIVE WAY on the road beside them, drivers often don't stop	Saturday, Jan 30th 11:35PM
248,240,802	Maybe extra signs for road users, warning that they'll shortly approach a zebra crossing.	Saturday, Jan 30th 5:04PM
248,214,749	Make sure they are wheelchair accessible, zebra crossings on speed bumps are dangerous, the bumps from the paint can make it incredibly difficult to cross.	Friday, Jan 29th 7:34PM
248,209,792	Remove that woman from the road. She actually requested for me to be sacked - Glad I left as I hated using that crossing, some drivers would actually turn right heading into town there into the old gallery driveway (on a crossing!!!) words fail me. Police turned up as she mashed up her car on a light pole and even policeman said it was not a traffic offense (he was educated too) lol	Friday, Jan 29th 4:31PM
248,199,627	Provide extra lighting at crossings.	Friday, Jan 29th 11:54AM
248,199,379	Maybe convert more of them into Pelican crossings.	Friday, Jan 29th 11:45AM
248,191,476	Put cameras and fine drivers who do not give priority	Friday, Jan 29th 8:56AM
248,190,930	Provide more of them	Monday, Jan 25th 5:18AM
248,187,702	Ensure that the flashing lights are always bright and do flash continuously. On too many occasions, I have come across crossings where the lights do not work or are absent from lights altogether. For pedestrians, signs like a simple STOP similar to GIVE WAY signs could be placed to add an extra reminder for people to stop first before crossing.	Friday, Jan 29th 6:03AM
248,179,239	Have car stopping distance a couple of metres before zebra crossing. Have the zebra crossing on a ramp/speed bump to slow down traffic. Combination of visual and audible measures. Due to covid 19 we need to ensure that there is no need to press buttons but have motion sensors to keep public safe. Also have inbuilt motion cameras that capture close calls at xings to assist this research. Evidence based solutions for continuous improvement. Along with raising awareness of the above safety and monitoring measures.e.g. traffic cameras reduce speeding so above measures could improve H and S at these xinggs.	Thursday, Jan 28th 5:43PM
248,178,874	Please change them to full pedestrian signalled crossings, they might have been ok in the 50’s but they are not fit for purpose now	Thursday, Jan 28th 5:22PM

248,177,521	In driving tests have about guide dogs and owners. We can't cross if we're waved across by a driver on a random part of road. Also on zebra crossings, we wait untill both sides have stopped. Today a driver on right side was beeping and shouting cause I was waiting on left side to stop. And teach drivers a white harness with yellow chest flash means it's a qualified guide dog with an owner with sight loss . A red and white checked chest flash means owner has sight and hearing loss. A white walking stick and white cane is sight loss. A white cane with red means sight and hearing loss. I ticked, acde but it won't let more than 1.	Thursday, Jan 28th 4:37PM
248,166,362	Touch free buttons would be much appreciated, especially when global pandemic so transmissible and deadly	Thursday, Jan 28th 11:17AM
248,162,346	Issue fines for drivers who don't stop! Erect signs that tell drivers to stop for pedestrians	Thursday, Jan 28th 9:37AM
248,155,997	Provide adequate lighting at either side of zebra crossings to allow visibility and anticipation of pedestrians at night.	Thursday, Jan 28th 5:43AM
248,151,486	Campaign to slow car drivers down Make zebra crossings the norm rather than the few. Seek to legalise non light based zebra crossings to enable pedestrian priority on all urban roads	Thursday, Jan 28th 12:06AM
248,134,261	There seems to be a general deterioration in the number of people parking on the zig zags. Not sure if this just worsening behaviour or ignorance, or lack of enforcement.	Wednesday, Jan 27th 12:08PM
248,128,622	I think zebra crossings have given way to pelican crossings with traffic lights which are much safer.	Wednesday, Jan 27th 9:45AM
248,104,058	Place a mandatory keep clear zone (box junction) for one car length beyond a zebra crossing to improve sight lines for traffic coming in the opposite direction	Tuesday, Jan 26th 4:07PM
248,103,591	Change to pelican or puffin	Tuesday, Jan 26th 3:47PM
248,103,549	anything to warn.drivers will be beneficial, there is no point for visual indicators to inform pedestrians when traffic has stopped as they usual not waiting long and crossing immediately	Tuesday, Jan 26th 3:47PM
248,097,289	Would also use the answer number 3	Tuesday, Jan 26th 1:01PM
248,080,806	Pedestrian activated light to illuminate the crossing when wishing to cross at night	Tuesday, Jan 26th 3:49AM
248,080,638	Physical measures shall be in place to slow down the traffic like speed humps etc	Tuesday, Jan 26th 3:36AM
248,080,051	Make zebra crossings with a raised table idea so that drivers have to slow down. Currently with zebra crossings being at grade there no need for a driver to slow to negotiate the crossing and therefore can travel through at a far higher speed than is safe. It also means they are less likely to be able to slow down should a pedestrian approach the crossing.	Tuesday, Jan 26th 2:50AM
248,071,505	I would rather have more pedestrian crossings (green man crossings with traffic lights) as when a predestination it feels unsafe, as a driver is can be hard to see people approaching the crossings	Monday, Jan 25th 5:29PM
248,071,392	Get rid of them and only have pedestrian crossings with traffic lights.	Monday, Jan 25th 5:20PM
248,070,920	I only use zebra crossings in high volume low speed areas - entrance to retail park for example. While I've never witnessed any hazardous situations I'm sure they happen. Furthermore if I had any disability I'm sure I'd feel vulnerable and unsure when to cross. Therefore all interventions above are viable. Consideration of smart technologies for those with disabilities also encouraged.	Monday, Jan 25th 4:58PM
248,070,628	Make failing to stop at a zebra crossing when a pedestrian is crossing/waiting a fixed penalty of nine points and £1000 fine. Double that for each subsequent offence.	Monday, Jan 25th 4:46PM
248,064,965	warning signs for drivers warning signs for pedestrians	Monday, Jan 25th 1:35PM
248,064,081	Its the drivers nothing to do with improve zebra crossing	Monday, Jan 25th 1:11PM
248,062,839	Don't have them	Monday, Jan 25th 12:44PM
248,061,636	At TRT Lighting we manufacture and supply an LED Zebra Lantern which highlights the crossing at night. Various councils around the UK use this fitting and have had great feedback. I can send info on this - e mail - David.johnston@trtlighting.co.uk	Monday, Jan 25th 12:22PM
248,060,690	Don't put them in and signalise crossing points.	Monday, Jan 25th 11:58AM
248,060,191	A and b are equay important depending on blind / deaf users - you could not have one over the other	Monday, Jan 25th 11:49AM
248,060,060	A change in law to allow zebra crossings on side streets without the flashing beacons would allow for a safer pedestrian environment and reduce the cost of installing zebra crossings at appropriate locations.	Monday, Jan 25th 11:45AM
248,059,876	Add barriers either side of crossings to encourage use at that point and not free crossing at any point on a dangerous road. Add a length of direct approach which is entirely visible to drivers to zebra crossings so that the pedestrian approach to crossing is perpendicular to driver vision further clarifying intent to use.	Monday, Jan 25th 11:42AM

248,059,455	Make it a legal requirement for vehicles to stop at all crossings	Monday, Jan 25th 11:33AM
248,058,101	N/a	Monday, Jan 25th 11:08AM
248,056,081	Zebra Crossings should be added to all GPS systems. Alerting drivers that a zebra crossing is nearing and that they should be aware of potential pedestrians stepping out.	Monday, Jan 25th 10:26AM
248,055,190	Improve the lighting on approach to zebra crossing so traffic has a chance to stop as pedestrians walk towards the crossing. I have seen flood lit crossings (rear of Lidl, Fullerton Road, Glenrothes)	Monday, Jan 25th 10:02AM
248,054,922	Use Spanish model where it is mandatory to stop	Monday, Jan 25th 10:02AM
248,054,484	Make sure there is good lighting. Make sure good positioning and that the crossing can be seen clearly for a good distance around. Not just off a junction like a roundabout	Monday, Jan 25th 7:06AM
248,052,910	Improved lighting would help significantly - not just in helping drivers to see pedestrians, but also to highlight that the zebra crossing is there. If not full lighting - even just cats eyes would be better than nothing	Monday, Jan 25th 9:25AM
248,052,748	Incorporate overhead flashing lights when pedestrian crosswalk activated on busy roads. 3D crosswalks.	Monday, Jan 25th 9:18AM
248,051,797	Any improvements made would have to take into consideration people with disabilities. IE: sight and hearing impairments. Plus some people take longer to cross the road due to many walking difficulties.	Monday, Jan 25th 9:04AM
248,051,290	Lights to stop cars	Monday, Jan 25th 8:54AM
248,049,890	Ensure the road markings are clear and not worn away	Monday, Jan 25th 8:30AM
248,049,603	My main concern is that some drivers do not stop!	Monday, Jan 25th 8:25AM
248,049,388	Install more of them in South Queensferry - especially in the lower half of The Loan.	Monday, Jan 25th 8:20AM
248,049,358	There needs to be bolder signposting to Drivers that they must slow down as approaching a zebra crossing and it is pedestrians right of way 'SLOW DOWN. BE AWARE OF PEOPLE CROSSING'. Lorry/van drivers are especially poor at slowing down and should be targeted.	Monday, Jan 25th 8:19AM
248,049,178	Make sure cyclists stop at them as well.	Monday, Jan 25th 8:16AM
248,048,565	Maintain them. Ours is almost invisible and the zig zag lines ignored. When teaching children to cross the road every opportunity to do so safely must be maintained to ensure respect of the rules and legislation	Monday, Jan 25th 8:01AM
248,048,017	Use more of them in West Lothian I areas near school and use cctv to impose fines where vehicles fail to stop to give the pedestrian right of way	Monday, Jan 25th 7:47AM
248,047,851	Near to me there is a Zebra crossing which has a lot of trees on one side. This can make it difficult to see if someone is about to cross when it is dark. It would be good if there was a distance where obstacles which could cause a hazard like this had to be removed to give a clear view	Monday, Jan 25th 7:41AM
248,047,675	Pedestrian can press a button to illuminate a “pedestrian crossing” warning sign. I have seen this work in France.	Monday, Jan 25th 7:34AM
248,047,620	Use traffic lights instead, they're safer and more visible. Pedestrians are also more likely to use them properly and drivers are more likely to stop when indicated.	Monday, Jan 25th 7:31AM
248,047,580	No matter what measures are taken, those who don't follow the rules of the road will ignore them. Some drivers actually speed up to get past the crossing before the pedestrian gets there. Traffic lights are the only way and even then you're not guaranteed people will stop.	Monday, Jan 25th 7:27AM
248,047,509	They could be lit better, as in the whole of the poles illuminated to give better forewarning to drivers and cyclists of the approaching crossing.	Monday, Jan 25th 7:27AM
248,047,175	Warning sign for drivers to slowdown? (Before the Crossing)	Monday, Jan 25th 7:14AM
248,046,829	Get rid of them totally as they are outdated	Monday, Jan 25th 6:59AM
248,046,621	I would like to see Zebra crossings phased out. Traffic light controlled crossings are much safer. Once the light turns red and the green man comes on there is no confusion as to who has the right of way. With Zebra crossings there is always an element of doubt. Is someone intending to cross or not. The Zebra near where I stay people hang around at it and chat with others and have no intention of crossing. There are some that are obscured by trees, lamp posts etc.	Monday, Jan 25th 6:51AM
248,046,620	Lighting needs to be improved especially at dusk/night as is it not clear to see if there is a pedestrian waiting at the crossing	Monday, Jan 25th 6:52AM
248,046,111	Re question 8. If your going to go down the route of providing visual and audio aids for pedestrians, why not just provide a pelican or similar traffic light controlled crossing	Monday, Jan 25th 6:31AM
248,046,068	signs reminding cyclists to stop as well	Monday, Jan 25th 6:30AM

248,045,896	Button, green man	Monday, Jan 25th 6:21AM
248,045,670	Turn zebra crossings in to traffic light crossings. Road users are more aware of the lights and the rules for them.	Monday, Jan 25th 6:10AM
248,045,637	Advertise it more on social media or TV.	Monday, Jan 25th 6:08AM
248,045,582	Stop them completely. So much safer to have traffic lighrs with red/green man and sound	Monday, Jan 25th 6:05AM
248,045,377	Bin them and utilise real crossings	Monday, Jan 25th 5:55AM
248,045,342	Zig zag barriers to prevent pedestrians from stepping out when they reach a crossing. Wide angle cameras and fines for drivers who do not stop at zebra crossings	Monday, Jan 25th 5:53AM
248,045,237	Place them sensibly, they must not be used near junctions or the entry and exit to roundabouts. People have died as a direct result of this reckless positioning and drivers are expected to take on an increasing burden of responsibility while the complexity of road systems and traffic increases. Do not use them in places where there are a large number of pedestrians. They're unsuited for busy high streets where large numbers of cars and pedestrians obscure visibility and the potential for seemingly random pedestrian movement without observation increases exponentially. Place signage instructing pedestrians to look left and right before crossing. This is by far the cheapest and most effective, reinforce stop, look, listen - do something to educate pedestrians to save their own lives rather than use them as collateral to create conflict on the roads.	Monday, Jan 25th 5:48AM
248,045,097	Review road lighting levels standards and what is being achieved on site after install.	Monday, Jan 25th 5:43AM
248,045,013	During school hours a road crosser should be present.	Monday, Jan 25th 5:38AM
248,044,824	They only work when drivers stop and a lot don't. It's like a lottery! Don't think they are effective and should have a green and red man signal	Monday, Jan 25th 5:29AM
248,044,770	Clean and maintain the beacons and paint the black and white lines on a regular as required basis.	Monday, Jan 25th 5:28AM
248,044,760	All road users should be put through a 5 yearly test say (online)	Monday, Jan 25th 5:26AM
248,044,728	Remove bushes/trees from crossings and avoid crossings directly after a round about. An example is the roundabout at home bargains/sports direct in Livingston. There are bushes and a crossing soon after the roundabout so cars are prevented from seeing pedestrians and safely stopping. It also makes pedestrians hesitate about using the crossing as it is unclear if cars will stop on time.	Monday, Jan 25th 5:25AM
248,044,700	New drivers seem to be better at this than older drivers- there should be a refresh on theory test for drivers who have done their test a more than 10 years ago etc. To refresh their knowledge.	Monday, Jan 25th 5:23AM
248,044,653	Zebra crossings should be limited to light traffic areas with traffic calming measures in place, they do not work in all areas and research should take place after installation to ensure safety	Monday, Jan 25th 5:22AM
248,044,016	Camera to catch drivers not obliged to stop.	Monday, Jan 25th 4:49AM
248,043,937	Tactile paving underfoot at the crossing would ensure visually impaired people are alerted to the location of the crossing.	Monday, Jan 25th 4:42AM
248,031,719	They must be placed where motorists can clearly see them. So often they are near mini roundabouts with bushes obscuring visibility.	Sunday, Jan 24th 2:04PM
248,031,490	I wish they could be more zebra crossings. Especially at roundabouts.	Sunday, Jan 24th 1:51PM
248,023,533	Traffic lights, Crossing barriers, Savage kind of sleeping policeman	Saturday, Jan 23rd 1:45PM
248,014,242	Need more zebra crossings to give priority to pedestrians where they need it	Saturday, Jan 23rd 2:56PM
248,009,298	I can see they might have a place in uncrowded areas but I think having a mixture of Zebra crossings and ones controlled by lights in a crowded town or city is too confusing and too dangerous.	Saturday, Jan 23rd 1:35PM
247,998,651	Install cct cameras at zebra crossings	Saturday, Jan 23rd 7:21AM
247,994,429	Better lighting is essential and pronanly the most important potential improvement	Saturday, Jan 23rd 5:01AM
247,993,608	Raising the crossing to slow traffic seems to help	Saturday, Jan 23rd 4:36AM
247,979,490	There should be more of them, on roads not very busy or without fast traffic.	Friday, Jan 22nd 2:56PM
247,978,792	Lighting on all zebra crossings at the point where people cross. Street lighting is often not enough.	Friday, Jan 22nd 2:27PM

247,978,151	Ensure good visibility	Friday, Jan 22nd 2:01PM
247,975,922	Traffic camera enforcement. Too many examples of drivers not stopping and it being one word against the other	Friday, Jan 22nd 12:35PM
247,974,222	Raise all crossings to pavement level. Will ensure motor vehicles slow down.	Friday, Jan 22nd 11:50AM
247,973,978	a) Would it be possible to put "dimple strips" along each edge to warn blind/partially sighted people where they are safe b) With the advent of almost silent electric vehicles - erect audible/visual bleepers set some distance from the crossing that would be activated when a car passes.	Friday, Jan 22nd 11:43AM
247,972,940	I do not believe any electronic measures should be implemented as the crossing may as well have traffic lights to control traffic and pedestrians. I feel that increasing the height of the crossing to that of the pavement, causing a wide speed bump type feature should slow traffic down enough if a pedestrian then steps out before the traffic has stopped, the traffic can then stop safely and quickly.	Friday, Jan 22nd 11:16AM
247,969,211	Perhaps a button on the crossing which changes the flashing warning light to RED when someone wants to cross.	Friday, Jan 22nd 9:28AM
247,966,684	All cyclists need to have an identifier so they can be reported for misusing zebra crossings. Changing them to crossings with traffic lights is the only way to make them safer for everyone. But cyclists ignore these too.	Friday, Jan 22nd 8:11AM
247,964,881	I think that there should be tactile markings on the pavement to indicate where the zebra crossing is located. Most of the time i do not know that there is a zebra crossing as there is no markings to indicate that there is one when passing them	Friday, Jan 22nd 7:07AM
247,964,781	Make it illegal to ignore pedestrians and put cctv in place	Friday, Jan 22nd 7:02AM
247,964,208	Where a zebra crossing is at the top of a rise in the road, it is difficult for approaching traffic to see the zebra stripes. Crossing markings should extend down each side of the slope so that they are clearly visible from both sides. (See crossing in Tillicoultry A908 Moss Road and The Devon Way Footpath where vehicles frequently fail to stop).	Friday, Jan 22nd 6:33AM
247,963,848	In my opinion, zebra crossings are no good when you are visually impaired because using it requires seeing on coming traffic. They are too dangerous because it requires drivers to be vigilant and sadly that is never the case on our roads. The only way I would feel safe using a zebra crossing is if there were audible signals saying it is safe to cross and barriers come down. Like railway crossings	Friday, Jan 22nd 6:19AM
247,963,706	More of them and a National ad campaign to support pedestrians	Friday, Jan 22nd 6:14AM
247,962,977	As I have a zebra crossing immediately outside my home I do not want anything added to increase noise or annoyance	Friday, Jan 22nd 5:36AM
247,962,375	Just make them more visable and keep them upgraded and clear	Friday, Jan 22nd 5:06AM
247,959,885	The small ones in car parks etc are often safer due to slower traffic and shorter road crossings - I use these with confidence. I often see more dangers on a stretched crossing over 2 way traffic, I wonder if these crossings should be indicated visually/audio, but at the same time I feel it defeats the purpose, I feel zebra crossings are convenient because they keep traffic moving using the driver/pedestrian discression - but if an indicator or signal is put in place the cars and person are stopped longer - just like traffic lights. Maybe a motion sensor - traditionally they have orange beacons maybe these could change to red if someone is on it.	Friday, Jan 22nd 2:55AM
247,952,857	Allow them to get rid of the light requirements so they can be installed for far far less money The lights are pointless anyway a sign would do.	Thursday, Jan 21st 9:04PM
247,944,883	Rip them out and make it a controlled crossing, either a puffin or toucan. This will be suitable for all, rather than trying to retro fit measures to a zebra crossing.	Thursday, Jan 21st 4:34PM
247,944,123	when I lived in West Mids the injury stats for peds showed Solihull was far better than national average; lots of zebras - typically a couple by every school and always raised (sump- smasher) crossing to force speed down. Next door B'ham had shit performance 143rd worst of 152 authorities- too few crossings and always flat and ill maintained. Oh and UK roads policing is shit and discriminatory as the PACTS reports on comparative ped safety show.	Thursday, Jan 21st 4:11PM
247,943,351	Place many more of them, especially on minor roads near the junction with a major road, making it easier for pedestrians to cross. Increase penalties for road users who fail to stop for pedestrians.	Thursday, Jan 21st 3:52PM
247,937,099	Change them to pedestrian crossings.	Thursday, Jan 21st 1:27PM
247,931,909	Educate pedestrians they should stop and wait briefly before stepping on the crossing, ensuring it's safe to cross. Educate drivers, cyclists etc to slow down on approach.	Thursday, Jan 21st 11:08AM
247,931,829	Enforcement of traffic laws (by human and by camera), including of violations by cyclists	Thursday, Jan 21st 11:05AM
247,930,259	Have bigger warning signs for drivers.	Thursday, Jan 21st 10:26AM
247,929,842	Perhaps have the belisha beacons change colour when the pedestrian is on the crossing - the pedestrian could press a button to change the colour.	Thursday, Jan 21st 10:14AM

247,927,491	In the USA they use a similar crossing design that uses a red flashing signal. On UK zebra crossings install a push button for pedestrians to use when the road is busy so the yellow beacons change from flashing yellow to flashing red. Flashing red would give a clear message to STOP as a pedestrian is crossing. Let it flash yellow again afterwards as a method of taking caution and to give way when pedestrians are crossing. But the red is only to add that extra security for both road users and pedestrians and cyclists.	Thursday, Jan 21st 9:18AM
247,925,999	I think the problem with Zebra Crossings is they are a lot like keep left islands that have dropped kerbs and so drivers treat them the same. If the keep left islands were all converted to zebra crossings it would be clearer to drivers how to use these crossings and they would be safer. I prefer Zebra Crossings to light controlled crossings because they are much faster, I can't see how any 'traffic has stopped' detection system can work without essentially turning the Zebra crossing into a Puffin crossing. In my experience, the most common indiscipline at Zebra Crossings isn't cars failing to stop, it's cars failing to wait for the crossing to clear before they move away. Narrow pavements are also an issue, as they make it hard to drivers to tell whether someone is intending to cross.	Thursday, Jan 21st 8:44AM
247,925,812	Replace them with pelican crossings!	Thursday, Jan 21st 8:40AM
247,925,333	More signs to warn drivers they are ahead	Thursday, Jan 21st 8:26AM
247,924,896	Replace them with pelican crossings. Zebra crossings are inherently dangerous due to not having clear signals. Also due to the lack of knowledge of how to use them particularly by non-drivers who have probably never read a copy of the highway code	Thursday, Jan 21st 8:07AM
247,921,541	More of them so that drivers get used to seeing them. They also need to be maintained properly (ie repainted regularly).	Thursday, Jan 21st 5:43AM
247,921,236	The Neatebox Button App automatically presses the button at automated pedestrian crossings. Its inclusion in Zebra crossings could trigger an increased awareness in drivers that a person is waiting to cross the road. Button app is free to the user and easy to install in crossings however a certain amount of development would be required to utilise it at Zebra crossings. At this time Button is available through Transport Scotland and in the towns Largs and Irvine. https://youtu.be/KmRLN_EbrJM more info at neatebox.com/button.	Thursday, Jan 21st 5:32AM
247,920,669	`Make the crossing points brightly coloured and/or raised [ideally level with the adjoining paths] to make the pedestrian crossing the priority which clearly defines the crossing as a pedestrian priority over which vehicles are allowed to proceed when there are no pedestrians.	Thursday, Jan 21st 5:08AM
247,920,097	Pedestrians should always have right of way and it should be up to the vehicle to slow down - many at present do not - this requires more information and training	Thursday, Jan 21st 4:49AM
247,919,673	I believe white paint should be refreshed regularly.	Thursday, Jan 21st 4:36AM
247,919,481	Zebra crossings should be the default crossing in retail and residential streets where traffic speeds are low (e.g. 20mph zones). They give priority to pedestrians where signal controlled crossings are far too often set so that pedestrians have to wait (often in the rain and cold) while vehicles go past (with their occupants warm, dry and comfortable). Zebra crossings that are raised to pavement level and/or have warnings to drivers (such as different coloured, high-grip surfaces) to warn drivers of the crossing and cause them to slow down should be used where possible. Where zebra crossings are not considered suitable, signal controlled crossings should be set to prioritise pedestrians - e.g. more than one pedestrian sequence on each cycle at a junction, lights set by default to red for traffic where no traffic is detected, shorter waiting times for pedestrians when a button is pressed. Far too often these crossings are designed to prioritise traffic flow and make pedestrians wait - that may be OK on arterial routes, but it should not be the case on any other streets.	Thursday, Jan 21st 4:29AM
247,919,110	Every road user knows how crossings work - severe, mandatory penalties for those that transgress the rules will quickly remove the dangerous drivers, and make the simply careless psy a bit more attention. Modern gechnology ould eadily allow cameras to be incorporsted in to crossing infrasteucture to enforce this.	Thursday, Jan 21st 4:19AM
247,918,752	Good lighting. Good maintenance of the crossings.	Thursday, Jan 21st 3:58AM
247,918,682	Install more crossings, UK legislation needs to be overhauled so that Belisha Beacons are not required. Europe has many more crossings and motorists are more observant. Adopt 20 mph zones by default in town and village centres.	Thursday, Jan 21st 3:38AM
247,918,649	Digital safety cameras to catch road users who fail to stop...	Thursday, Jan 21st 3:49AM
247,918,584	Prosecute a few drivers for not using them properly and highlight the prosecutions in the press	Thursday, Jan 21st 3:46AM
247,918,392	Tighten up the law to ensure pedestrians have absolute priority. Liwer speed limits (20mph) on streets with ZCs. CCTV monitoring of 'problem' crossings.	Thursday, Jan 21st 3:32AM
247,918,189	Raised them slightly like a flat topped speed bump to slow traffic down slightly.	Thursday, Jan 21st 3:21AM
247,915,821	Penalise drivers that don’t stop	Thursday, Jan 21st 1:37AM
247,911,465	Not sure they need improving	Wednesday, Jan 20th 9:08PM

247,906,744	There are some crossings eg the main set at Tollcross where all the roads meet where the crossing time is quite short and the paired crossings have lights which don't work together, tempting people to try to dodge across when the lights are against them.	Wednesday, Jan 20th 4:46PM
247,903,966	Better street lighting at night. Road signs indicating to traffic that a zebra crossing is ahead. More zebra crossings. People will become more familiar with their use.	Wednesday, Jan 20th 2:53PM
247,903,529	Have more of them to encourage regular road crossing locations in 0places that currently have 'open roads' would need to look at desired lines to help get the best locations although would need to check safe slightlines	Wednesday, Jan 20th 2:39PM
247,901,490	Scrap them and install Puffin Crossings.	Wednesday, Jan 20th 1:23PM
247,901,306	No overtaking to be allowed for quite a distance prior to the crossing. Better driver training & awareness - a more difficult driving t5est, lower speed limits in areas with pedestrian crossings.	Wednesday, Jan 20th 1:17PM
247,897,850	CCTV, if they don't already have it.	Wednesday, Jan 20th 11:19AM
247,886,339	Improve lighting around zebra crossings, especially in the winter months.	Wednesday, Jan 20th 3:34AM
247,886,215	make signage clear that a crossing is there - pre warn drivers in good time raise the crossing as if on a wide speed bump railing either side of crossing area so it is more visible to all who use it cameras	Wednesday, Jan 20th 3:27AM
247,885,049	camera to identify unsafe practices	Wednesday, Jan 20th 2:02AM
247,884,961	Audible indicators as picked above is definitely one of the musts here especially for those who have some form of visual impairment.	Wednesday, Jan 20th 2:00AM
247,877,086	Zebra crossings are great. Let's have more of them. But perhaps some public information campaigns on how they should be used would be a good idea too. Your suggestions sound more like pelican crossings than zebras. The audible stuff could get really, really annoying for people who love and work nearby. Don't do that, please.	Tuesday, Jan 19th 5:54PM
247,876,544	Advertising campaigns to let both drivers and pedestrians know that zebra crossings prioritise pedestrians and that drivers have to stop when they see a pedestrian. I didn’t know that!	Tuesday, Jan 19th 5:28PM
247,871,501	I'm afraid they are a relic from the past, and the best thing would be to scrap them	Tuesday, Jan 19th 2:22PM
247,867,752	Zebra crossing only work when they are the normal crossings in an area - drivers' reflexes soon vanish when there are only crossings with signals. A lot of (re)-education is needed on drivers' responsibility towards more vulnerable road users. For the roads to be bearable for everyone, the volume of motor traffic needs to be reduced (what's the proportion of trips that are below 5 miles (or was it km)? - when drivers are all stressed out from sitting in interminable jams it's no wonder they give no quarter to (any) other road users.	Tuesday, Jan 19th 12:31PM
247,866,796	locate at convenient crossing sites-desire lines.	Tuesday, Jan 19th 12:01PM
247,864,888	Cameras on ped crossings. Many drivers drive far too fast in built up areas	Tuesday, Jan 19th 11:15AM
247,863,929	Enhance visibility on their approaches. Elevated crossings (speed tables)	Tuesday, Jan 19th 10:48AM
247,863,885	In a relatively quiet place, zebra crossings are generally ok. However, in busy towns they are not always suitable as there is no bunching of pedestrians so no clear break for traffic to move. This leads to impatience and increased chances of a driver going through a crossing when it is not clear. Pedestrian lights would be better in such locations as everyone gets their turn (Though I have witnessed a driver go through a red light on one of the too!)	Tuesday, Jan 19th 10:47AM
247,862,543	I particularly like the orange ball encircled in LED lights	Tuesday, Jan 19th 10:07AM
247,861,560	Some zebra crossings are not well lit and it is hard to see pedestrians approaching the crossing.	Tuesday, Jan 19th 9:33AM
247,861,057	Roads should be narrowed to single lane at ALL zebra crossings and have raised surfaces above road level creating a speed hump. This would mean cars HAVE to slow down for the crossing, so A) they are sure the lane is clear and B) don't damage their car on the hump. This would also improve sight-lines from traffic to pedestrians starting to cross and reduce the time pedestrians spend in the danger zone.	Tuesday, Jan 19th 9:18AM
247,860,867	Improved street lighting on both sides of the crossing so drivers can spot pedestrians easier in the dark.	Tuesday, Jan 19th 9:11AM
247,860,298	Raised table at zebra crossings and good quality lighting. More consideration into where they are positioned as crossings placed on bends sometimes mean view of peds is blocked by vehicle pillars, or placed in locations where peds are likely to congregate on the footway without crossing, leading to confusion on whether vehicles need to stop and driver frustration.	Tuesday, Jan 19th 8:55AM
247,860,146	better lighting at a crossing, in the winter if someone is dressed in dark clothing and it's not beside a lamp post it is very difficult to see them.	Tuesday, Jan 19th 8:49AM
247,857,666	Legal changes, for example: presumed guilt on the part of the motor vehicle driver.	Tuesday, Jan 19th 6:56AM

247,855,191	Mandate the paint to have better anti slip properties, and said properties have to last the life of the paint. They are very dangerous for two wheel vehicles.	Tuesday, Jan 19th 5:16AM
247,854,923	Instead of using white paint, which can wear out and be treacherous for cyclists, it might be better to make the stripes from a contrasting material like light coloured setts surrounded by dark coloured setts.	Tuesday, Jan 19th 5:03AM
247,854,789	Just have many more of them. Once there are normal rather than an oddity (like in most other western countries) people will know what to do and feel comfortable.	Tuesday, Jan 19th 4:59AM
247,854,362	Pedestrians need to assert their right to cross by stepping on to the crossing. Waiting for traffic to stop defeats the purpose.	Tuesday, Jan 19th 4:41AM
247,853,386	High grip visible surface on approach to zebra crossing with large warning triangles to inform road users of the hazard and traffic monitoring cameras to be used for rule enforcement (even against pedestrian who just step out)	Tuesday, Jan 19th 3:51AM
247,852,381	The issue with zebra crossings is lack of use, there are very few Zebra crossing and the ones that are inuse are not always well designed or implemented. There is also a number of 'zebra crossings' in supermarket carparks, which lack polls and yellow becons, which increase confusion, are these in fact Zebra crossings, or simply indicative crossing routes? A Policy of making all crossings in 20 mph zones would increase familiarity, compliance and safety whilst also achieving a key policy aim of switching priority from Vehicles to active travel.	Tuesday, Jan 19th 2:46AM
247,847,349	Ensure good street lighting, minimum road width and speeds at any zebra crossings. Where parallel crossings are used, consider localised PR campaigns highlighting that cyclists may be using the crossing.	Monday, Jan 18th 7:36PM
247,846,975	Actual penalties for dangerous driving. Capacity for pedestrians to report dangerous drivers.	Monday, Jan 18th 6:57PM
247,846,563	Place cameras like you have at a pelican crossing so drivers have to stop otherwise they get a fine like they would if the run a red light	Monday, Jan 18th 6:20PM
247,846,029	Make them edible	Monday, Jan 18th 5:45PM
247,845,712	Only for use on uncomplicated bits of road with no other traffic features	Monday, Jan 18th 5:24PM
247,845,596	Make them my re widespread. Not enough crossings in towns.	Monday, Jan 18th 5:16PM
247,845,516	National tv advertising on the rules for zebra crossings. Simplify the rules and give priority to pedestrians waiting to cross.	Monday, Jan 18th 5:09PM
247,843,922	All zebra crossings should be at same level as pavement which means road users have to slow to pass over the crossing, also change in regs/training so to make it a requirement when someone on the tactile paving they are required to stop, not when someone steps onto the road.	Monday, Jan 18th 3:38PM
247,843,502	Replace the requirement for an expensive belisha beacon with a Give Way sign and Give Way markings on the road. This would make it much clearer to road traffic that they must give way to pedestrians (and cyclists) crossing the crossing. It would also make zebra crossings much cheaper to install. Legalise use of zebra crossings by cyclists. Where there is conflict between cyclists and pedestrians, suggested segregation could be installed using different styles of paint, preferably continuous red paint for the cycle lane.	Monday, Jan 18th 3:13PM
247,843,219	Zebras are a useful & cheap option. If there is an issue it is that a few drivers are fully aware of their obligations to give way. We need more, at all crossing points, and not necessarily with Belisha Beacons which are expensive to install.	Monday, Jan 18th 3:02PM
247,843,178	Driver education on speed, however visibility from modern cars a pillars is terrible	Monday, Jan 18th 2:59PM
247,843,167	I suggest considering the cheap and simple style of zebra crossing that is common elsewhere in Europe. This research appears to have decided that zebras have certain problems and need to have more technology added, and to then be asking questions designed to justify the position.	Monday, Jan 18th 2:58PM
247,843,028	Change the law so that zebra crossings can be installed more frequently as they are in Europe, and don't require belisha beacons.	Monday, Jan 18th 2:51PM
247,842,910	Make them light controlled crossings!	Monday, Jan 18th 2:45PM
247,842,685	More of them so drivers are more used to them. Every side street would be good.	Monday, Jan 18th 2:37PM
247,842,680	Repercussions for drivers who do not stop as supposed to	Monday, Jan 18th 2:36PM
247,842,490	instead of trying to over engineer Uk zebras consider legalising / using continental zebras (without beacons) so people who need to cross the streets don't have to walk a mile to find an official crossing point. Europe is full of zebra crossings at every street corner. Is there evidence to suggest that they are more dangerous then UK style zebras. They are cheaper to implement and provide priority over vehicles at side street crossings and provides frequent crossings points in main streets too.	Monday, Jan 18th 2:26PM
247,842,414	Raised 'table' road surface at crossings so that drivers have to slow down.	Monday, Jan 18th 2:23PM
247,842,274	Provide physical measures such as chicanes to ensure that drivers will not be able to cross the crossing until they have manoeuvred their vehicle safely.	Monday, Jan 18th 1:35PM

247,842,253	Zebra crossings on speed bumps	Monday, Jan 18th 2:14PM
247,842,237	Paint a big yellow semi circle at each end (entry point from pavement) on to the crossing. Driveds must pay attention to pedestrians approaching fromvthede semi Circle and stop.	Monday, Jan 18th 2:12PM
247,842,168	Proper road maintenance making sure paintwork does not fade	Monday, Jan 18th 2:09PM
247,842,158	Due to the use and abuse of these i think they should just be replaced with a formal crossing where there is less risk	Monday, Jan 18th 2:09PM
247,842,121	I don't think you need to complicate it so much. Just make drivers aware of the rights of pedestrians. If zebra crossings require more infrastructure there will be less of them built. Just stick to the basic white stripes on ground. If drivers cannot see them they should not be driving.	Monday, Jan 18th 2:08PM
247,842,088	I would prefer if zebra crossings were replaced with traffic lights.	Monday, Jan 18th 2:07PM
247,841,881	There should be more zebra crossings - this would improve pedestrian safety, and also make it less unusual for drivers to stop when they see pedestrians approaching. In continental Europe, virtually all crossings are zebra crossings (without the beacon lights), and motorists are much more courteous.	Monday, Jan 18th 1:59PM
247,841,794	Zebra crossings should be used in series rather than in isolation. The more that are provided on a route or within an area would increase driver awareness, change behaviour and improve pedestrian confidence.	Monday, Jan 18th 1:55PM
247,841,640	Zebra crossings are the least safe way of crossing a road, change them to traffic lights and remove the beg buttons	Monday, Jan 18th 1:51PM
247,841,533	Cameras used to fine or prosecute drivers who do not suitably stop or slow down or who overtake at crossings or park on our too close to the crossing.	Monday, Jan 18th 1:44PM
247,841,193	Signs saying don't cross when pedestrians on the road	Monday, Jan 18th 1:32PM
247,841,163	I feel that question 8 is trying to solve issues that might not necessarily exist. Having lived in other countries with zebra crossings, I have never experienced or seen any real issues as most will stop when a pedestrian wants to cross although this might not be true for some people with disabilities.	Monday, Jan 18th 1:31PM
247,841,056	Rumble strips would be awkward/slippery and potentially unsafe for people cycling. However, having raised zebra crossings at pavement height, where the road surface rises up to the zebra crossing height (in a sinusoidal hump), would be a very obvious signal to road users that they need to approach slowly and always prepare to stop and give way to people wanting to cross the road. In addition, road speed limits should be 20 mi/h (or less) on roads where zebra crossings are used.	Monday, Jan 18th 1:25PM
247,840,998	I think zebra crossings are good because they force the road users to make an eye contract before the pedestrian steps onto the road. Thus decreasing the likelihood of a car driving straight through	Monday, Jan 18th 1:23PM
247,840,916	the whole of this survey seems to be geared towards the old rules of zebra crossings. Have you understood that there were changes made to the legislation concerning zebra crossings?????	Monday, Jan 18th 1:19PM
247,840,783	Make them easier & cheaper to install by removing belisha beacons. Change regulations to allow them to be installed at junctions with side roads. Install them across all junctions where a side road joins a main road.	Monday, Jan 18th 1:13PM
247,840,650	As always - enforce it! It seems that in the UK hardly anything gets enforced, especially if it has to do with cyclist or pedestrian safety. If police notices drivers not stopping at zebra crossings - fine them, and fine them heavily!	Monday, Jan 18th 1:07PM
247,840,618	Greater use of humped crossings which slow drivers down and also remove the likelihood of flooding where there are dropped kerbs.	Monday, Jan 18th 1:06PM
247,840,449	Need more of them	Monday, Jan 18th 12:57PM
247,840,273	Prosecute drivers who do not stop. Many drivers do not slow down when they come to the zebra crossing. On the continent they use zebra crossings well, we have had them for 50 years & drivers just ignore them.	Monday, Jan 18th 12:50PM
247,840,061	Make sure the paint is really visible on the roads, not rubbed off.	Monday, Jan 18th 12:39PM
247,840,003	Barrier the "Entry" to slow pedestrian access to the carriageway.	Monday, Jan 18th 12:38PM
247,839,996	Simple maintenance like ensuring that the zebra crossings are repainted frequently so that the white stripes aren't faded and ensuring that the flashing lamps are operational. Lights could be brighter during the day in my opinion.	Monday, Jan 18th 12:38PM
247,839,995	Possibly use raised tables to calm the traffic as well	Monday, Jan 18th 12:37PM
247,839,984	Fine drivers who don't stop at them when pedestrians need to cross. Lani of enforcement against driving crime is the key danger to pedestrians in Scotland.	Monday, Jan 18th 12:37PM
247,839,141	Where applicable and especially in urban locations, increase and encourage the use of zebra and tiger crossings in order to prioritise pedestrians and cyclists over other road users (in accordance with the transport hierarchy). Increasing the use of them will also making road users more familiar how they operate and in turn make them safer for all modes.	Monday, Jan 18th 4:52AM

247,837,390	Ban parking beside them. I am thinking particularly about the one in Victoria Street, Dyce where Tesco customers park.	Monday, Jan 18th 11:01AM
247,836,311	Ensure paint is non-slip. Even if road has been gritted I've slipped (as a pedestrian) on the white paint on road markings.	Monday, Jan 18th 10:23AM
247,836,108	The ones I generally use are all to close the junctions, therefore do not give adequate time/ room for vehicles to stop, when turning out of junctions.	Monday, Jan 18th 10:14AM
247,834,297	Pedestrian has priority signage and cyclist to dismount before crossing	Monday, Jan 18th 9:03AM
247,833,429	Monitoring of behaviour by police. Overt and covert as behaviour changes once big yellow jackets seen ! Translated guidance given many residents may never have experienced crossings before. Better education for kids. They will soon tell their parents they are doing things wrong.	Monday, Jan 18th 8:28AM
247,833,033	Perhaps making sure that road markings are clear and not run down so that all road users are clear it is a zebra crossing. Even the crossing used to provide an example of a zebra crossing is looking a bit tired.	Monday, Jan 18th 8:11AM
247,832,829	The crossings must be lit properly, poor sightlines must be avoided when planning new crossings, vegetation must be cut-back to improve visability.	Monday, Jan 18th 8:00AM
247,832,754	Make the law clear that it's the driver that has to stop. And use caution as approaching the crossing	Monday, Jan 18th 8:03AM
247,831,717	Improve lighting on them and upgrade belisha beacons to have an illuminated pole as well as a head (as outside Royal Mile Primary School, Canongate). Where appropriate, advance warning signs, particularly if there is not a clear approach. If failing to stop at zebras is a major issue, then an information campaign backed up by roving enforcement and driver education may be effective?	Monday, Jan 18th 7:16AM
247,831,376	In darkness, some luminaires are better than others that at providing a sharp and clear light over the point where pedestrians stand waiting to cross the road. Some are very good and highlight the pedestrian area really well, while others are less so and the light supplied is little better than standard street illumination. Is there a requirement to provide increased and brighter illumination at the crossing points and is there a national standard on this issue?	Monday, Jan 18th 7:00AM
247,830,224	Make sure they are repainted once the lines start to fade	Monday, Jan 18th 6:05AM
247,829,692	Clearly - an issue for the visually impaired. In Highland I am aware that supplementary signs have been erected warning road users to give way to pedestrians - I assume this is because that there have been issues.	Monday, Jan 18th 5:53AM
247,829,283	I think people just need to be reminded of the ettiquette, especially older drivers, a public awareness campaign would be good for this - as well as raising awareness of nay repercussions for cars that don't stop	Monday, Jan 18th 5:32AM
247,829,121	The installation of Zebra crossings is too onerous due to the need for lit belisha beacons, which requires electrical connections. This requirement should be changed to permit un-lit belishas so that it is more affordable to introduce zebra crossings.	Monday, Jan 18th 5:26AM
247,828,535	Beacons take space on the pavement which sometimes is very narrow, it would be good to remove this "requirement" as it adds clutter to already cluttered pavements. I understand however that this allows drivers to identify and reinforce the fact that there is an "formal" zebra crossing and that they do not have priority. Perhaps an "at level" zebra crossing with speed bumps on the approach. I would try to make the "formal" crossing simpler and reduce clutter and visual impact. I would stay away from any "electric" add-on as this would increase the cost of delivering them easily. Andres Lices - Dropped Kerb and Continuous Crossing programme project manager for City of Edinburgh Council (Active Travel)	Monday, Jan 18th 4:57AM
247,773,523	I think the Zebra Crossing should always be raised so that it acts as a traffic calming facility and also means motorists have to slow down even if no-one is crossing, parituarly if the road is 30mph. This could be removed if lower speeds	Friday, Jan 15th 1:22PM
247,771,281	I have seen various incidences of obstructive parking close to zebra crossings (on zig-zags) which reduces visibility. There are locations where footway build-outs could remove the temptation to park illegally and could provide a safer situation by a capital investment rather than necessitating Police or warden to patrol to protect zig-zags.	Friday, Jan 15th 11:41AM
247,770,278	I think that one of the issues that is often missed is the surrounding street lighting. I believe that street lighting around pedestrian crossings needs to be at a higher class than that of the surrounding area and I think this is often overlooked. Also there are occasions where the light from the beacons/poles can emit glare towards driver which actually makes it harder to see pedestrians at night. Another suggestion would be to have sensors which pick up pedestrians waiting to cross and this then triggers the belisha beacons to activate. This would make it clear to drivers that there is someone waiting to cross, however, would require a large amount of re-education on how they work. Detection loops in the road could link to audible/tactile signals to pedestrians to indicate when it is safe to cross.	Friday, Jan 15th 11:01AM
247,768,907	Consider cyclists using Zebras as a crossing point, esp outside school. Need education across the board, drivers and pedestrians. Due to dark nights consider lighting in the area.	Friday, Jan 15th 10:03AM
247,768,422	I believe that the major problem with Zebra crossings is the determination of when it is safe to cross. This is brought about by the need for pedestrians to have stepped onto the crossing prior to vehicles having to stop. This leaves both the driver and the pedestrian unsure as to just when the priority changes as pedestrians are often unwilling to step onto the crossing until a vehicle has stopped. This should be changed to pedestrians having absolute priority as soon as they wait to cross thus removing this area of conflict.	Friday, Jan 15th 9:58AM
247,768,264	Regular maintenance to refresh markings and additional signing to draw drivers attention to the crossing.	Friday, Jan 15th 9:51AM

247,759,670	Move them away from corners on the road.	Friday, Jan 15th 2:47AM
247,745,126	Make the rules around stopping g for a pedestrian more clear A pedestrians ‘Intent to cross’ can easily be misconstrued and lead to confusion. Making the Highway Code more clear about stopping for any pedestrians near a crossing removes this doubt	Thursday, Jan 14th 1:57PM
247,741,564	Don't put them directly off roundabouts. Drivers watching the road might not see a pedestrian.	Thursday, Jan 14th 12:17PM
247,738,183	Flood lights on walking area	Thursday, Jan 14th 10:39AM
247,727,037	Some crossings in the wee county are far too close to road junctions and in my opinion cause more danger to slowing traffic especially at mini tour a bouts. The 2 crossings at Tullibody cross are a disgrace and very badly designed in their location. Both should have been placed furthe back from the mini round a bout and staggered junction to give vehicle s a chance. Also the Tesco’s one at the round a bout is too close to to vehicles just turning off the round a bout.	Thursday, Jan 14th 4:42AM
247,726,469	Teach people the rules of a zebra crossing. They should not step foot onto the road until they see a car has stopped. As a driver this panics me incase I miss someone and they just go regardless.	Thursday, Jan 14th 4:21AM
247,725,641	Put traffic lights on the crossing that way the vehicles on the road must stop at the lights .	Thursday, Jan 14th 3:43AM
247,711,714	Avoid putting them immediately where cars are exiting roundabouts.	Wednesday, Jan 13th 5:17PM
247,711,694	replace them all with pedestrian controlled traffic lights	Wednesday, Jan 13th 5:14PM
247,710,728	Consider the location and education eg green cross code.	Wednesday, Jan 13th 4:57PM
247,708,287	May be Ramps just before in town to slow cars . Sign to tell bikes to dismount . Signs and TV adverts how to use them. People have forgot	Wednesday, Jan 13th 4:12PM
247,706,199	Please distance further from roundabouts. Our area situates the crossing immediately a few metres from the mini roundabouts. As a driver I'm concentrating on turning, ensuring other cars stop & immediately at the point you're starting to 'pull away' on the new road you have to stop again. From both driver & pedestrian I'd feel safer if it was spaced further along	Wednesday, Jan 13th 2:58PM
247,704,995	Traffic calming would be ideal around zebra crossings. I live in Moss Road, Tillicoultry and cars often spotted down this 30mph road at speeds I would estimate in excess of 50mph. We do have zebra crossings in the village but I never attempt to use them unless I know the traffic has stopped. More speed bumps and traffic calming would greatly increase confidence for pedestrians.	Wednesday, Jan 13th 2:14PM
247,702,715	In question 8 it let's me only select one. Considering there are visual and hearing impaired people using zebra crossings too both audible, visual and tactile indicators would make sense to me.	Wednesday, Jan 13th 1:05PM
247,701,704	Don’t put them where cars can’t see round corners. The one at top of tescos Alloa is a accident waiting to happen! Cars come round the corner blind straight on to a crossing !!	Wednesday, Jan 13th 12:38PM
247,701,454	Change beacon colour when pedestrians detected on crossing or have activated crossing as described in previous section. Consider how 5G connected infrastructure can communicate warnings with vehicles.	Wednesday, Jan 13th 12:31PM
247,701,363	Some modern beacons have black and white light up poles as well as the yellow top. These are excellent and should be made standard.	Wednesday, Jan 13th 12:25PM
247,700,344	Lights shining directly on the the pavement at each side so driver visibility is increased.	Wednesday, Jan 13th 12:00PM
247,696,278	Use traffic lights instead as zebra crossing are ignored by most drivers and they are unsafe for children especially	Wednesday, Jan 13th 10:17AM
247,696,094	Educate pedestrians how to use them would be good start - the number who don't look, or cross while on their phones not watching the traffic is unbelievable.	Wednesday, Jan 13th 10:13AM
247,696,011	More thought has to go into where crossings are sited. They are even sited on bends and just around corners. More visual indicators for traffic on approach. Don’t place bus stops on the approach to a crossing. Overtaking traffic will often pass the bus not realising there could be someone waiting or already starting to cross. Currently the law says that traffic does not have to stop until someone is on the crossing. This needs to change to traffic must give way to anyone waiting to cross.	Wednesday, Jan 13th 10:10AM
247,695,076	Better street lighting at every crossing so drivers can see anyone approaching the crossing. Education of who has right of way.	Wednesday, Jan 13th 9:45AM
247,694,611	Roadsigns ahead of the crossing to warn driver there is one ahead. Positioning of a lot of Zebra Crossings could be better placed to allow clear visibility for all and better lighting at night.	Wednesday, Jan 13th 9:32AM
247,694,493	Not locating them so close to junctions and or roundabouts	Wednesday, Jan 13th 9:29AM
247,694,354	Cameras on crossings, fine cars who won’t stop or go too fast through crossing and endanger people	Wednesday, Jan 13th 9:26AM
247,694,196	Do not place them near junctions, roundabouts etc as this does not give drivers enough notice to slow down/stop an often creates situations where pedestrians are in danger and cars risk running into the back of vehicles that have had to stop at the crossing.	Wednesday, Jan 13th 9:21AM

247,693,903	Move crossings to a safer distance from road junctions	Wednesday, Jan 13th 9:14AM
247,693,765	Encourage the public not to stand and chat at a zebra crossing as you never know what their intentions are. Also put crossings in sensible areas where there is a clear view for drivers to see pedestrians approaching, and avoid putting them right next to roundabouts or turnoff's in the road as it posses an accident risk! Place warning signs where there are ramps near the crossing for slowing.	Wednesday, Jan 13th 9:10AM
247,693,545	Most of the time it is poor maintenance of the crossings and bad lighting that stop drivers seeing the crossings. And modern distractions for drivers. You cant put the obligation on the padestrian you might as well put in traffic lights, than wasting money on the above suggestions.	Wednesday, Jan 13th 9:04AM
247,693,123	My local authority area has zebra crossings directly after mini roundabouts. Making it difficult to watch roundabout for cars and gauge where pedestrians are trying to cross. Also having had to stop suddenly myself and cars behind me can not see pedestrian because of corner causing a near accident. Have them on the brow of a hill making it hard for people not from area to know there is one at the top of the hill.	Wednesday, Jan 13th 8:02AM
247,693,065	Better signage on approach for vehicles and signage for pedestrians	Wednesday, Jan 13th 8:52AM
247,692,849	Well used zebra crossing, if not so already, should have cameras. Think people would be astonished at some of the bad behaviour of some of the drivers.	Wednesday, Jan 13th 8:44AM
247,692,635	I think all zebra crossings should have a walkway, gated are where u stand until it's safe to cross. There are too many dangerous crossings where u can't see if anyone is going to step onto the crossing. Anyone going to cross should be more visible. Some crossings have no filter method and the entry to the crossing is wide open thus people just step into it without pausing or children can just run onto it	Wednesday, Jan 13th 8:40AM
247,691,612	Do not put them near roundabout exits . Make sure the lights work AND ARE SEEN.	Wednesday, Jan 13th 8:07AM
247,691,546	Don't have them so close to mini roundabouts the same I would say should apply to traffic light crossings Alloa has both going on its very dangerous to pedestrians and drivers and also causes traffic jams	Wednesday, Jan 13th 8:05AM
247,691,428	Not have roundabouts too close to them the one at the leisure bowl in alloa is an accident waiting to happen it's too close to the roundabout	Wednesday, Jan 13th 8:02AM
247,691,413	Don't place them so close to junctions and/or roundabouts. I have a 4yr old and a 10 month old baby and if the only crossing available is at a junction or a roundabout, I will avoid this and cross by using other means	Wednesday, Jan 13th 8:02AM
247,691,236	Locate the zebra crossings where drivers can see in advance any pedestrians that are about to walk through onto one. Some are located as you turn a corner, others are placed where you come round a bend and suddenly come across a crossing which when dark is poorly lit. The main one at Clacks hq at Tesco, you can't see pedestrians until the last minute. Children sometimes cycle across here on their bikes having obviously been told they have right of way. This is obviously true however not every driver is aware of the blind spots as you approach this zebra crossing.	Wednesday, Jan 13th 7:54AM
247,691,165	Ban on the use for cyclists unless dismounted	Wednesday, Jan 13th 7:56AM
247,691,112	I think they should be changed to pelican crossings as these are safer	Wednesday, Jan 13th 7:53AM
247,691,064	Put them in a safe place not directly after a roundabout as that makes no sense at all. The one at the leisure bowl is a prime example.	Wednesday, Jan 13th 7:53AM
247,690,879	Reduce speed, using speed bumps I dont think tumble strips would work. Fit cameras and issue penalty points for not complying or speeding.	Wednesday, Jan 13th 7:47AM
247,690,456	Have consideration as to where to locate crossings. The two at Tullibody Cross are dire. From the Main Street to the Cross, almost every car waiting to turn into Alloa has to sit across the zebra crossing in order to have sight of the traffic. The crossing on Menstrie Road to the Cross is the same.	Wednesday, Jan 13th 7:43AM
247,690,391	Decrease road width to make pedestrian intention clear, site crossings away from roundabouts and junctions so drivers have clear view. If needed near junctions or roundabouts use other crossing means/ traffic lights	Wednesday, Jan 13th 7:40AM
247,690,380	Better lighting in areas where there is zebra crossings Better, Bigger and More signage of zebra crossings Cameras actually covering crossings so when accidents do happen it's clear to understand who was in the wrong, I'm sick of trying to do the school run and try not to be knocked down by speeding cars in Alloa towns zebra crossings at TESCO and on AULD BRIG ROAD! Absolutely unacceptable!!	Wednesday, Jan 13th 7:40AM
247,690,361	Camera s to make cars stop	Wednesday, Jan 13th 7:39AM
247,690,319	Move them MUCH further away from roundabouts and junctions	Wednesday, Jan 13th 7:35AM
247,690,243	Improve positioning of them...some are badly placed near busy junctions and roundabouts ...drivers don't leave them clear and pedestrians are often obscured by cars queuing on the opposite side, Another option would be a flashing road sign as drivers approach. Education for both drivers and school children would be beneficial. Children assume drivers will stop so run across without looking.	Wednesday, Jan 13th 7:35AM
247,690,126	Set up speed cameras at all zebra crossings	Wednesday, Jan 13th 7:32AM
247,690,102	Implement high way code testing when applying or reapplying for road tax, vehicle insurance, or driving licences. At the moment we only check highway code knowledge at the time a person takes their driving test. Highway code knowledge must be tested more regularly.	Wednesday, Jan 13th 7:30AM

247,690,094	Make the flashing bulb lights only flash when someone has pressed a button to cross the road. Then drivers will have something that changes in there view when someone is there. Right now the cossing always look the same to drivers. Also move crossings away from corners where they can not be seen or put a flashing light like mentioned above before the corner that flashes when someone presses the button.	Wednesday, Jan 13th 7:29AM
247,690,006	Larger signs for pedestrians to WARNING - STOP & WAIT !	Wednesday, Jan 13th 7:27AM
247,689,904	Light the crossing up more , someone crossing in the dark with dark clothing on is so hard to see. Zebra crossing me which are placed round the corner from a roundabout is a massive risk. I've witnessed many an accident people watching to the right of them at a roundabout unaware of someone crossing the zebra crossing in front of them .	Wednesday, Jan 13th 7:21AM
247,689,779	Zebra crossing are great. Caution needed but make crossing roads safer but without need for traffic lights. If problem are found it probably due to lack or education for drivers and pedestrians on how to use them (thought it's pretty straightforward!!) Some zebra crossing locally seem to have been out rather close to junctions and mini roundabouts which does seem unsafe.	Wednesday, Jan 13th 7:12AM
247,689,704	Driver training isbrequired and some campaign to make people aware that they should be stopping.	Wednesday, Jan 13th 7:17AM
247,689,645	Replace them with traffic light crossings	Wednesday, Jan 13th 7:15AM
247,689,607	Educate users that pedestrians need to stop and ensure traffic has seen them rather than walking along pavement and just suddenly stepping out onto oncoming traffic	Wednesday, Jan 13th 7:13AM
247,689,574	Reduce the amount of zebra crossings and replace them with puffin or pelican crossings - this makes is clearer for drivers (especially uneducated drivers) on how the crossing works and that they must stop.	Wednesday, Jan 13th 7:11AM
247,689,203	More warning signs on approach while in a car. Brighter lighting around the area. Move the crossings away from corners and junctions.	Wednesday, Jan 13th 6:59AM
247,689,167	Fixed fines for drivers/cyclists not adhering to laws and more training for pedestrians who think it's their right to walk straight out	Wednesday, Jan 13th 6:56AM
247,689,148	Barrier that stops traffic allowing people (Especially children) to cross safely. Traffic lights are good but many drivers drive threw red lights to now.	Wednesday, Jan 13th 6:55AM
247,689,138	I think increased lighting on the crossing and on approach to the crossing would be beneficial as it is difficult to see people approaching the crossings at night	Wednesday, Jan 13th 6:56AM
247,689,094	Re assess the position of some in regards to - A. different lighting conditions such as twilight and low sun. B. Distance from junctions Assess how well used they are as this will give an indication on how safe people feel using them.	Wednesday, Jan 13th 6:51AM
247,689,025	Dont put them so close to junctions, right outside main entrance to parks, paths etc...I've had on numerous occasions people, kids, cyclists just come right out of park, path etc. & step on crossing. Accidents waiting to happen	Wednesday, Jan 13th 6:50AM
247,688,999	Install traffic calming measures to ensure traffic slows down when approaching crossing	Wednesday, Jan 13th 6:48AM
247,688,949	Signage that there is a crossing up ahead for drivers, make crossing lights brighter! It is generally the driver at fault, not the pedestrian, so efforts need made to make it safer	Wednesday, Jan 13th 6:45AM
247,688,908	Change to traffic lights	Wednesday, Jan 13th 6:41AM
247,688,733	Make the one way system for both cars and cycling, slower speeds on main roads. Bikes not aloud to go three/ four a breast for the cycle groups that were using the roads. In our area there was some cycle groups going out with 20-30 cycles at a time.	Wednesday, Jan 13th 6:37AM
247,688,731	For them not to be close to a roundabout. Lots are as soon as you come off a roundabout which isn't ideal	Wednesday, Jan 13th 6:37AM
247,688,687	The most dangerous crossings are the one's just around corners, and just off roundabouts. Drivers are trying to read traffic, signal, and keep traffic flowing and just around the corner is a zebra crossing which adds to an already busy mind and an accident waiting to happen. As a driver, we can't see around corners to anticipate whether someone is there or going to use the crossing, so it does mean we have to stop suddenly when someone is using those crossings, again a hazard to other drivers as well as the pedestrian.	Wednesday, Jan 13th 6:34AM
247,688,666	It's mostly about education of drivers. Many drivers believe they have absolute right of way at all times (over pedestrians and cyclists) and refuse to stop at pedestrian crossings. As a regular user of pedestrian crossings I've witnessed this countless times. Cycling on our roads is also generally dangerous as many drivers do not believe cyclists are entitled to be on the road at all. As a cyclist I've also witnessed this countless times and think myself lucky that I haven't been hit by a car.	Wednesday, Jan 13th 6:34AM
247,659,395	Zebra crossing on raised tables could indicate that the pedestrian has priority, however not suitable on all routes. Awareness campaign for all road users, as many just don't seem to understand that the driver must stop. However I do think pedestrians that know they have priority do not take a duty of care for themselves to make sure the car has seen them and stopped. Maybe this 'right of way' should be caveated with if the vehicle has seen you. Need more consideration of how cyclists and mobility scooters and scooters/e-scooters use zebra crossings. Zebra crossing were not designed with these users in mind, should barriers be used on approach? Difficult with so much other street furniture and for people with disabilities.	Tuesday, Jan 12th 12:04PM
247,602,376	Consider replacing zebras with other safer types of crossing	Monday, Jan 11th 5:41AM

247,577,327	Well lit & frequently painted zebras could help. Make cyclists aware they must dismount when using a zebra to cross a road. Introduce more 20mph zones	Sunday, Jan 10th 1:42PM
247,569,956	Maybe put up video cameras or have the police speed camera vehicles from time to time to raise awareness on crossings where drivers tend to behave inappropriately.	Sunday, Jan 10th 6:45AM
247,569,761	All the options above need to be taken to be inclusive & prevent disability discrimination.	Sunday, Jan 10th 6:23AM
247,565,211	I always thought zebra crossings were very safe.	Sunday, Jan 10th 3:48AM
247,550,854	Add red stop lights for traffic!	Saturday, Jan 9th 5:43PM
247,549,669	Only use zebra crossings in 20mph zones	Saturday, Jan 9th 4:52PM
247,549,502	Replace them with pelican crossings	Saturday, Jan 9th 4:44PM
247,548,225	Better signage for cyclists & cars to warn of crossing - flashing lights on crossing signs in advance of the crossing. As well as the light on the top of the Belisha Beacon additional flashing lights on their posts.	Saturday, Jan 9th 4:00PM
247,547,811	Options a b and e above are good but I could only choose two	Saturday, Jan 9th 3:46PM
247,537,952	Tactile signals are no good if the pole is not right next to the crossing, so don't use them unless they are in a suitable place. have ways other than a button which has to be located to activate the crossing	Saturday, Jan 9th 10:19AM
247,536,670	I think if they were more prevalent, such as at every side street crossing, then drivers would become more aware of them and potentially respect them more. This would need the requirement to provide beacons at each crossing to be removed. Possibly if they could be indicated in other ways, (i.e. surfacing, colours) this coukd make them more easy to identify. Having the scope to inventive could help instead of being hamstrung by current standards.	Saturday, Jan 9th 9:28AM
247,535,844	Educate drivers that pedestrians have priority at zebra crossings. Drivers should slow down when approaching zebras so they have time to check for pedestrians and stop	Saturday, Jan 9th 8:54AM
247,533,015	How would audible or visual indicators to inform pedestrians that it is safe to cross work? Surely it is more important to give an indication to drivers that they must stop. Replacement of zebra crossings by pelican or toucan crossings would be the best solution.	Saturday, Jan 9th 7:13AM
247,525,595	*Remember to think about people with Guise dogs for Blind & Deaf candidates. *Lighting needs to be bright for drivers	Saturday, Jan 9th 4:09AM
247,489,979	I said f. in question 8, but I really meant I don't know, because I don't know what would help. I've never had an issue with zebra crossings, drivers always stop	Friday, Jan 8th 12:21PM
247,485,909	More education for drivers is essential. Making it legal to install cheaper zebra crossings, as advocated by Chris Boardman (https://www.bbc.co.uk/news/uk-england-manchester-48744233) would also be an excellent step, and would result in a far higher number of crossings, making walking easier for everyone. More zebra crossings would also make them a more frequent occurrence for drivers, making it easy to retain and reinforce proper behaviour around them.	Friday, Jan 8th 10:57AM
247,475,648	As a zebra crossing requires the pedestrian to step onto the crossing the options you are considering re feedback are more conducive for a push button crossing. Enhancing conspicuity of crossing and having them well lit to avoid shadows are a must.	Friday, Jan 8th 7:08AM
247,474,460	Replace them with Puffin Crossings	Friday, Jan 8th 6:38AM
247,472,667	So many crossings are worn out and not obvious to drivers, meaning they often don't realise it's there until too late. Same applies to road markings in general. Edinburgh has been poor at repainting them.	Friday, Jan 8th 5:54AM
247,471,201	I have a zebra crossing local to me, the road is very dark now the new LED type street lights are in place. Possibly a bright light soley for the crossing would be beneficial for all.	Friday, Jan 8th 5:13AM
247,430,096	Cameras and heavy fines / endorsements. Force insurance companies to increase premiums for car driver offenders. Finland rt fines are a percentage of take home pay ????	Thursday, Jan 7th 5:29PM
247,428,786	I know why they exist but I believe a lot of drivers don’t know how to behave safely. If there were also notices at each crossing reminding pedestrians about their priority and safe use it might help. But ultimately I think they should be phased out (although pedestrians are potentially vulnerable using any type of crossing)	Thursday, Jan 7th 4:49PM
247,427,802	We should follow Wales by having 20mph speed limit as the default limit in all residential and urban areas	Thursday, Jan 7th 4:15PM
247,425,846	I think all crossings should have traffic lights whereby the traffic has to stop when pedestrians have the right of way to cross, ie green man. I have witnessed in the past , drivers ignoring the fact that pedestrians are waiting to cross/or crossing the road and there has been a few near misses. Zebra crossings are dangerous, with no clear indication that cars etc are going to stop. I always make sure traffic has stopped before I put one foot on the zebra crossing & I continue to look both ways whilst crossing. It must be a nightmare for blind people with or without guide dogs & its a danger to children.	Thursday, Jan 7th 3:26PM

247,425,741	Change the law to make it clearer that vehicles must stop if a pedestrian is waiting to cross or clearly intending to cross before they enter the zig zag area. Decriminalisation of enforcement and allow camera enforcement. Mandatory tactile markers on pole to allow identification of crossing.	Thursday, Jan 7th 3:23PM
247,424,627	Much stricter penalties for vehicles not stopping that are involved in a near miss. Also zebra crossings that have been involved in a near miss should be made even more visible with a universal recognisable sign or colour scheme to make it really stand out. Also cameras on these crossings (school routes) that can be used for recording dangerous driving. Maybe also have a person observing these crossings from a distance to see for themselves. When I reported one before to my council they sent someone to stand and observe who was wearing a HV jacket that made everyone slow down. Safe to say this wasn't realistic as everyday people don't wear knee length HV coats so it was a unfair assessment. Thank you	Thursday, Jan 7th 2:59PM
247,422,864	Change beacon flashing pattern / extra warning to drivers when crossing is being used by visually impaired person. neate box technology	Thursday, Jan 7th 2:33PM
247,404,938	The lighting of zebras need to be improved. They should be much more iluminated than the surrounding road.	Thursday, Jan 7th 12:00PM
247,393,509	Put traffic cameras on them - the only way some people will stop is if they think they have been filmed	Thursday, Jan 7th 10:49AM
247,383,598	Very difficult to know when to cross the zebra crossing when you are blind having no idea when it is safe to do soo	Thursday, Jan 7th 9:48AM
247,357,401	Make all zerbra crossing raised/on a ramp to slow and encourage cars to stop and not just wizz by without caring or stopping.	Thursday, Jan 7th 7:06AM
247,348,899	Enforce existing laws and actually prosecute drivers that fail to stop at zebra crossings.	Thursday, Jan 7th 6:14AM
247,343,562	Firstly I think we need a lot more zebras and put them where most people want to/try to cross Secondly where zebras are on a main road and near to a side road junction I believe we should have a side by side crossing for cyclists and pedestrians to cross . lastly we need to have the zebra crossing paint looking bright and complete rather than (as if often the case) half erased and grey	Thursday, Jan 7th 5:45AM
247,322,743	make all the zebra crossings the type that requires cars and cyclists to stop as soon as someone is approaching them (sorry im not sure of the name)	Thursday, Jan 7th 3:50AM
247,215,147	Being register blind approaching crossings you do not know if cars are slowing down. So anything that would help V.I.P would ve grateful.	Wednesday, Jan 6th 2:02PM
247,215,141	The best thing about zebra crossings is that they're not formal. If no one is using them, traffic can flow freely and in practice drivers are almost always respectful of pedestrians waiting to use them, please don't get rid of them or over- complicate them	Wednesday, Jan 6th 2:05PM
247,164,259	Zebra Crossings are an effective way to control traffic without causing extended delays like the bizarre installments of crossing points at roundabouts. They're a necessary evil, but the main things you need to consider for any crossing point is; how long does it take for people to identify, access, indicate to traffic from and cross from the crossing point to the opposite side safely? How long do those steps take individually and together? You may think of your own experience, you may be used to waiting no longer than a minute or two but not everyone has the same level of confidence, ability or mobility to make that type of experience a reality for everyone. There are however mitigating, tangible changes that can be put in place. Firstly, for a majority just visual or audible signs would be enough, even just a car stopping is fine for most in many cases but that instinctual, somewhat complacency for the status quo with this is outdated and only causes heightened risk for those with mobility issues, particularly those who have sensory impairments like myself or those with dual hearing/visual impairment. These crossings should be safe for anyone able to cross independently. That's why would have if it allowed me to tick all boxes under the enhancements that should be made. There should be; properly laid tactiles, physical indicators that the traffic has stopped alongside audible and visual cues - these should also be well-maintained to ensure faults/risks/disruptions are uncommon, with that Rumble strips should definitely be implemented and information on such crossings should also be provided to drivers - especially why certain pedestrians may behave differently to indicate they wish to cross. A Guide Dog owner like myself for example will put our right foot forward at the kerb of a zebra crossing, how many drivers do you think know what that means? I'd guess at least some will just think we are just standing funny. This information should be provided during driving theory tests too. As you will know zebra crossings will only have become more dangerous as shared space expansion has continued to tear away at familiarity and accessible layouts for admittedly a fresher, modern look but it's far from safe. The increass in electric and dual electric-fuel has also added to risk for those of us with sensory/mobility impairments. Everything that can be done to make not just zebra, but road crossings entirely should be completed as soon as it's practical to do so. Thank you for reading! Robert & Guide Dog Winnie! ????	Wednesday, Jan 6th 10:43AM
247,146,167	I approach a zebra crossing (infrequently, there are none in my local area) on the same manner as I would approach a shared use surface, with caution both as a driver and pedestrian. Although the pedestrian has priority, I would still exercise caution.	Wednesday, Jan 6th 9:30AM
247,145,830	Paint them bright yellow, rather than white, so drivers can see them and know not to stop on them. Every junction should have a zebra crossing, so pedestrians can cross safely, without risk of cars not stopping	Wednesday, Jan 6th 9:30AM
247,139,540	Making sure cyclists know they need to stop for pedestrians - most car drivers will stop if there is a person waiting to cross. Too often cyclists ignore the person wanting to cross or cross the crossing on their bikes either horizontally or use the crossing themselves while a pedestrian is crossing. This is particularly bad if you are deaf and cannot hear them behind you.	Wednesday, Jan 6th 9:04AM
247,124,140	Alternative signal system - button for pedestrians to press which initiates flashing amber lights (either beacons or more like a traditional signal head) to warn drivers pedestrians may be crossing, could also be fitted with audible warning, spinning cone, etc. to help those who are visually impaired. Raised table style crossing to force vehicles to slow down and give more indication that pedestrians have priority.	Wednesday, Jan 6th 8:09AM

247,086,153	The key to improving most crossings, including zebra crossings, for most users, is to design them so they are obvious and prominent. Often crossings are partially hidden by parked vehicles, and wide sections of carriageway remain to be crossed. Key is to design the carriageway so that the presence of the crossing stands out - with road narrowings, breaking opposing carriageways into separated lanes and so on.	Wednesday, Jan 6th 5:37AM
246,943,732	Not sure, but a way of enforcing no phones while driving would improve safety for pedestrians and cyclists generally.	Tuesday, Jan 5th 11:23AM
246,930,597	Zebra crossings should be visible to road users for around 60 - 100 metres either side so people with mobility issues, hearing, visual and learning impairments can see oncoming traffic and oncoming traffic can see them. A pelican crossing should be used where there is limited visibility or yellow/pink markings etc put in the road from e.g. 30/40 m distances as warnings in the middle of the side of the road cars approach on - even repeating solid circles a couple of feet across would do. A lot of road users don't seem to get that I have to wait off the crossing for them to stop even when they are going slow because I don't have the flexibility of movement to get out of their way if I'm on it and they don't see me. Sometimes I have to wait for cars to come and then stop because its unsafe otherwise in case they don't see me. It is frightening being already on a crossing when someone speeds round the corner at 30 miles an hour and screeches to a halt, endangering vehicles following behind as well as the person on the crossing when they are braking just in time. I find the sudden loud noise of the braking as well as the sudden close proximity of the vehicle knocks me out cognitively and leaves me shaky. In a less familiar area, or on a bad day, I might go paralysed due to it. My local zebra crossing is at a cross roads - directly on one of the multi use roads as it crosses the other busier vehicle only one. Cars turning from the busier road cut right across the zebra crossing to turn right or left. Many expect me to move out of their way when I am approaching the zebra crossing at up to 3 metres away and expect me to move across the slope of the road, which is unsafe to do in a wheelchair, to get out of their way. Cars shouldn't be able to turn across a zebra crossing when someone is approaching it and is only a few metres away (at mine we end up facing each other head on which is unnerving as they are moving albeit slowly). This is especially bad as there is a notable slope down to the zebra crossing on one end into a multi use road, because wheelchairs aren't designed to do slopes in two directions and some can slide - mine used to- the new road surface is helpful but I avoid it in rain etc mostly because of being scared of a vehicle user turning into me (sometimes only a metre away) and so forcing me not to approach the zebra crossing head on and potentially sliding. Not knowing if its gritted enough in bad weather would make it even more dangerous. The old pelican crossing wasn't on accessible pavement to wheelchair users and I'd have to wait in the side multi use road for vehicles to see me and stop but there must be better designs for the zebra crossing?	Tuesday, Jan 5th 10:26AM
246,906,792	Better street lighting around crossings so car drivers can see pedestrians	Tuesday, Jan 5th 9:09AM
246,906,709	I would also support the use of measures such as rumble strips.	Tuesday, Jan 5th 9:10AM
246,901,080	I think that many drivers are unfamiliar with the requirement to stop and give way to pedestrians who have started crossing. This is an issue of driver education.	Tuesday, Jan 5th 8:50AM
246,884,665	Greater level of enforcement by Police relating to abuse by motorists	Tuesday, Jan 5th 7:55AM
246,875,581	Allow more simplified zebra crossings in 20mph zones.	Tuesday, Jan 5th 7:28AM
246,871,199	Consider widespread implementation of 20mph speed limits in current 30mph zones to compliment other measures to improve safety around zebra crossings.	Tuesday, Jan 5th 7:15AM
246,853,204	I think that all of your ideas regarding stopped traffic detection above a very poorly considered. There is no such detector that can provide the necessary data. Your proposal also fundamentally changes the way safety is assured at crossings. It is always the responsibility of the crosser to ensure it is safe to cross and for drivers to drive appropriate to the situation. There is no crossing type that signals to crossers when it is safe to cross. Please note that PUFFIN, TOUCAN, PEGISSUS and PELICAN crossings give a green man/ green other/ audible/ tactile indication to signal that vehicles have been signalised to stop. The issues I see with them is that it is government policy that we should be using these types of facilities and then TS put out a document saying that we should not due to disabled users. There is no clear guidance on their use making it difficult to implement them. Also with the historic move to PELICANS which almost completely replaced this crossing type so few of these are left that many drivers are no longer used to them. So we needed updated design guidance to get them out there which has reliable information on disabled users (in particular mentally disabled users) and some effort on driver training would not go a miss.	Tuesday, Jan 5th 6:19AM
246,850,302	Visual signs which warn drivers of 20mph zones are very effective - perhaps something similar on approach to a pedestrian crossing. Afterthought to a previous question: I have also witnessed near-misses in which a wheelchair user has almost been missed at a pedestrian crossing - as drivers often tend only to look / expect people to be standing. Perhaps the above-suggested signage could include an image of a standing person, a seated/wheelchair user, and a person with a stick/zimmer-frame/crutches to denote the various possibilities of zebra-crossing users.	Tuesday, Jan 5th 6:08AM
246,198,413	More 20 mph zones, and more speed cameras or monitoring of 20and 30mph zones. Sadly the density of motor traffic means more controlled green man crossings are needed. A continual traffic stream limits a driver's awareness and view of pedestrians.	Thursday, Dec 31st 2:19AM
246,147,959	Replace them with Pelican crossings or similarar. Drivers do not appear to show the same level of courtesy as they did years ago and cannot be trusted to just give way to a person at a Zebra crossing.	Monday, Dec 28th 3:52PM
246,147,067	Lower speed limits	Monday, Dec 28th 3:07PM
246,133,826	enforce zig-zag areas to ensure visibility of to users to drivers.	Monday, Dec 28th 5:48AM

246,120,261	change all zebra crossings into traffic light crossings	Sunday, Dec 27th 2:01PM
246,111,636	Better road markings or sign warning approaching a crossing	Sunday, Dec 27th 6:19AM
246,105,049	Make them traffic lighted crossings instead of zebra crossings where traffic has to stop.	Saturday, Dec 26th 6:20PM
246,050,393	Replace them with normal light controlled crossing.	Thursday, Dec 24th 9:10AM
246,045,489	Put crossing onto tables to provide level access for all pedestrians (so many crossings seem to attract puddles). Drivers seem to manage to slow down aporoaching speed bumps much more reliably than zebra crossings despite zebra being much more visible.	Thursday, Dec 24th 7:20AM
246,045,312	I think measures need to be considered that are INCLUSIVE: ie tactile, audible & visual. Measures to decrease speed would be exceptionally helpful. Also clarity of right of way.	Thursday, Dec 24th 7:10AM
246,002,250	Neatebox has an app named button that allows people of all abilities including blind to access an app on their phone that triggers crossings to go to the stop position. I feel Zebra crossings are very unsafe for blind people like me as traffic rarely know how to treat pedestrians as we cross often reving engines or moving while you are still crossing when they have stopped for you.	Wednesday, Dec 23rd 3:18PM
245,997,887	There are not enough light controlled crossings and zebra crossings are dangerous for visually and hearing impaired people. Especially now we have increasing numbers of quiet electric cars and cyclists not to mention drivers who don't respect them or us. Rumble strips too please. I actually checked all of the suggestions above apart from f none of the above!	Wednesday, Dec 23rd 2:12PM
245,987,708	As a sight-impaired pedestrian, zebra crossings are my nemesis, though sometimes completely unavoidable. In terms of locating the crossing, it would be useful to have a different pattern of tactile paving from the standard "square dot" layout (and obviously different from the "diamond dot" pattern used to indicate railway / tramway platform edges). Radar / Lidar vehicle detection and audible, visual and tactile indications that it is currently safe to cross would also be extremely valuable. Also, consider a new format of Belisha Beacon - currently these are yellow only - use modern LED technologies such that when a sight-impaired, cognitively-impaired, or other person presses a 'call' button similar to that on a pelican / puffin / toucan crossing the Belisha Beacon changes from alternating yellow to simultaneously flashing red as an additional warning to drivers that there is a person waiting to cross who may need additional time. For clarity, make the 'call' button on the posts a different shape to those on a controlled crossing, preferably something easily noticeable, such as a triangular button.	Wednesday, Dec 23rd 10:46AM
245,980,801	Better enforcement of parking om zig-zags. Zig-zag enforcement to be extended to pavement. Increase visibility of crossing. Road sign on approach? Different colour road surface on approach? Rumble strip on approach?	Wednesday, Dec 23rd 7:56AM
245,979,349	Except for situation where there is both high pedestrian flow and high vehicle flow, Zebra crossings almost always provide the best crossing and provide pedestrians with a level of priority that pelican/puffin/toucan dont. However, as a result of their failure to provide a safe option for those with reduced visibility they are rarely installed now. It would be great if this can be addressed because as well as being more effective in the vast majority of contexts they also cost less to install and maintain than alternative crossings.	Wednesday, Dec 23rd 6:14AM
245,979,083	Making road 20mph zone (or less depending on situation). Slower moving cars would more easily be able to stop when a pedestrian is crossing	Wednesday, Dec 23rd 6:23AM
245,976,428	Clear and obvious warnings signs on approach letting drivers know of zebra crossing ahead.	Wednesday, Dec 23rd 4:13AM
245,976,102	Reduce the road width and use other measures (such as ruble strips, chicanes etc) to reduce vehicle speed for some distance either side of the crossing.	Wednesday, Dec 23rd 3:54AM
245,938,791	Put cameras on them so drivers can be fined for dangerous driving if they fail to stop	Tuesday, Dec 22nd 2:26PM
245,924,931	Speed humps two car lengths before the crossing.	Tuesday, Dec 22nd 11:02AM
245,911,525	Replace them with pelican crossings.	Tuesday, Dec 22nd 6:30AM
245,909,470	High profile driver education campaigns. Police days of actions around them.	Tuesday, Dec 22nd 5:03AM
245,908,113	Every road junction and entrance to a school/nursery/care home should have a zebra crossing outside. Ideally they could have average speed cameras beside them to ensure drivers are following the speed limit (as a lot speed through zebras if they see people approaching or half way across)	Tuesday, Dec 22nd 4:10AM
245,908,089	The beacons could/should extend outward from top of the polls to be more visible to drivers!	Tuesday, Dec 22nd 4:07AM
245,907,967	" Provide physical safety measures such as rumble strips to warn drivers and cyclists to slow down" And Stop as appropriate!	Tuesday, Dec 22nd 3:57AM
245,907,066	Rule 195 of the Highway Code says "you MUST give way when a pedestrian has moved onto a crossing". I'd change the rule to state "you MUST give way when a pedestrian is waiting to cross".	Tuesday, Dec 22nd 3:32AM

245,907,024	Make lots more of them. Every junction should have zebra stripes. Drivers should lose the presumption of right of way at every junction. In residential areas it's crazy that pedestrians have to wait to cross their own road while rat running drivers have a clear road. If there was a zebra at every corner then it would reduce speeds and discourage rat running. In addition, any central islands should have zebras. Drivers should be going at a speed where they assume they will have to stop every time there is a junction or a traffic island.	Tuesday, Dec 22nd 3:31AM
245,874,493	It should be the norm for zebra crossings to be raised and 'at grade' for pedestrians, not vehicles. On streets where the speed limit is 20mph this should be automatically the preferred design and only in exceptional circumstances (e.g. perhaps on a bus route where the crossing is sited well away from stops) would a crossing not be raised. Since bus routes are for the most part on 30mph speed limit (or more!) streets this would not cause any significant problems for bus drivers or users. The raised crossings would act as additional traffic calming features that are much needed on many 20mph streets and are essential if speeds are to be reduced to something close the 20mph limit, given the absence of any effective enforcement regime.	Monday, Dec 21st 6:01PM
245,867,175	Any of the choices rely on the road users to make them safe. Other than making them full signal crossings . Cars and buses are almost not as much an issue as cyclists. I am visually impaired and although cars and buses can be dangerous, cyclists take them as no reason to stop so carry on regardless weaving round and close passing. It is a lottery anytime stepping out.	Monday, Dec 21st 4:04PM
245,860,655	Slow traffic down. Put them on desire lines.	Monday, Dec 21st 2:32PM
245,855,668	Replace them all with Green man type, cars usually obey red lights.	Monday, Dec 21st 1:11PM
245,853,355	Drivers need awareness training that wherever a zebra crossing exists, pedestrians have priority and they must stop. Too often I have found zebra crossings in hospitals or shopping centres that drivers totally ignore and drive straight across even though they can easily see me and my guide dog at the pavement edge waiting for them to stop. Also, zebra crossings need to be well maintained by councils, hospitals or for example the owners of shopping centres - it doesn't help driver's awareness of their obligation to stop at what is a zebra crossing for the orange beacon to be missing or not flashing, or for the road markings to be worn away.	Monday, Dec 21st 12:26PM
245,853,073	The main problem is that the law says that a pedestrians foot has to be on the crossing before they have to stop. This leads to bullying as pedestrians are unlikely to put a foot on a crossing if a car is bearing down on them. Better that there is a pavement zone adjacent to the crossing where people stand to indicate they wish to cross and drivers have to stop when people are in this space,	Monday, Dec 21st 12:17PM
245,852,231	The paint is often worn away. For them to be safe they need to be visible	Monday, Dec 21st 11:46AM
245,852,190	Remove the need for expensive Belisha beacons & put zebras across every junction & regularly along every road - this would make driving more uncomfortable & slower, forcing drivers to take more care	Monday, Dec 21st 11:44AM
245,851,765	Speed limits should be lower. This gives drivers much more time to see and decide to stop. It also allows pedestrians more time to get out way if they are not	Monday, Dec 21st 11:28AM
245,851,713	In my experience, zebra crossings on raised tables significantly reduce approaching vehicle speeds and hence make crossing safer and easier.	Monday, Dec 21st 11:27AM
245,851,559	Ensure that the surface is clear. The one I use regularly, close to a school, has a worn and pitted surface, tho has a raised surface which I think is a good idea. Another one is close to a button roundabout, and same comment as previously...surface not maintained. I think they are probably much cheaper to install than traffic lights. There ought to be more of them positioned on long stretches of road between traffic lights and junctions	Monday, Dec 21st 11:21AM
245,851,502	CCTV	Monday, Dec 21st 11:20AM
245,851,430	We many more if them	Monday, Dec 21st 11:17AM
245,851,378	No need for orange flashing bulbs at crossings. Make more of them cheaper and with more crossings drivers will get use to the fact they have to stop. More priorities to walkers and cyclists. Stop the car is king approach.	Monday, Dec 21st 11:16AM
245,850,836	Allow cheap paint-only zebras, ie without the beacons,band allow them at road junctions	Monday, Dec 21st 10:58AM
245,816,149	Maybe something to ask/warn drivers to stop for people crossing.	Sunday, Dec 20th 7:52AM
245,750,485	Some of the above but also some zebra crossings are close to traffic islands and this adds confusion. I also often find cars parked on the approach to the crossing, which reduces visibility. Need better parking enforcement particularly around crossing points.	Friday, Dec 18th 11:32AM