

## **PUBLISHED PROJECT REPORT PPR1010**

### **Non-prescribed Zebra crossings at side roads**

Technical Annex 7: Observations of conflict and giving-way during on street trials

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## Report details

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## Executive Summary

This document forms a Technical Annex to the report *Trials of non-prescribed Zebra crossings at side roads: Final Report* and presents the methodology and findings from on-street trials. As part of a programme of user research and trials of non-prescribed side road zebra crossings, this phase of the research focuses specifically on the following research questions:

- What level of interaction are present before and after application of side road zebra markings?
- Is the propensity for motor traffic to give way to pedestrians entering or exiting side roads increased when the zebra markings are applied?

Video observations were undertaken at two trial sites in Greater Manchester, with ordinary give-way markings, and at the same crossings with a non-prescribed zebra crossing.

### *Prescribed vs. non-prescribed crossings*

A prescribed zebra crossing is indicated by a series of alternate black and white stripes on the carriageway; a yellow globe mounted on a black and white striped post (a Belisha beacon), positioned on the pavement at each end of a zebra crossing; and the crossing area is marked with a line of studs and zigzag markings. There is no recommended minimum distance that a zebra should be placed from a junction; however, in practice, the need for a minimum of two zigzags creates a minimum set-back of about 4.8m.

A non-prescribed zebra is a standard zebra crossing which uses the prescribed black and white markings without the other features present on a prescribed zebra crossing. Key differences are:

1. Excludes the requirement for studs and zigzag markings
2. No requirement for Belisha beacons
3. No minimum set-back distance from the junction with the main road (due to no requirement for zigzag markings)

The simplified design requirements of the non-prescribed crossing should lower implementation and maintenance costs for local authorities. In addition, no minimum set-back distance from a junction has an advantage of keeping pedestrians on their desired walking line, giving them a more direct route across the mouth of the junction.

### *Assessing risk in a trial*

The relatively short period of video observation for any practicable on-street trial is unlikely to yield collisions at a statistically significant level to allow for comparison, given the historical infrequency of STATS19 records of this type at any given crossing. For this reason, this trial focused on observations of interactions and conflicting behaviour as indicators of the relative safety of the non-prescribed zebra crossing in the longer term, to understand if a wider trial may be undertaken with more confidence.

Interactions were categorised on a scale of 1 to 5, with levels 1 and 2 being normal interactions compliant with the use of desired give-way behaviour, and levels 3, 4 and 5 indicating a progressively more serious level of risk between a pedestrian and a vehicle.

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### *Results*

A sample size of 196 interactions at each site and each phase was considered likely to be suitable to find a difference between phases. However at one site the sample was not reached (38 with the give-way markings, and 35 with the non-prescribed zebra crossing), and at the other site it was reached.

Only one (level 3) interaction was (seen with the non-prescribed zebra crossing at Peel Street), otherwise nothing of concern was noted in either give-way marking phase or the non-prescribed zebra crossing.

Only very small differences were observed in the number of low level interactions. The difference was too small to be considered significant with the sample size used.

Give-way behaviour by motorists improved by a considerable margin with around a 30 percentage point improvement in compliance with the non-prescribed side road zebra crossing of (which is significant at a statistical level). Adherence to the give-way requirement by drivers is nonetheless far from universal with the Peel Street site achieving 71% compliance and the Hazelwood Drive site achieving 57% compliance with the non-prescribed side road zebra.

### *Conclusions*

Give way behaviour by motorists has been improved greatly by the non-prescribed side road zebra crossing, with a majority giving way whereas a minority did previously. As no statistically significant change in the level of interaction was observed, the remaining level of non-compliance, while still significant, does not appear to be associated with increased risk compared with a normal side road. There is therefore nothing to suggest from this trial of two sites that pedestrian safety is adversely impacted by the introduction of the non-prescribed side road zebra crossing compared to give way markings only.

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# 1 Introduction

## 1.1 This document

This document forms a Technical Annex to the report *Trials of non-prescribed Zebra crossings at side roads: Final Report*, which presents the findings of a programme of user research and trials into the proposed use of a non-prescribed form of zebra crossing at side-roads. Technical Annex 7 sets out the methodology and findings from the final stage in this programme, on-street trials at two sites in Greater Manchester. The overall conclusions from the research programme are set out in the Final Report.

## 1.2 Background to the research

This phase of the side-road crossing research programme considered the following two research questions:

- What levels of interaction are present before and after application of (non-prescribed) side road zebra markings?
- Is the propensity for motor traffic to give way to pedestrians entering or exiting side roads increased when the zebra markings are applied<sup>1</sup>?

The focus of the research is in understanding “Interaction”, that is, some form of interplay between motorists and pedestrians. This varies from simply wanting the same piece of road space at the same time but following the rules without any conflict (including giving way), through to harsh braking, near avoidance, and collision itself. Interaction is important for two reasons:

- The higher-level interactions, i.e. those indicating conflict, can point towards a likelihood of actual collision
- More serious interactions are likely to discourage pedestrians from walking as they may make them feel uncomfortable and at risk.

In line with previous on-street studies, TRL utilised use a five-point scale of interaction ranging from (1) ‘precaution’; (2) controlled action, (3) near miss, (4) very near miss to (5) collision.

It is important to note that for a crossing of this type, where one party is expected to give way to another, the desired behaviour will be included in the count of interactions, at levels 1 and 2. Therefore, a fall in the number of low-level interactions would not necessarily be expected.

Both research questions were investigated using video observations of on-street trials that were conducted at two sites in Greater Manchester.

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<sup>1</sup> Note this is where the vehicle is entering or exiting the side road in any direction, and when the pedestrian is using the crossing in any direction

## 2 Method of data collection

### 2.1 Preparation for data collection

In discussion with TfGM, the research questions were discussed in more depth to define the data collection requirements, identifying specific movements and locations on the crossing that would be observed, the camera positions required to capture them and how they would be recorded.

The crossing sites were visited with the client to ensure that the field of view of the video cameras would cover the correct areas. Cameras were mounted on street furniture and were relatively inconspicuous. Recorded video was stored on-site in hard drives that were regularly swapped by the contractor. In line with data protection requirements a sign was placed at each camera advising any interested parties of the purpose of the study and who to contact should they have any questions. A Data Protection Impact Assessment was undertaken.

### 2.2 Locations

Two sites were selected by TfGM, representing different examples of low risk environments where such crossings might be used in an initial roll-out. An example is shown in Figure 1 and images of each site in each phase are shown in Appendix A. Because the non-prescribed crossing is not currently approved by DfT, and the trials were not covered by an experimental traffic order, TfGM undertook a comprehensive risk assessment before proceeding with the trials<sup>2</sup>.

**Table 1 Site locations**

| Site                           | Coordinates             | Description  |
|--------------------------------|-------------------------|--|
| 1) Peel St/Manchester Rd (A57) | 53.456204,<br>-2.116877 | High street, with busy traffic, high pedestrian numbers, shops, and other amenities. |
| 2) Hazelwood Dr/Ravenwood Dr   | 53.468405,<br>-2.114725 | Residential area, with low levels of vehicle and pedestrian flow.                    |

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<sup>2</sup> Non- prescribed zebra crossings at side roads: legal advice. Deegan B and Huxford R, report by Urban Movement for TfGM, 2021



**Figure 1 Example of the non-prescribed zebra crossing**

### 2.3 Sample and Duration

Experience from previous studies - such as those undertaken on Bus Stop Bypasses<sup>3</sup> - was that a sample of around 200 interactions between pedestrians and vehicles at each site in each phase would likely generate sufficient variance to understand differences between the give-way only crossing and the non-prescribed zebra crossing. To align with hours of most pedestrian activity and hours of daylight (where actions can be more readily seen on camera) it was planned that the first 2 interactions seen from the start of each of 14 hours for a week would be collected, providing a sample size of 196 interactions at each site and each phase.

To assess the likelihood of reaching a sufficient sample at each site casual observations of user numbers and interaction frequency were undertaken by the client. On the basis of this sample it was agreed that the duration of the video survey would be extended from 1 week to 2 weeks in each phase to attempt to reach a sample of 196.

The intention was to observe the first two pedestrian and vehicle interactions in each hour between 0700hrs and 20:59hrs of each day for the first 7 days of video, providing a sample of 196 interactions. Were this not possible then the second 7 days would be used to complete the sample for the corresponding day and time, and where this was not possible then the sample was drawn from any available. At Peel Street the second week of data was required to reach the target sample, and at Hazelwood Drive the approach to using any interaction was used and this was still insufficient. A consideration was given to extracting more data from Peel Street to provide a higher sample, however this was rejected on the basis that the sites are not representative of each other.

The decision to undertake observation via video was taken due to the need to avoid an observer effect, the human exposure risk given the duration of collection, and the repeatable accuracy of data extraction afforded by video.

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<sup>3</sup> Greenshields, S. et al (2018). Bus Stop Bypasses – Analysis of pedestrian and cyclist behaviour via video. Crowthorne: TRL.



## 2.4 Dates

The first duration of video to cover the standard give-way marking phase was scheduled from 10<sup>th</sup> May 2021 at both sites. However, due to a localised error the Peel Street site was inadvertently painted with the non-prescribed zebra crossing on the 10<sup>th</sup> May therefore a decision was made to switch the phases/timing of that site. Further a gap in this video collection occurred between 18<sup>th</sup> May and 9<sup>th</sup> June. The second duration of video was collected between 21<sup>st</sup> June and 4<sup>th</sup> July 2021.

## 2.5 Data extraction

Two staff members (enumerators) were trained in the extraction of the video data. Each was provided with an encrypted full copy of the video footage and extraction undertaken according to the prescribed data extraction spreadsheet. A 10% sample of each staff's extraction was checked by the other member of staff, to ensure correctness and consistency.

## 2.6 Data to answer the research questions

The table in Appendix B was provided to enumerators to understand and define the data. The "category" indicates the applicable research question. Where an interaction occurred between pedestrians and vehicles each item of data below was observed and recorded. Data was entered in to an Excel table by enumerators.

# 3 Quantitative Findings

## 3.1 Number of records

The target sample at each site and each phase was 196. A single sample is where a pedestrian and a vehicle interact at the crossing. This was not reached at the Hazelwood Dr/Ravenwood Dr site despite the extension in video capture time from one week to two weeks in each phase. This is due to the low number of interactions between motorists and pedestrians at this site.

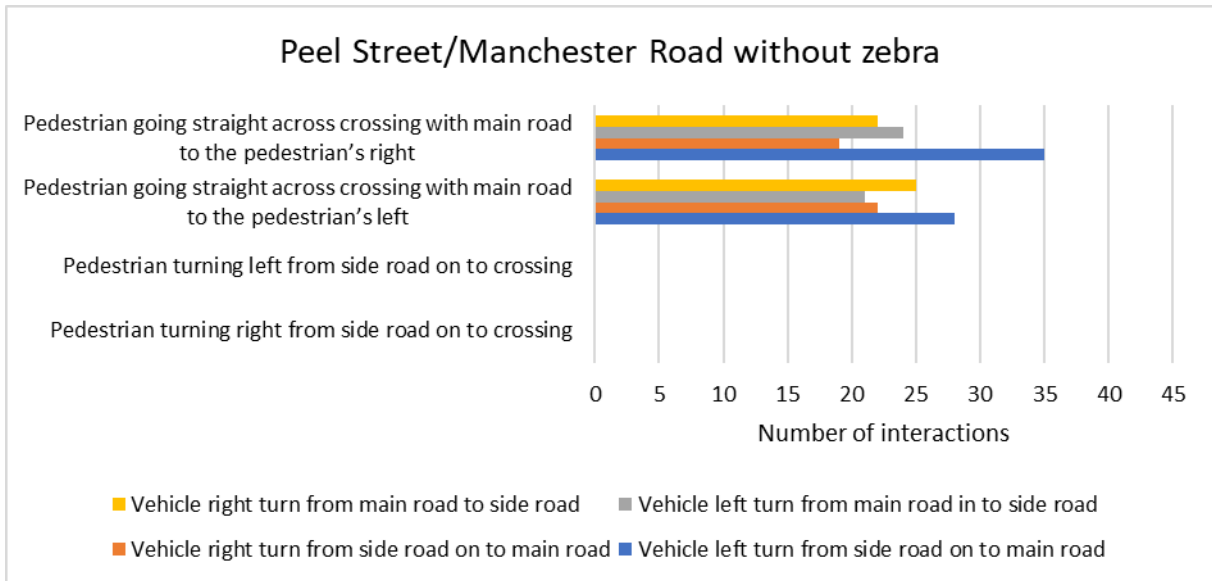
**Table 2 Sample sizes**

| Site                        | Phase         | Number of records |
|-----------------------------|---------------|-------------------|
| Peel Street/Manchester Road | without zebra | 196               |
| Peel Street/Manchester Road | with zebra    | 196               |
| Hazelwood Dr/Ravenwood Dr   | without zebra | 38                |
| Hazelwood Dr/Ravenwood Dr   | with zebra    | 35                |

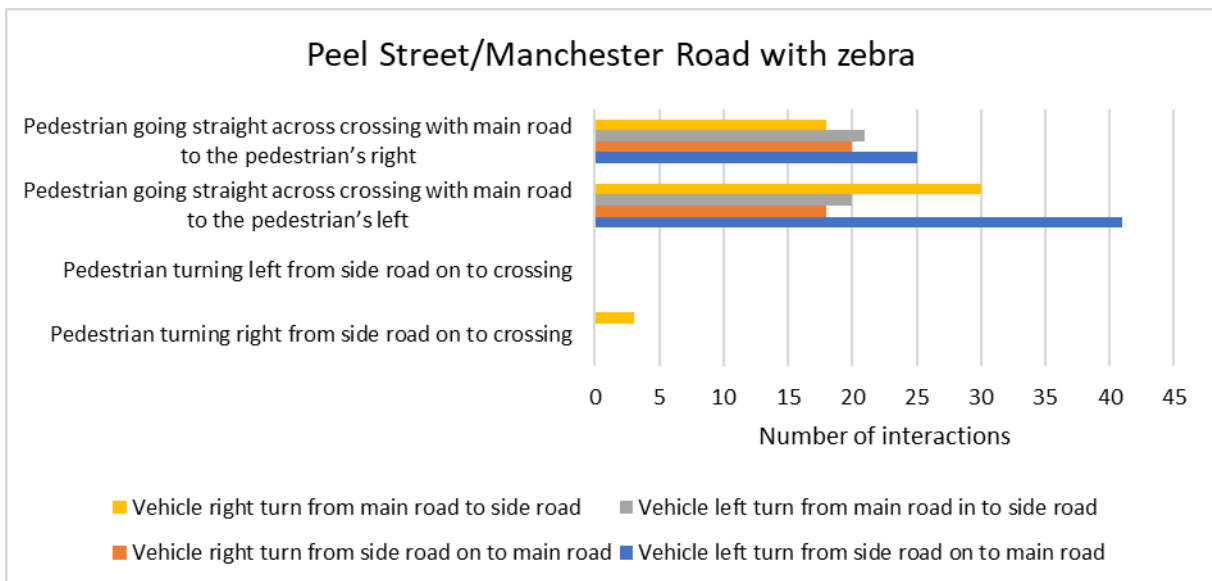
## 3.2 Direction of pedestrian travel and direction of vehicle travel

Where an interaction between a pedestrian and vehicle occurred, the direction of movement of both parties was recorded. This helps with an understanding of which movements have been examined, and which types of movement might be related to conflict. The observations indicate that whilst vehicles were observed to go in all directions (in and out of the side road, left and right), pedestrian movements were largely confined to going straight across the crossing (rather than turning in or out of the side road). Note that the combination of

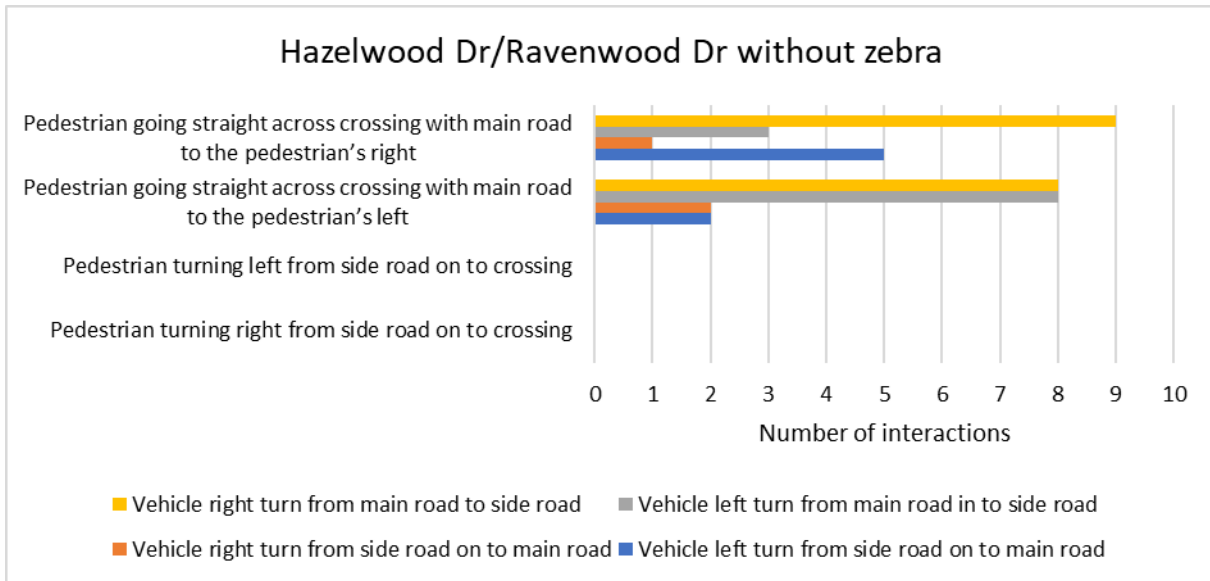
movements involved in interactions are likely to be a coincidence rather than being influenced by the crossing type. This is shown in Figure 2 to Figure 5 for each site and phase.



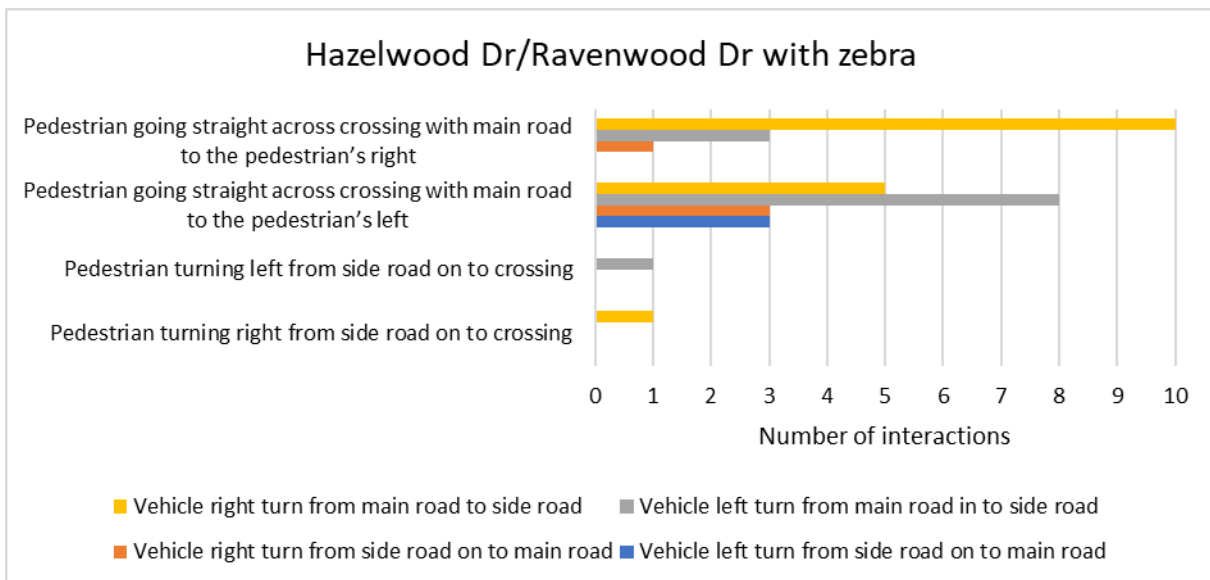
**Figure 2 Pedestrian and vehicle direction – Peel St without zebra**



**Figure 3 Pedestrian and vehicle direction – Peel St with zebra**



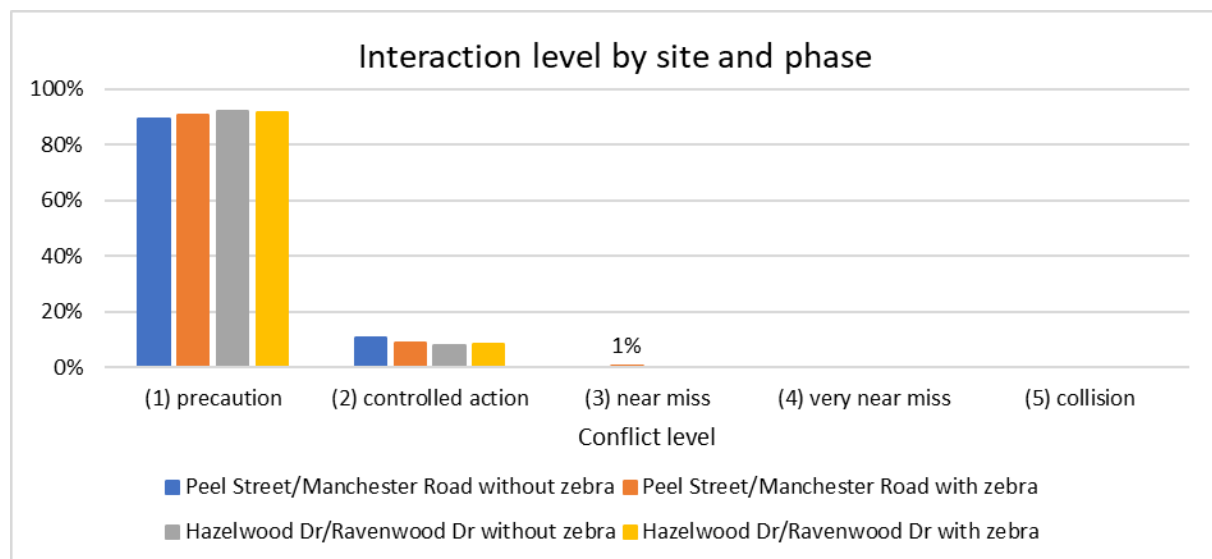
**Figure 4 Pedestrian and vehicle direction – Hazelwood Drive without zebra**



**Figure 5 Pedestrian and vehicle direction – Hazelwood Drive without zebra**

### 3.3 Interaction level by site and phase

The graph below shows the interaction level between pedestrians and motorists at the crossing, at both sites and in both phases. The distribution of interaction level follows an expected pattern, with the vast majority being (1) precaution or (2) controlled action. Neither of these categories are high level conflicts, and are simply the expected interactions between pedestrians and motorists at the crossing.



**Figure 6 Interaction level by site and phase at both sites**

When the percentage of interactions at Level 1 and Level 2 are compared, only small changes can be observed with- and without- the zebra markings. At the Peel Street/Manchester Road junction there was a small decrease in the proportion of ‘controlled actions’ (from 11% to 9%), and a small increase in the percentage of ‘precaution’ interactions (from 89% to 91%). At Hazelwood Dr/Ravenwood the ‘controlled action’ percentage slightly increased (from 8% to 9%), while precautionary interactions decreased (from 92% to 91%).

Note that no ‘very near miss’ (level 4) or ‘collisions’ (level 5) were observed, and only one ‘near miss’ (level 3) occurred after the implementation of the non-prescribed Zebra crossing at Peel Street/Manchester Road.

To check whether any of the two observed trends at the two locations, even if small, was actually linked to the change in the zebra crossing, the chi-squared test<sup>4</sup> for independence was performed. Since this test is not applicable when there are categories with zero or one count only, categories from 3 to 5 were merged with category 2 (and named ‘other interactions’)<sup>5</sup>. The chi-squared was therefore calculated for the two categories, ‘precaution’ and ‘other interactions’, and two categorical variables ‘with’ and ‘without’ zebra crossing. Note that the desired give way behaviour is the ‘precaution’ group and accounted for all but one of the interactions.

<sup>4</sup> When the observations are independent a chi-squared statistic can be used to check whether a relationship between two categorical variables exists (in this example ‘before/after’ the zebra crossing and the level of interaction vehicle-pedestrian). It is based on the calculation of a parameter (chi-squared) and its comparison with a critical value corresponding to the hypothesis that the two variables are not linked (null hypothesis). If the calculated chi-squared is smaller than the critical value then the null hypothesis cannot be rejected, that is, there is no evidence that the two variables are associated.

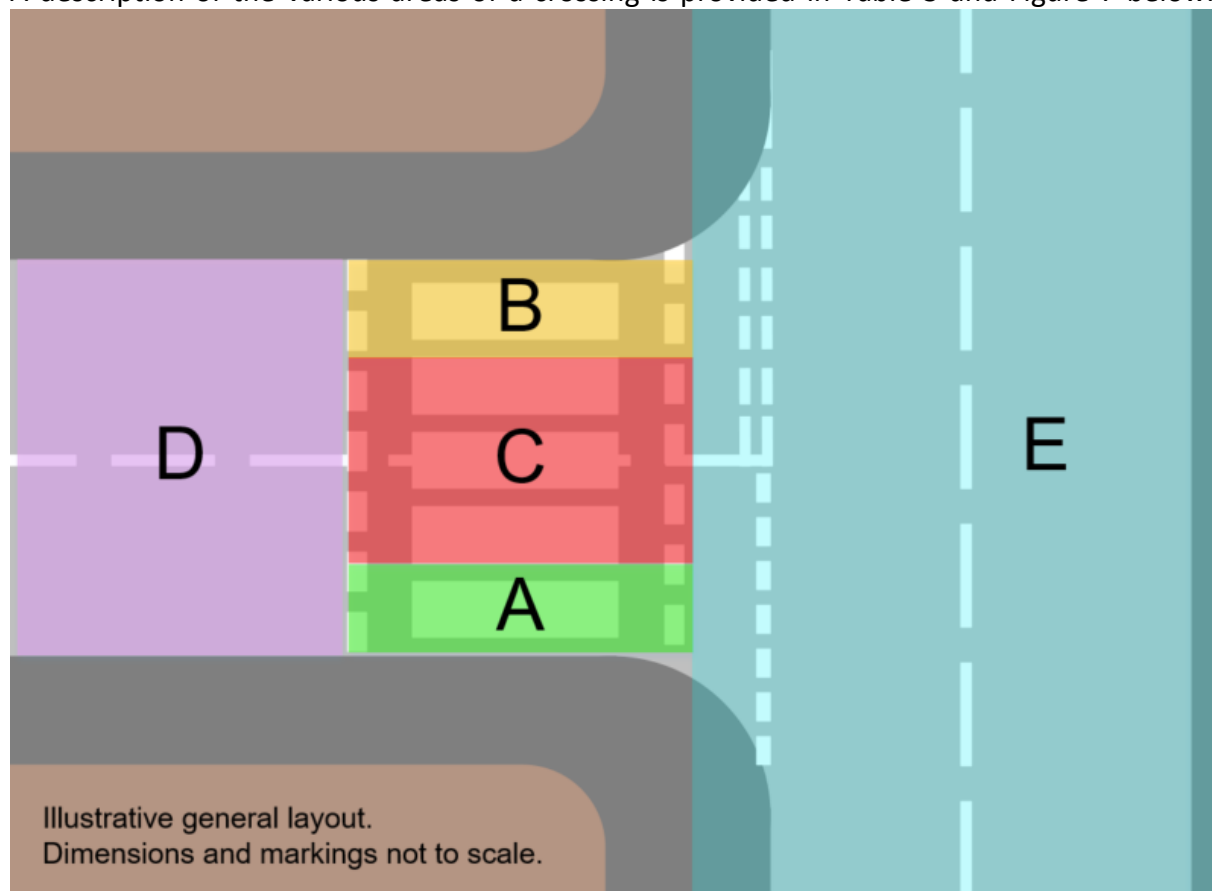
<sup>5</sup> Note that the degrees of freedom in this scenario equals 1, therefore it was necessary to correct the difference between observed and estimated value used in the calculation of chi-squared by 0.5.

The calculation of chi-squared gave approximately 0.1 for both sites, which is much smaller than 3.8, that is the critical value corresponding to a scenario with 1 degree of freedom and significance level 0.05<sup>6</sup>. This means that no statistically significant changes in the severity of interactions were observed.

### 3.4 Interaction by location on the crossing

The location on the crossing of any interaction or conflict can help to provide an understanding of if there are riskier areas, where they might be, and may lead to a better understanding of how to mitigate risk.

A description of the various areas of a crossing is provided in Table 3 and Figure 7 below.

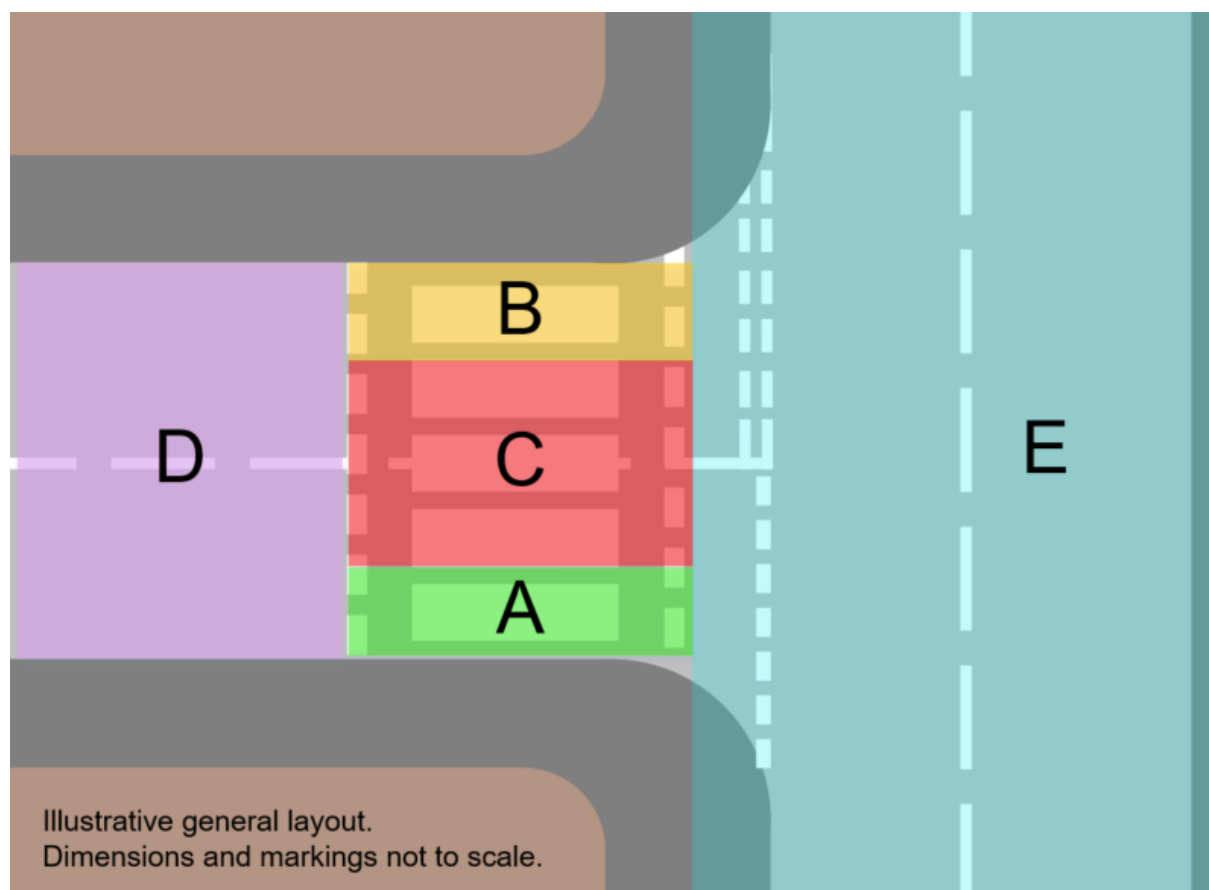


Note that the image depicts a prescribed zebra crossing, and these areas were interpreted by the enumerators for each crossing layout.

<sup>6</sup> A significance level of 0.05 indicates a 5% risk of concluding that an association between the variables exists when there is no actual association.

**Table 3 Locations on and around the crossing**

| Reference | Description  |
|-----------|--|
| A         | First quarter of distance across zebra with the main road to the right as the crossing is entered from the footway, across the full width to any limit markings. |
| B         | First quarter of distance across zebra with the main road to the left as the crossing is entered from the footway, across the full width to any limit markings.  |
| C         | Remaining space between part reference A and B.  |
| D         | Distance of 50m along the side road  |
| E         | Distance of 50m in either direction on the main road.  |

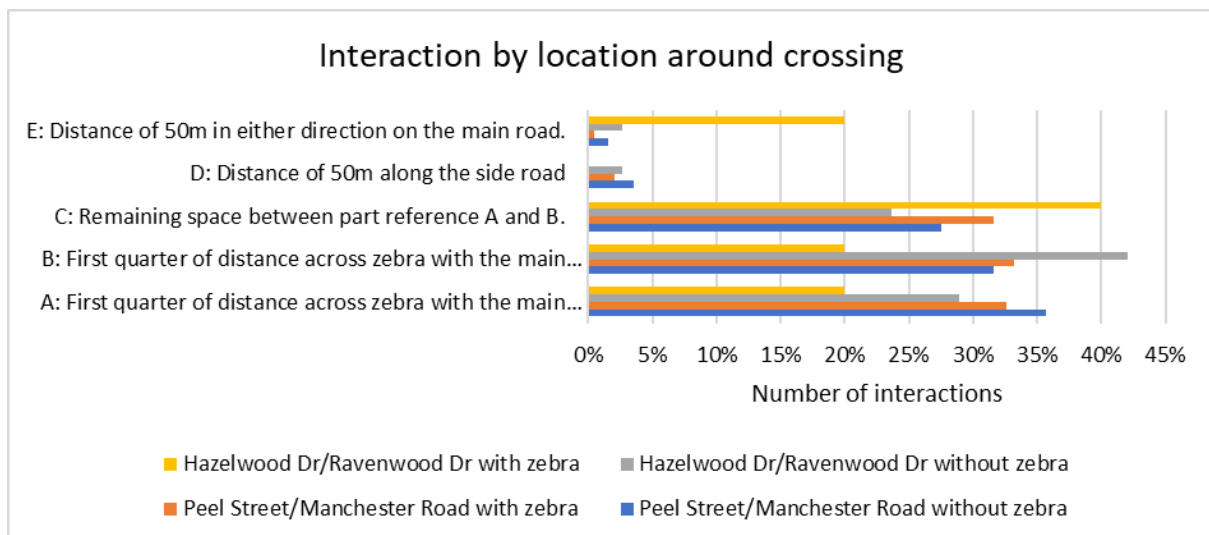

**Figure 7 Map of locations on and around the crossing**

Analysis of the crossing movements observed found that the majority of interactions occurred within the non-prescribed zebra crossing area itself (locations A, B, and C). Hazelwood Drive/Ravenwood Drive had a higher incidence of crossing movements in location E, away

from the crossing markings (Figure 7) The reasons for this are not directly known as pedestrians were not asked, however from observation of the video footage it might feasibly be attributed to either:

- the non-prescribed zebra crossing markings being a little more set back down the side road resulting in pedestrians following the give way mark as it is the shortest route, or
- the high levels of street parking and close layout (due to hedges), which provides relatively short sightlines for pedestrians and motorists, meaning pedestrians gravitate to a location which provides the best sightlines.

Such influences might be considered further during the design of future sites. Note that the crossing at Peel Street also had restricted sightlines on approach due to the positioning of buildings, however the crossing was also directly on the pedestrian desire line for those travelling down Manchester Road across the mouth of Peel Street.



**Figure 8 Interaction by location around crossing at both sites**

A chi-squared test for independence was applied to the data on the interaction locations in order to investigate the existence of a connection between the categorical variables ‘with’ and ‘without’ the zebra crossing markings and the interaction location. This is testing whether there was a statistically significant change in where pedestrians cross when the zebra markings were applied.

The chi-squared value was calculated for the two sites and compared with 9.5, that is the critical value for this scenario<sup>7</sup>.

Chi-squared for Peel Street/ Manchester Road was 2.7, that is smaller than the critical value and therefore there is no statistically significant association between the distribution of the

<sup>7</sup> 9.5 is the critical value tabulated for a significance level 0.05 and 4 degrees of freedom (that is the number of alternative locations that a pedestrian could have chosen, in addition to the one actually taken).

number of interactions by location and the introduction of the non-prescribed zebra markings. However, the variables have a statistically significant association at the crossing between Hazelwood Dr and Ravenwood Dr, for which the chi-squared was 10.9. There was therefore a small but statistically significant change in where people crossed at the site where the zebra markings were set further back down the side road, but not at the site where the zebra markings were closest to the main road. Many, but not all, pedestrians appear to have changed their route to follow the zebra markings, suggesting that it is recognised as a crossing; however the relatively small size of the change suggests a preference for following the most direct line across the side road mouth, and that pedestrians would not necessarily divert much further if there was a greater set-back distance. This may have implications for design guidance.

### 3.5 Number of pedestrians and vehicles present

Previous studies of Bus Stop Bypasses<sup>8</sup> have revealed an issue with pedestrian numbers reducing inter-visibility between crossing pedestrians and oncoming (bicycle) traffic, resulting in an increased likelihood of conflict. This was not seen at these sites, which may have been a result of relatively low pedestrian numbers.

### 3.6 Serious conflict by location

Significant numbers of serious vehicle-pedestrian interactions (levels 3, 4, and 5) were not observed with or without the zebra markings. It appears that the safety of the sites was not noticeably compromised by the change, however, it is not possible to establish how significant this observation is due to the small sample sizes.

### 3.7 Give way behaviour

When an interaction occurred, the give way behaviour of the pedestrian and vehicle was noted, to understand if the type of crossing had a positive or negative impact on give way behaviour. Give-way behaviour was noted as a party stopping or slowing to allow another conflicting party to cross. The party who gave way being the party which allowed the other party in front of them. The findings of this analysis can be found in Figure 8 and **Figure 9**. The main findings are:

- In almost all cases either the vehicle or pedestrian gave way (there were virtually no near-misses and no actual collisions). One level 3 interaction occurred at Peel Street with the non-prescribed zebra. A single interaction is too small to draw any statistically-valid conclusions.
- Give way behaviour by vehicles increased at each site, with an increase of around 30 percentage points in the proportion of motorists at both sites now giving way at the non-prescribed zebra when they were not giving way with only give-way markings.
- The chi-squared test of independence confirmed that the introduction of the non-

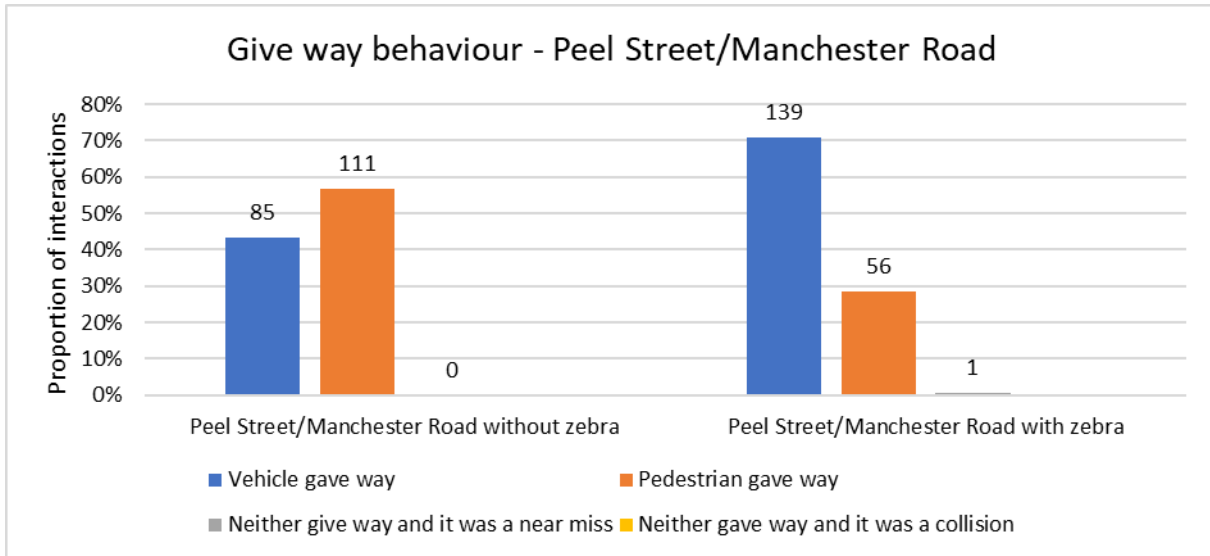
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<sup>8</sup> Greenshields, S. et al (2018). *Bus Stop Bypasses – Analysis of pedestrian and cyclist behaviour via video*. Crowthorne: TRL.

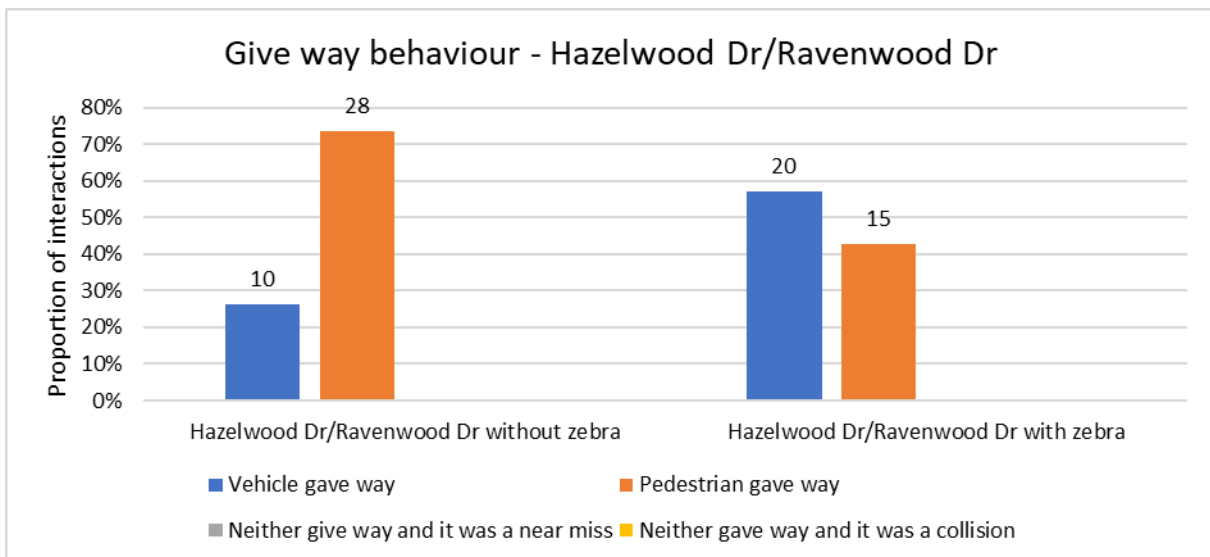


prescribed zebra crossing markings has a statistically significant association with the observed give-way behaviour (the likelihood that the association does not exist is 5%). The relationship was particularly evident for the Peel Street/Manchester Road location.

It can therefore be concluded that give-way behaviour was improved by the introduction of the non-prescribed zebra crossing and that this improvement was statistically significant.



**Figure 9 Give way behaviour at Peel Street**



**Figure 10 Give way behaviour at Hazelwood Drive**

### 3.7.1 Give way behaviour by turning direction

Previous research questions in this project, undertaken in a driving simulator, noticed drivers had a differing propensity to give way dependent upon their turning direction, with drivers emerging from the side road being more likely to give way to crossing pedestrians. This was seen within the video data too. As seen in Table 4, giving way whilst turning from the side road (shown in orange) is undertaken more than giving way when turning in to the side road (shown in blue), and this is common both with and without the non-prescribed zebra crossing. Note that because this involves further subdivision of the sample, a statistical analysis has not been undertaken.

**Table 4 Give way behaviour by turning direction**

| Movement                                     | Measure           | Peel Street/Manchester Road without zebra | Peel Street/Manchester Road with zebra | Hazelwood Dr/Ravenwood Dr without zebra | Hazelwood Dr/Ravenwood Dr with zebra |
|--|-------------------|---|--|---|--------------------------------------|
| 1. Left turn from side road on to main road  | Sample            | 63  | 66                                     | 7                                       | 3                                    |
|  | Number giving way | 33  | 53                                     | 1                                       | 2                                    |
|  | % giving way      | 52%                                       | 80%                                    | 14%                                     | 67%                                  |
| 2. Right turn from side road on to main road | Sample            | 41  | 38                                     | 3                                       | 4                                    |
|  | Number giving way | 22  | 35                                     | 1                                       | 3                                    |
|  | % giving way      | 54%                                       | 92%                                    | 33%                                     | 75%                                  |
| 3. Left turn from main road in to side road  | Sample            | 45  | 41                                     | 11                                      | 12                                   |
|  | Number giving way | 17  | 26                                     | 6                                       | 6                                    |
|  | % giving way      | 38%                                       | 63%                                    | 55%                                     | 50%                                  |
| 4. Right turn from main road to side road    | Sample            | 47  | 51                                     | 17                                      | 16                                   |
|  | Number giving way | 13  | 25                                     | 2                                       | 9                                    |
|  | % giving way      | 28%                                       | 49%                                    | 12%                                     | 56%                                  |

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## 4 Discussion

The overall aim of the non-prescribed zebra crossing is to provide a more convenient crossing for pedestrians whilst not reducing their safety.

### **What level of interaction are present before and after application of side road zebra markings?**

The purpose of this question was - on the basis that during a short trial a statistically significant selection of actual collisions was unlikely - to understand if precursor indications of collisions exist with the non-prescribed zebra crossing compared to the normal give way markings, and if they suggest a reduction of safety. The data collected showed that the level of interaction remained similar at the two sites, with only small changes in the distribution of level 1 and level 2 interactions that the chi-squared tests showed not to be statistically significant. Note that the desired behaviour by users would result in a level 1 or 2 interaction, so no reduction would be necessarily expected.

### **Is the propensity for motor traffic to give way to pedestrians entering or exiting side roads increased when the zebra markings are applied?**

The purpose of this question is to understand if the non-prescribed crossing provides more utility to pedestrians by increasing the propensity of motorists to give way to them. With the addition of the non-prescribed zebra markings, drivers were more inclined to give way to pedestrians at both sites, and the chi-squared test confirmed that this observation was statistically significant. However the propensity of motorists to give way is still relatively poor (71% at Peel Street, and 57% at Hazelwood Drive) with the non-prescribed give way markings, suggesting that whilst give-way behaviour greatly improved, it is not a perfect solution and pedestrians would be wise to still exercise considerable caution when crossing.

There is an interplay between the two research questions. An increasing propensity for vehicles to give way to pedestrians (RQ9) would not be beneficial if the vehicles which don't give way are involved in a higher level of conflict/collision (RQ8). This was not seen in the results, which suggests that difference in the conflict level between a give way marking and the non-prescribed zebra crossings in these locations is largely neutral. Note that lower-level interactions (levels 1 and 2) are merely as a coincidence of the pedestrian and vehicle needing the same space at the same time, and the adherence to the normal desired safe behaviour of both parties. The non-prescribed zebra crossing does appear to encourage more drivers to give way, but a significant level of non-compliance remains.

An interaction greater than level 1 or 2 was seen only once in the trial (where an adolescent ran across the Peel Street non-prescribed zebra and had a single near-miss level 3 interaction with a vehicle emerging from Peel Street), this is at too low a level to be important statistically, and the trial did not directly survey those involved to understand more about what occurred.

## 5 Conclusion

Whilst caution should be exercised due to low sample numbers, the findings do not suggest that the use of the non-prescribed zebra crossings as an alternative to give way markings introduces measurable additional risk to pedestrians.

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Give-way behaviour by motorists at the non-prescribed zebra crossings improved by a considerable margin at a statistically significant level when compared with the give-way markings only, with an increase in around 30 percentage points in the proportion of motorists giving way when they did not at the give-way markings. The Hazelwood Drive/Ravenwood Drive site achieved 57% compliance and the Peel Street/Manchester Road side achieved 71%. While it is clear that a significant levels of non-compliance remains, the absence of change in interaction level provides evidence that the remaining non-compliance did not lead to a significant increase in risk.

There is some observational evidence from the data on where pedestrians cross that the use of the marked crossing space by pedestrians will improve if it is on their desire line. This is a commonly-seen phenomenon of pedestrian movement in transport planning and is recognised as a design consideration within the Traffic Signs Manual Chapter 6<sup>9</sup>.

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<sup>9</sup> Department for Transport et al (2019). *Traffic Signs Manual Chapter 6 – Traffic Control*. London, Crown Copyright.

## Appendix A Site photographs

Each site was monitored with four video cameras, for durations as an ordinary give-way crossing (i.e., without zebra), and with the non-prescribed zebra crossing. The following images are captured from one camera at each site in each phase, to provide an understanding of the layout and markings of each site.



Figure 11 Hazelwood Dr/Ravenwood Dr without zebra



Figure 12 Hazelwood Dr/Ravenwood Dr with zebra

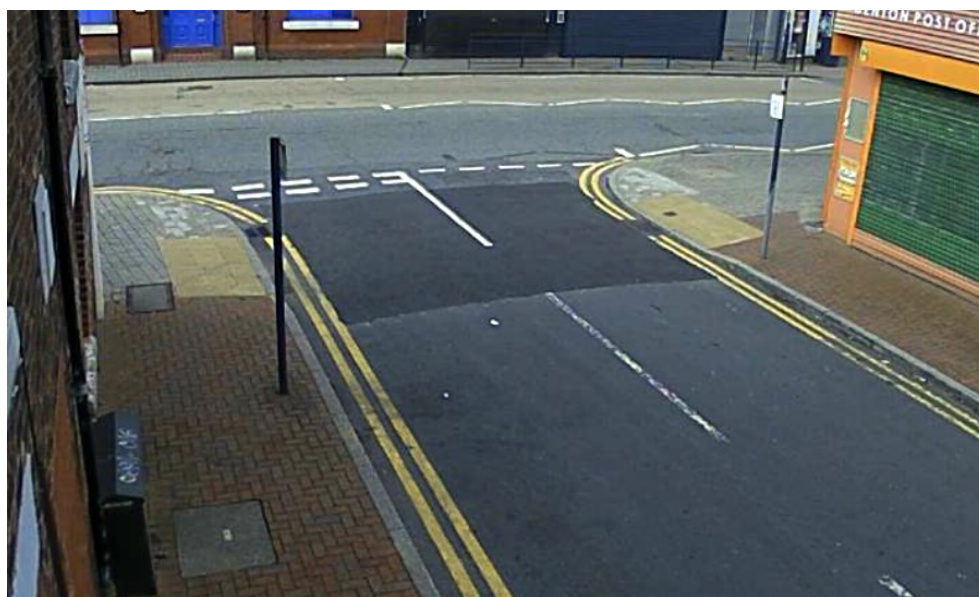


Figure 13 Peel Street/Manchester Road without zebra



Figure 14 Peel Street/Manchester Road with zebra

## Appendix B Instructions to enumerators

The following table was provided to enumerators to guide the extraction of data from video footage.

**Table 5 Data extraction instructions**

| Title  | Category                        | Definition   |
|--|---------------------------------|--|
| <b>Enumerator</b>                            | Administration                  | Enumerator name or initials.   |
| <b>Record number</b>                         | Administration                  | Automatically generated  |
| <b>Site</b>                                  | Administration                  | The location   |
| <b>Before or after</b>                       | Administration                  | "Before" means without the zebra crossing, "after" means with the zebra crossing   |
| <b>Sample calculator</b>                     | Administration                  | Do not touch this. It lists the total number of samples of each type, and will turn red when the total reaches 196 (at which point you stop entering data)   |
| <b>Time</b>                                  | Administration                  | Hour in 24 hour clock, then ":", then minutes, then ":", then seconds i.e. hh:mm:ss<br>Look for first two samples per hour in the first week. If this is not available look at the same time period the next week for the missing 1 or 2 samples.<br>Run the samples from 07:00 to 20:59 |
| <b>Date</b>                                  | Administration                  | dd/mm/yyyy   |
| <b>Confirm number of pedestrians present</b> | General explanatory information | Number of pedestrians in the immediate vicinity of crossing.   |
| <b>Direction of pedestrian travel</b>        | RQ8                             | Code for pedestrian crossing direction, use the tab to understand each direction<br>Direction relates to primary pedestrian, not others which might turn up shortly after but have not influenced the driver decision  |
| <b>Confirm number of vehicles present</b>    | General explanatory information | Number of not-parked vehicles in the immediate vicinity of crossing.<br>Note that cyclists are also counted as vehicles if using the road  |
| <b>Direction of Vehicle Travel</b>           | RQ8                             | Code for vehicle direction, use the tab to understand each direction   |
| <b>Level of interaction/conflict</b>         | RQ8                             | Code for level of interaction.   |
|  |                                 | (1) precaution - - Level 1: Precaution – For example, a pedestrian, or driver, markedly slowing down in carriageway in response to another user requiring the same space.  |
|  |                                 | (2) controlled action - - Level 2: Controlled Action - Pedestrian, or driver, deviating from route.  |
|  |                                 | (3) near miss - - Level 3: Near Miss - Pedestrian, or driver, rapidly slowing down, stopping or changing direction to avoid collision.   |

|   |                                 |  |
|---|---------------------------------|--|
|   |                                 | (4) very near miss - - Level 4: Very Near Miss - Pedestrian, or driver, using emergency braking or violent swerve.   |
|   |                                 | (5) collision - - Level 5: Collision – Contact between a driver and a pedestrian.  |
| <b>Location of interaction</b>  | RQ8                             | See tab for code for location of conflict  |
| <b>Which party gave way in the interaction?</b>   | RQ9                             | In situations where a pedestrian and motorist would otherwise collide (or be a near miss), did the motorist stop or slow to allow the pedestrian in front (in which case "yes") or did the pedestrian stop or slow to allow the vehicle in front (in which case "no"). |
| <b>Brief written description of what occurred (where level of interaction 3, 4, or 5)</b> | RQ8                             | Where the level of interaction is 3, 4 or 5, write a brief description of what happened.   |
| <b>Any other interesting notes</b>  | General explanatory information | Note anything else which might have influenced the findings (i.e. <i>torrential rain impacting visibility</i> )  |



## Non-prescribed Zebra crossings at side roads

### Technical Annex 7: Observations of conflict and giving-way during on street trials

This document presents the methodology and findings from on-street trials at two road crossing sites in Manchester, conducted as part of a programme of user research and trials of non-prescribed side road zebra crossings. This phase of the research focused on the impact of the non-prescribed crossing on the propensity of drivers to give way and level of interaction as an indicator of risk.

A statistically significant increase in giving way by drivers was observed, with the Peel Street site achieving 71% compliance and 57% at the Hazelwood Drive site; while less than half gave way without the non-prescribed crossing. While a significant level of non-compliance remained, when the level of interaction (conflict) was observed, there was no statistically significant change, providing evidence that no additional risk was introduced.

Compliance was significantly lower for drivers turning into the side road from the main carriageway than when turning out.

#### Other titles from this subject area

|                |   |
|----------------|---|
| <b>PPR1003</b> | Non-prescribed zebra crossings at side roads. Final Report. Jones M., Matyas M. and Jenkins D. 2021   |
| <b>PPR1004</b> | Non-prescribed zebra crossings at side roads. Technical Annex 1: Analysis of collision records at existing sites. Hammond J. and Simms G. 2019  |
| <b>PPR1005</b> | Non-prescribed zebra crossing at side roads. Technical Annex 2: User surveys at existing sites. Verwey L., Novis K., Wallbank C. and Stuttard N. 2020   |
| <b>PPR1006</b> | Non-prescribed zebra crossing at side roads. Technical Annex 3: Effectiveness of alternative markings. Novis K., Hyatt T., Stuttard N. and Wallbank C. and Verwey L. 2020                     |
| <b>PPR1007</b> | Non-prescribed zebra crossing at side roads. Technical Annex 4: Road user perceptions and understanding. Blunden A., Gupta B., Matyas M., Mazzeo F., Wallbank C. and Wardle A. 2021           |
| <b>PPR1008</b> | Non-prescribed zebra crossing at side roads. Technical Annex 5: Implications for people with disability. Blunden A., Gupta B., Verwey L., Butler, R. and Wallbank C. 2021                     |
| <b>PPR1009</b> | Non-prescribed zebra crossing at side roads. Technical Annex 6: Driver simulator trials. Jenkins D., Ramnath R., Stuttard N. and Chowdhury S. 2021  |
| <b>PPR1010</b> | Non-prescribed zebra crossing at side roads. Technical Annex 7: Observations of conflict and giving-way during on street trials. Greenshields S., Ognissanto F., Lee R. and Macgregor E. 2021 |

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