Appendix A Site and Survey Details

A.1 Different types of Sites, Corridors and their labels

As discussed in the main body of the report, analysis was conducted on the following:

- **London Road Network** – consisting of the TLRN Road Network and Borough Road Network, these are termed the TLRN Bus Lanes and the Remainder of London's Road Network in the collision analysis. Also, the TLRN Bus Lanes are sections of road containing a bus lane. This London wide analysis is the key source of information on the effect of the trial.
- **Network Sites** – consisting of both sites on the TLRN network and sites on the borough network.
- **Corridors** – main arterial routes, which were a subset of the whole TLRN network; these were chosen by TfL, with police speed enforcement on some corridors and not on others. Both the full length of the corridors, and just the length of the corridors with bus lanes were analysed.
- **Corridor Sites** – the subset of the 'Network Sites', which were on the 'Corridors'.
- **Speed Assessment Sites** – a subset of the 'Corridor Sites'; these were surveyed specifically for the motorcycles speed analysis.

These are described in more detail below.

A.1.1 Network Sites

In the previous study, there were 56 sites split into pairs, with one site on the TLRN network (Network TLRN Sites) and a partner site on the Borough network (Network Borough Sites).

Previous monitoring sites were re-surveyed where possible to allow backwards comparability. However, the 28 sites on the TLRN in the previous study were selected randomly. As a result of this, some sites were not suitably located for the current study. It was therefore necessary to introduce 5 new sites on the TLRN.

In total there were 33 Network TLRN Sites, and 28 Network Borough sites. Sites were labelled 1 to 67 in the previous study and sites introduced in the current study were labelled N1 to N5. Information on the site numbers is in Table A1.

Table A1: Network Sites

Network Site Type	Site Labels	Total
TLRN	1-12,14-17,19-23,25-28,30-31,33,N1-N5	33
Borough	35-46,48-51,53-57,59-62,64-65,67	28

Sites 28 and 62 had to be excluded from the collision analysis in this study, as the bus lane operational hours changed within the studied time periods. However, it was still possible to use these sites within the flow analysis.

A.1.2 Corridors

TfL defined 28 main arterial routes as 'Corridors', which were part of the TLRN. Of the 28 Corridors (labelled 1-28), 16 were defined as 'Enforcement Corridors' and 12 were defined as 'Non-enforcement Corridors'. Information on the corridor numbers is in Table A2.

Table A2: Corridors

Type of Corridor	Corridor Labels	Total
Enforcement Corridor	1,3,4,5,6,7,9,10,11,12,13,19,20,21,23,24	16
Non-enforcement Corridor	2,8,14,15,16,17,18,22,25,26,27,28	12

A.1.3 Corridor Sites

Of the 32 sites on the TLRN Network used in the collision analysis, 27 were on a Corridor: 15 on Enforcement Corridors and 12 on Non-enforcement Corridors, see Table A3.

Table A3: Corridor Sites

Type of Site	Site Labels	Total
Site on Enforcement Corridor	1,6,7,8,9,16,17,19,20,21,22,25,27,33,N2	15
Site on Non-enforcement Corridor	2,3,4,10,14,23,26,31,N1,N3,N4,N5	12
Site not on a Corridor, but still on TLRN	5,11,12,15,30	5

The distribution of sites on corridors was random owing to their selection method. This resulted in some Corridors containing several site, and others having no sites. Table A4 shows specifically which sites are on which corridors.

Table A4: Corridors and site on them

Road Type	Corridor Type	TfL Corridor Number	Site Numbers
TLRN	Enforcement Corridor	1	17
		3	7,19
		4	1,9,20,27
		5	No sites
		6	No sites
		7	No sites
		9	21
		10	16
		11	N2
		12	No sites
		13	8,33
		19	No sites
		20	22,25
		21	6
		23	No sites
		24	No sites
	Non- Enforcement Corridor	2	2,4
		8	31,N4
		14	No sites
		15	3,10
		16	N1
		17	No sites
		18	N5
		22	23,26
		25	N3
		26	No sites
		27	No sites
		28	14
	Neither		5,11,12,15,30

A.1.4 Speed Assessment Sites

Of the 27 sites on the Corridors, 16 were selected for video surveys to capture the motorcycle speeds. Half of these 'Speed Assessment Sites' were selected on Enforcement Corridors, and the other half on Non-enforcement Corridors, see Table A5.

Table A5: All 16 Speed Assessment Sites

Type of Speed Assessment Site	Site Labels	Total
Enforcement	6,9,16,17,19,25,33,N2	8
Non-enforcement	2,3,14,23,N1,N3,N4,N5	8

Sites 16, 25 and N4 had to be excluded from the speed assessment part of the study owing to unforeseen changes occurring on the sites, or traffic queues affecting speed measurements. Therefore for this part of the analysis in total, there were 6 Speed

Assessment Sites with enforcement and 7 Speed Assessment Sites without enforcement see Table A6.

Table 6: Speed Assessment Sites, excluding removed sites

Type of Speed Assessment Site	Site Labels	Total
Enforcement	6,9,17,19,33,N2	6
Non-enforcement	2,3,14,23,N1,N3,N5	7

Analysis was also undertaken on just the sites common to the previous study, i.e. excluding N1-N5. For this part of the analysis it was possible to use sites 16 and 25. Therefore there were 7 Speed Assessment Sites with enforcement and 4 Speed Assessment Sites without enforcement, see Table A7.

Table A7: Speed Assessment Sites, which were common in the previous study

Type of Speed Assessment Site	Site Labels	Total
Enforcement	6,9,16,17,19,25,33	7
Non-enforcement	2,3,14,23	4

A.1.5 London Road Network

The entire road network was categorised into TLRN and Borough, using data provided by TfL.

A.2 Types of surveys conducted

In the previous study, 2 days of video data and 7 days of ATC tube surveys were collected on all 56 sites.

In the current study, the existing data was re-used, where appropriate. New video and ATC data was also collected on selected sites, see below.

A.2.1 Speed assessment – video surveys

New video surveys were conducted on the 16 'Speed Assessment Sites'. The videos were analysed to extract motorcycle speeds and lane positions. As described in Section A.1.4, 8 of the sites had police enforcement and 8 had no police enforcement.

Each of the 16 sites was on a distinct Corridor, as shown in Table A8.

Table A8: Summary of video surveys in the current study

Road Type	Corridor Type	TfL Corridor Number	TRL Site Number: Video
TLRN	Enforcement	1	17
		3	19
		4	9
		10	16
		11	N2
		13	33
		20	25
		21	6
	Non-enforcement	2	2
		8	N4
		15	3
		16	N1
		18	N5
		22	23
		25	N3
		28	14

A.2.2 Flows – ATC tube surveys

ATC surveys were conducted on 28 sites in the current study; half of the 56 sites included in the previous study. These consisted of 14 pairs of a TLRN site with its partner Borough site. These were combined with the original datasets to determine flow trends across all five surveys (Autumn 2008, Autumn 2009, Autumn 2010, Spring 2011, Autumn 2011).

All of the 16 sites that had video surveys also had ATC surveys, with the exception of the 5 new sites. No ATC surveys were conducted on the new sites, because it would not have been possible to determine flow trends across the previous and current studies on these sites.

The flow methodology and results are discussed further in Appendix C. The 28 ATC sites are shown in Table A9.

<table>
<caption>Table A9; Summary of ATC surveys in the current study</caption>
<tr><th>Road Type</th><th>Corridor Type</th><th>TfL Corridor Number</th><th>TRL Site Number: ATC</th></tr>
<tr><td rowspan="11">TLRN</td><td rowspan="7">Enforcement</td><td>1</td><td>17</td></tr>
<tr><td>3</td><td>7, 19</td></tr>
<tr><td>4</td><td>1[1], 9, 20</td></tr>
<tr><td>10</td><td>16</td></tr>
<tr><td>13</td><td>33</td></tr>
<tr><td>20</td><td>25</td></tr>
<tr><td>21</td><td>6</td></tr>
<tr><td rowspan="3">Non-enforcement</td><td>2</td><td>2</td></tr>
<tr><td>15</td><td>3</td></tr>
<tr><td>22</td><td>23</td></tr>
<tr><td>Neither</td><td></td><td>30</td></tr>
<tr><td>Borough</td><td>N/A</td><td></td><td>35, 36, 37, 40, 41, 43, 50, 51, 53, 54, 57, 59, 64, 67</td></tr>
</table>

A.2.3 Sites with neither Video nor ATC surveys

Table A10 shows the other sites, by Corridor, which did not have any new surveys in the current study.

<table>
<caption>Table A10: Summary of other sites with no new surveys</caption>
<tr><th>Road Type</th><th>Corridor Type</th><th>TfL Corridor Number</th><th>TRL Site Number: ATC</th></tr>
<tr><td rowspan="10">TLRN</td><td rowspan="4">Enforcement</td><td>4</td><td>27</td></tr>
<tr><td>9</td><td>21</td></tr>
<tr><td>13</td><td>8</td></tr>
<tr><td>20</td><td>22, 28</td></tr>
<tr><td rowspan="5">Non-enforcement</td><td>2</td><td>4</td></tr>
<tr><td>8</td><td>31</td></tr>
<tr><td>15</td><td>10</td></tr>
<tr><td>22</td><td>26</td></tr>
<tr><td>28</td><td>14</td></tr>
<tr><td>Neither</td><td></td><td>5, 11, 12, 15</td></tr>
<tr><td>Borough</td><td>N/A</td><td></td><td>38, 39, 42, 44, 45, 46, 48, 49, 55, 56, 60, 61, 62, 65</td></tr>
</table>

[1] NOTE: it was not possible to collect data on Site 1 in the Current Trial (Autumn 2011) survey due to road works

Appendix B Detailed Methodology

B.1 Site Selection

The previous study design used a random selection method and incorporated a number of supplemental rules to ensure the Survey Sites were suitable for collecting the required observations. Half the previous 56 TRL Sites were on the TLRN with a bus lane and the remainder were elsewhere on London's Road Network, i.e. on Borough Roads. The sites were required not to have:

- A bus stop between the two timing points;
- A major turning movement occurring between the timing points; greater than approx. 5%;
- A pedestrian crossing between the timing points;
- Other factor affecting speeds or flows between the timing points; and
- Any road works on OR near the road being studied.

All chosen video sites in this study had to satisfy the same criteria and also:

- Half of them had to be on an enforcement corridor
- Half of them had to be on a non-enforcement corridor

Liaison also took place with the police in order that the sites on enforcement corridors were suitable for the police to use.

B.2 Surveys Performed

Video analysis provided the most accurate method of collecting motorcycle speeds and other positional information. At each of the sixteen video survey sites cameras recorded traffic for twelve hours a day (0700 to 1900) over two weekdays in each survey period.

Two video cameras were positioned on one link (of up to three lanes). The video cameras were set between 150 and 250 metres apart, such that no bus stops were between them. The upstream camera recorded the rear of vehicles and the downstream camera recorded their fronts, as shown in the following figure. The ideal setup is shown in Figure B1**:**, however some minor adjustments were made to this layout where site conditions did not permit its exact implementation; although the underlying design principles were maintained.

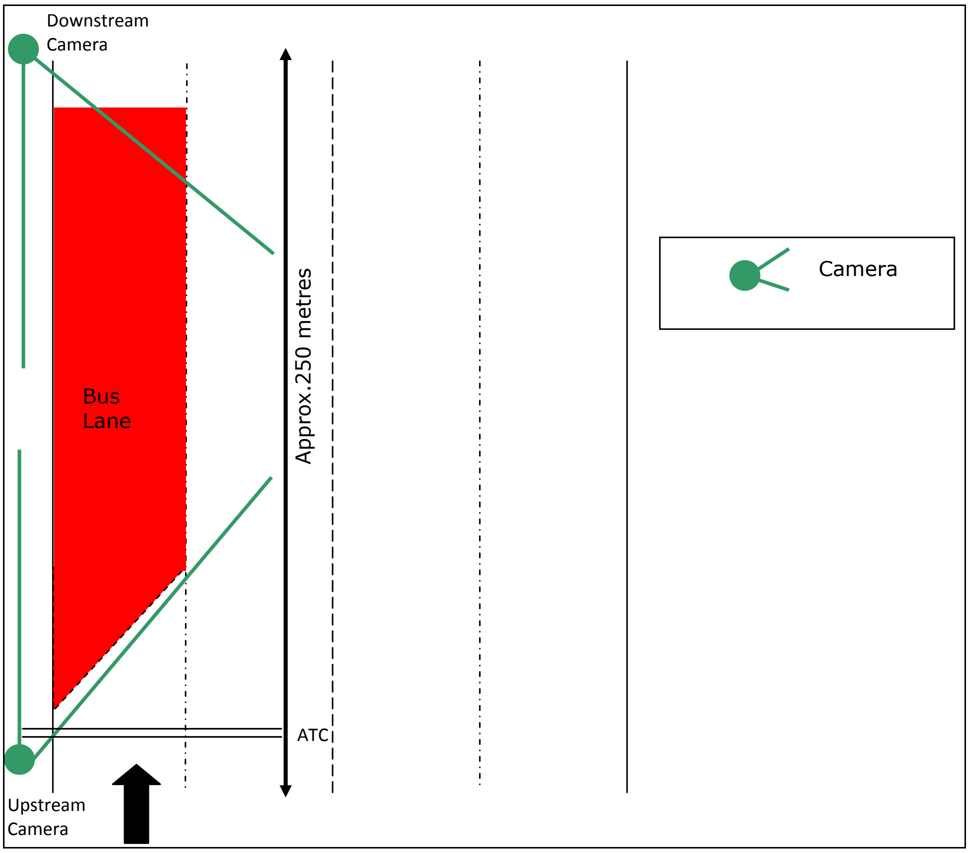


Figure B1: Camera Positions and Fields of View

B.3 Video Data Collection

Video data was available between 0700 and 1900 for each of the sixteen video survey sites on two week days. Up to 50 motorcycles were observed for each of the hours shown in Table B1.

Table B1: Motorcycle Speed Sampling

AM Peak	Off Peak	PM Peak
0730-0830	1200-1300	1600-1500
0830-0930	1300-1400	1500-1800

Thus observations were made in both peaks and in the off-peak, and up to 600 motorcycles were observed on each site. For each motorcycle, the following was recorded:

- Time passing up-stream timing point
- Time passing down-stream timing point
- Traffic lane used when crossing one of the timing points
- Position in the lane (left/middle/right) when crossing the timing point

Also, the same lane information was collected for a sample of pedal cycles

Appendix C Flows – Methodology

C.1 Objective

Flow calculation is necessary in the calculation of collision rates, and in placing the speed observations into context.

In the speed analysis, the flows used were the link flows occurring on the site at the time the speeds were measured.

In the collision analysis, the traffic flows were required on each road section for the time period to which the collisions refer. This required multiplying a link flow[2] by the length of road section to get the vehicle-km. The collision data analysis investigated the relative changes for the following:

- Network (TLRN Bus Lanes compared to Remainder of London's Road Network)
- Network Sites (TLRN compared to Borough)
- Corridors (Enforcement compared to Non-enforcement)
- Corridors Sites (Enforcement compared to Non-enforcement)

Therefore, traffic flow estimates were required for each of these and for the three time periods as described in Table C1.

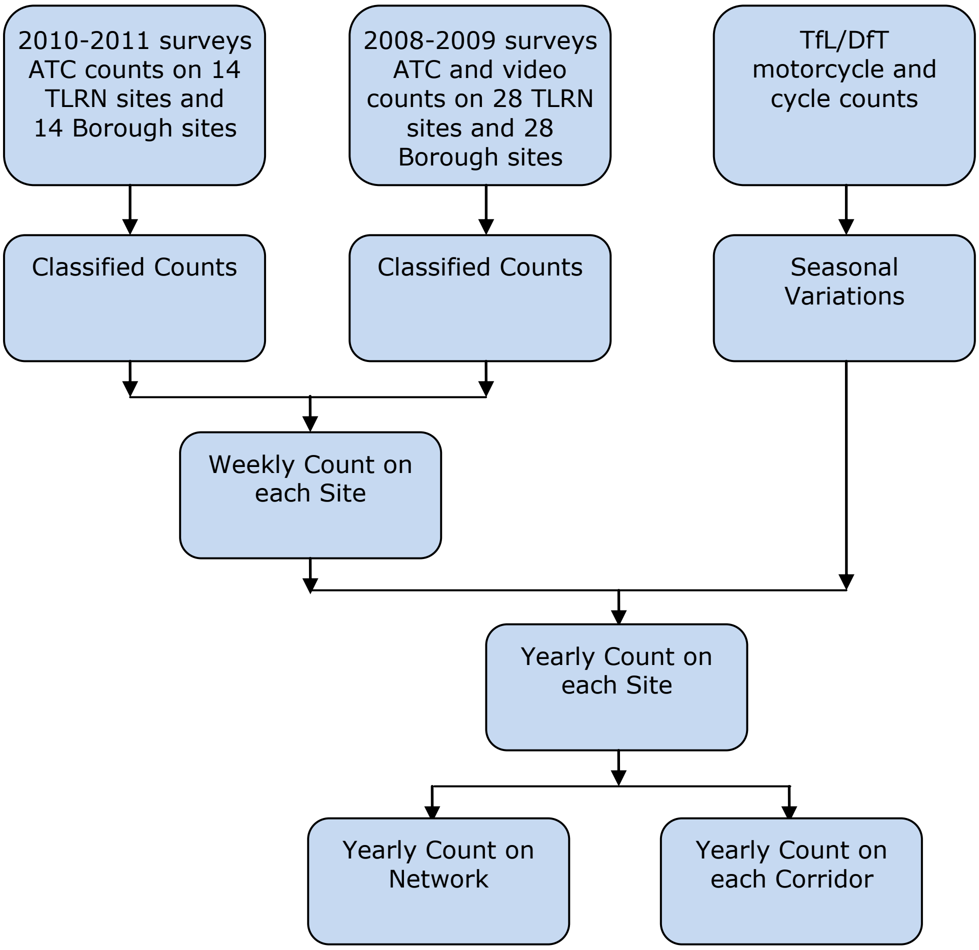
Table C1: Required flow estimates for collision analysis

Analysis	Time Period		
	Aug 2007 to May 2008	Aug 2009 to May 2010	Aug 2010 to May 2011
Network	√	√	√
Network Sites	√	√	√
Corridors		√	√
Corridor Sites		√	√

2 Estimated for the same 9-month period of Aug-May, excluding Dec

C.2 Data collection

The various traffic flow data sources needed to produce estimates for the classified traffic flows on individual sites, corridors and the network are shown below.



The previous study had a total of 56 sites, with 28 sites on the TLRN and 28 partner sites on the Borough network. The following flow data was collected for all 56 sites in the Autumn 2008 and Autumn 2009 surveys.

- Manual classified counts from video data – 07:00-19:00 for two weekdays
- Automatic Tube Counters (ATCs) classified counts – 24-hours for seven days

In the current study, for the Autumn 2010, Spring 2011 and Autumn 2011 surveys, the following flow data was collected on 14 TLRN sites and 14 Borough sites:

- Automatic Tube Counters (ATCs) classified counts – 24-hours for seven days

This enabled flow trends to be estimated across the five surveys. No flows were collected for the other 28 sites nor the five new sites, but it was possible to estimate these using the data from both the previous and current studies.

The ATC tube data was collected near the upstream camera. An indicator of accuracy of the ATC data is the hit profile. This shows the number of times an axle crossed each of the two ATC tubes in each hour. In clean data the axle counts from both tubes agree and there are no occurrences of zero counts. An example of such data can be seen below for Site 8 ATC data in the Before survey.

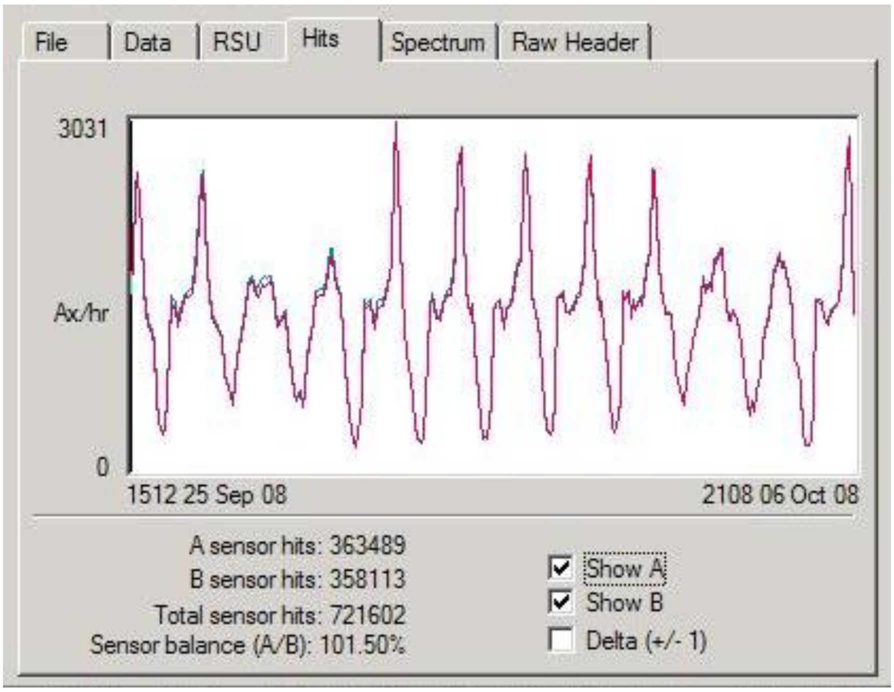


Figure C1: Weekly Traffic Flow for Site 8: Before Survey (ATC 'A' and 'B' Tube Hit Count Data)

Weekdays can be clearly identifieds, as they have the higher evening peak. The data from this site was clean, with both the 'A' tube and the 'B' tube functioning correctly over the whole survey. Corresponding video data for Site 8 in the previous study is shown in Figure C1.

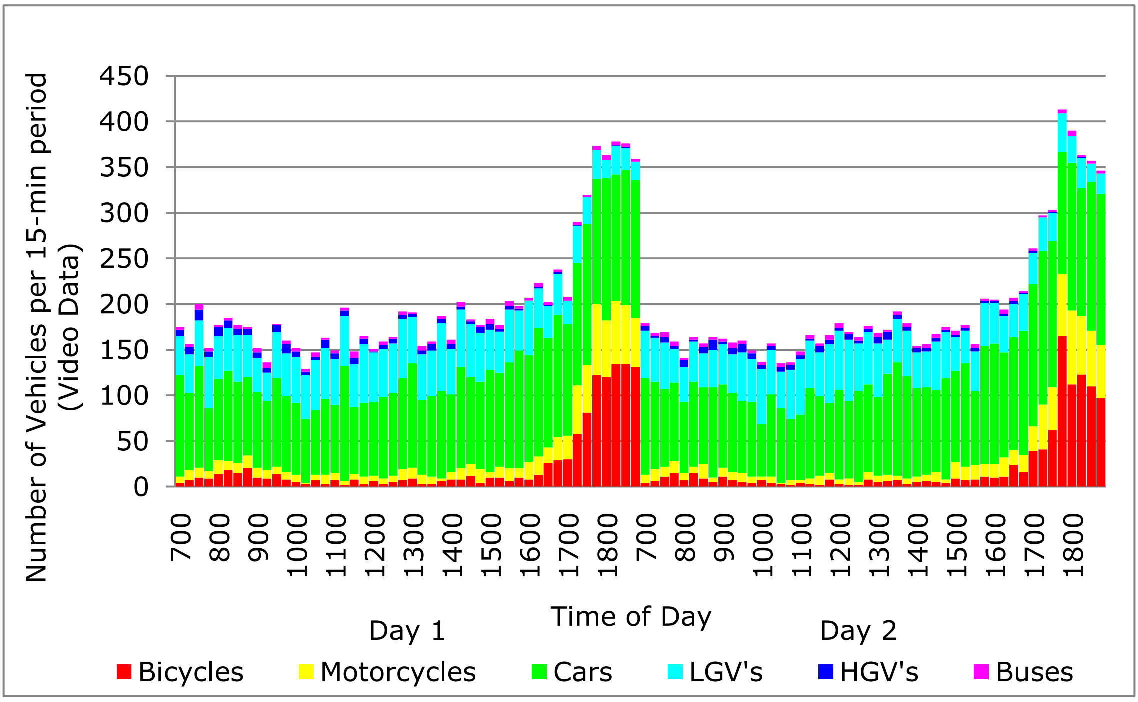


Figure C2:Flow by Mode for Site 8: Before Survey (Video Data)

The video data was analysed in 15-minute periods, and can be seen to be consistent with the axle counts. For example, between 1800 and 1900, the quarter-hour vehicle count was approximately 360. Thus, the hourly count was approximately 1,440, and assuming two axles per vehicle, the hourly axle count was approximately 2,880, and this compares favourably with the evening peak axle counts in Figure C2. In addition to the video and ATC data that was collected specifically for this project, TfL also supplied data on the typical monthly variations of motorcycles and cycles across the whole London network. This is discussed in Section C.5.

Further information on the sites and the data collection method is in Appendix A and Appendix B, respectively.

C.3 ATC Data Cleaning

The Automatic Traffic Counters (ATCs) consist of two parallel rubber tubes a fixed (known) distance apart. These were placed across the carriageway, covering all lanes in one direction. The data analysis software was able to provide the following outputs:

- Axle count – The "hits" of each vehicle's axles as they cross the tubes.
- Speed – Differences in times between the two tubes being crossed provides details of the vehicle's speed. In particular, the average speed can be outputted in hourly periods.
- Classified count – Differences in times between the axles of the vehicle crossing the tubes provides information for calculating the vehicle's axle spacing and therefore the class of vehicle.

These counts can be accurate under ideal conditions, but there are a number of known issues with the counters that affect data quality:

- Total failure – Both axle and classified data can be missing through a vehicle parking on a tube, ingress of water into the tubes, or other similar situations.
- Undercounting due to speed – Classified counts fail for a particular vehicle if the speed is below approximately 6 mph.
- Undercounting due to mode – Classified counts are generally accurate for most modes, but even under ideal conditions they typically only count up to 80% of cycles and motorcycles, with this sometimes being as low as 30%.

Point 1 is discussed in Section C.3.1 and Points 2 and 3 are discussed in Section C.4.1.

Another issue is that there are sometimes vehicle in the opposite direction are also counted. This may be caused for example if the tubes are placed opposite a bus stop, where multiple vehicles from the other side of the road may overtake buses at the bus stop: such vehicles were filtered out of the data.

C.3.1 Total failure – patching

Total failure can occur when a vehicle has parked on the tubes; in this case there are gaps in the data for up to several hours. Total failure can also occur if the tubes become filled with water or broken, for example by road sweepers. Such gaps in data can occur for a few days, depending on where in the planned maintenance programme the damage occurs.

Figure C3 shows an example of total failure for a 5-hour period, where no data was collected. This is the ATC classified count for Site 53 in the Before Access survey.

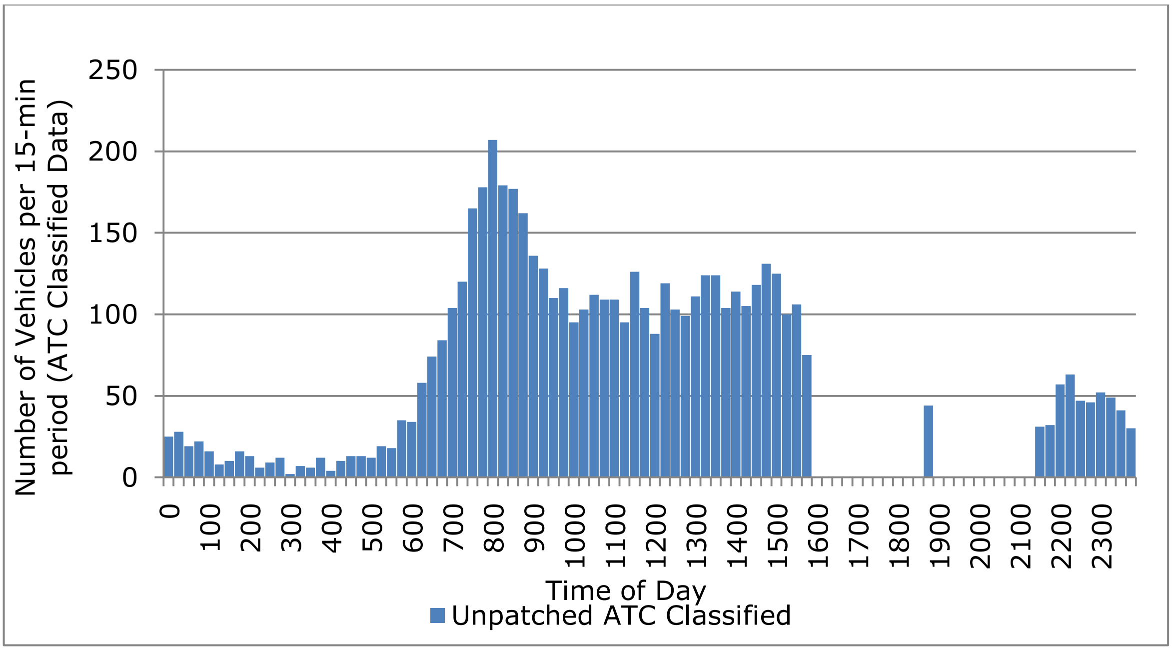


Figure C3: Unpatched Traffic Flow for Site 53: Before Survey, 14/10/08 (ATC Classified Data)

In such a case, patching was required. For the missing period, the average 15-minute flow from similar days was taken, e.g. weekend or weekday. Furthermore, the ATC data was collected for a period longer than seven days where possible, in which case the counts from the correct day of the week could be used from the following week. Figure C4 shows Site 53 in the Before survey once patched.

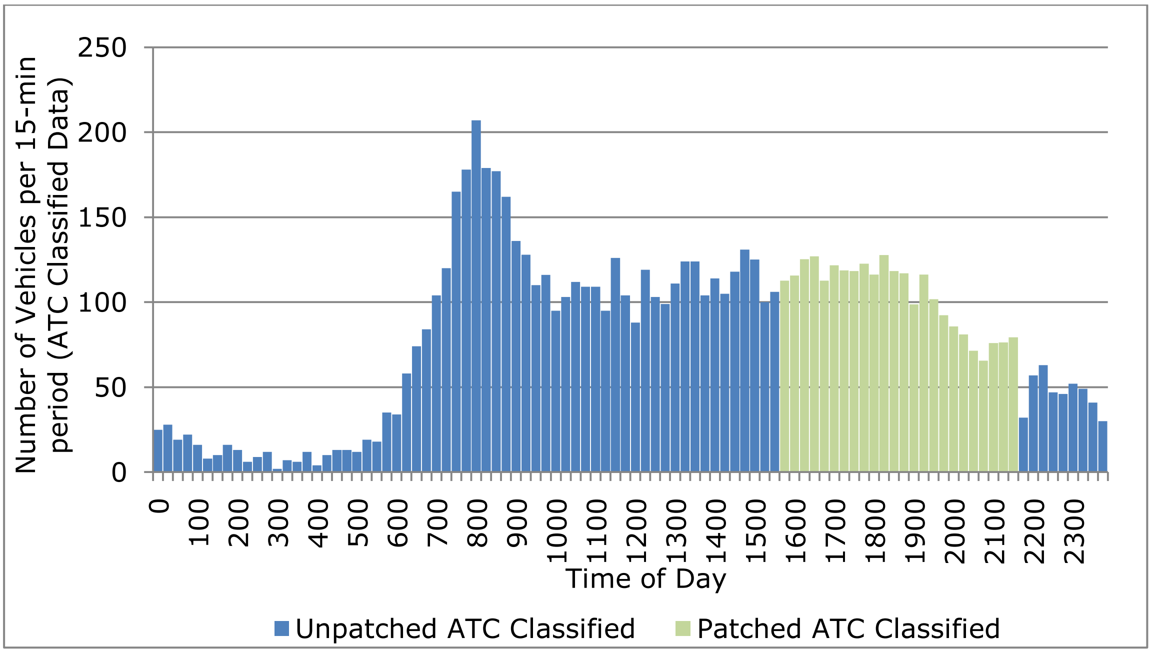


Figure C4: Patched Traffic Flow for Site 53: Before Survey, 14/10/08 (ATC Classified Data)

C.3.2 Other data cleaning

Log sheets were kept of any special events, such as football matches and road works, which would cause atypical traffic flows. These days were excluded and alternative days used.

Also, in the Current Trial 1 survey (Autumn 2010), 10 out of the 28 sites had to be conducted in the last week of October, which was the half term. A (scalar) correction factor was applied to these, which was based on the 18 out of 28 sites that were unaffected.

C.4 Combining data sources to form flow estimates

There are two types of undercounting in the ATCs

- Undercounting due to speed – Classified counts fail for a particular vehicle if the speed is below approximately 6 mph.
- Undercounting due to mode – Classified counts undercount cycles and motorcycles even under ideal conditions.

Figure C5 shows the classified count for Site 14 in the Previous Trial survey (Autumn 2009). Red indicates speeds of 0-10 km/h and orange indicates speeds of 10-20 km/h. The black line represents the video count.

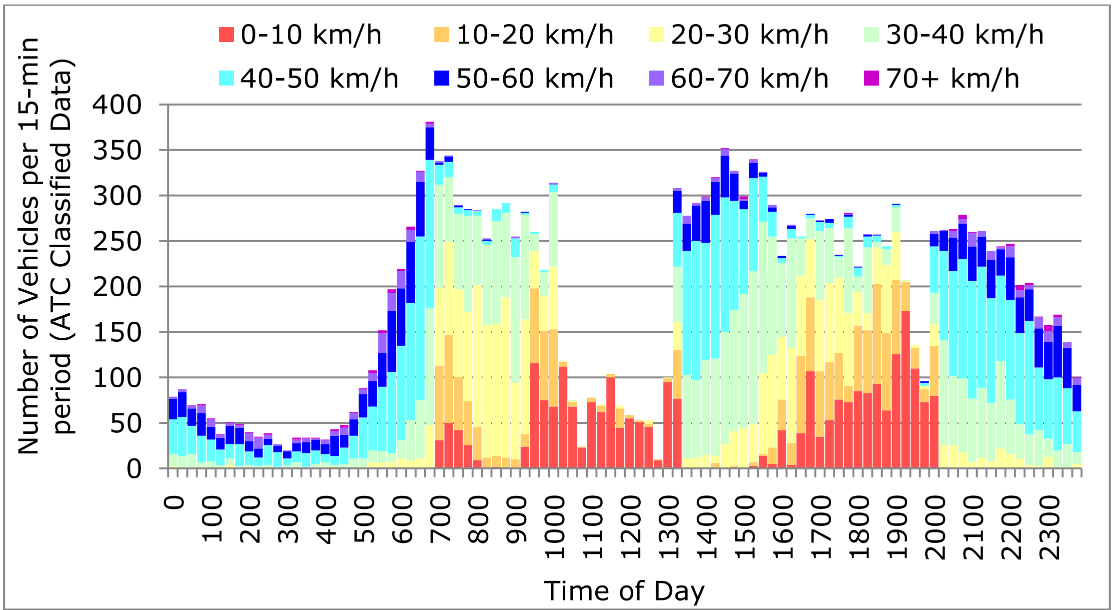


Figure C5: Traffic Flow and Speed for Site 14: Previous Trial survey, 09/09/2009 (ATC Classified Data – total for all modes)

This shows that for the periods with low speeds, the ATC classified count was inaccurate. This was confirmed by comparison with video data. It also implies this undercounting was due to the low average speeds. This was a common problem in London sites, with some undercounting at 64 out of 112 sites.

C.4.1 Method used to account for undercounting

The video flow counts were only available for the Before Access surveys (Autumn 2008) and the Previous Trial surveys (Autumn 2009) datasets. Due to the substantial increases in cycling over the last 2 years, it was not possible to assume the same modal split in the current study.

Therefore the approach was taken to develop "undercounting models" using the video and ATC data from the Previous Trial surveys and then to apply these to the Current Trial surveys. The models compared the undercounting (against video data) in the ATC classified data against the average speed for each hour. Three models were developed one each for cycles, motorcycles and all other modes combined (car, LGV, HGV, bus).

Figure C6 shows for Site 7 the hourly flow for all modes excluding cycles and motorcycles (left vertical axis) as recorded by the video counts and ATC classified counts in black and red, respectively. It also shows the average speed (right vertical axis) in grey.

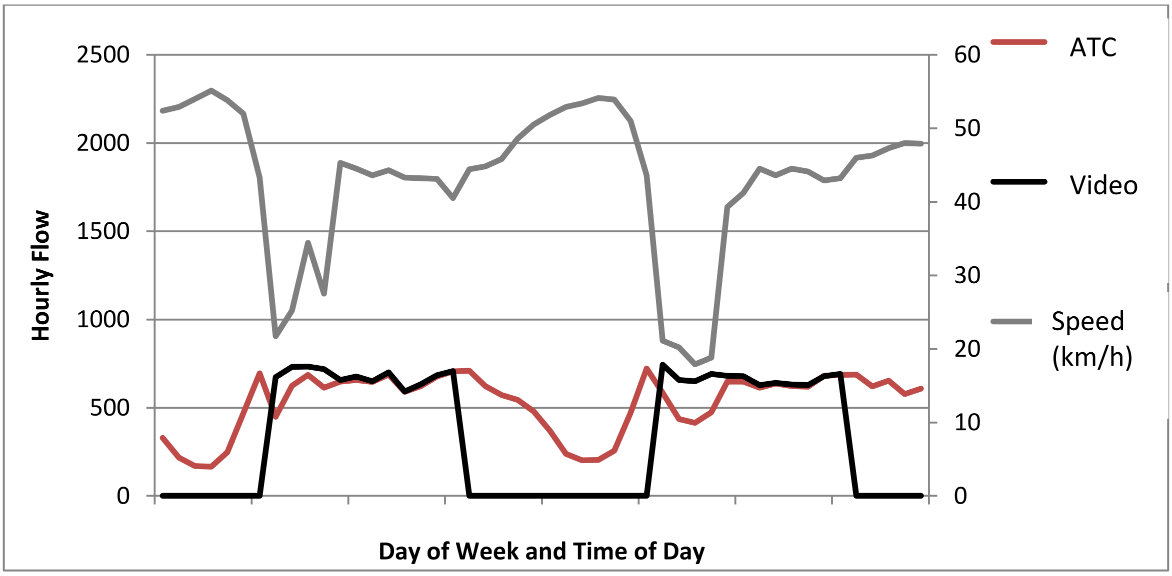


Figure C6: Other modes combined flow and average speed for Site 7: Previous Trial survey

This shows that on Site 7, where the average speed is greater than 40 kph there is a close match between the two data sources, but for speeds below 30 kph there is some undercounting. The fitted relationship can be seen in Figure C7

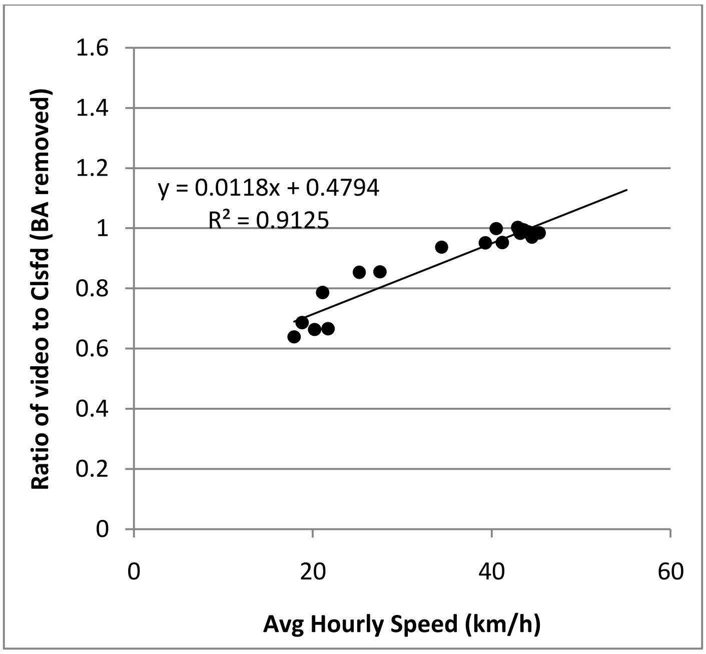


Figure C7: Relationship between other modes combined flow and average speed for Site 7: Previous Trial survey

The same trend is visible in the non-linear regression. This analysis was conducted for all sites and similar trends were present. All the sites were combined into one model, as shown in Figure C8.

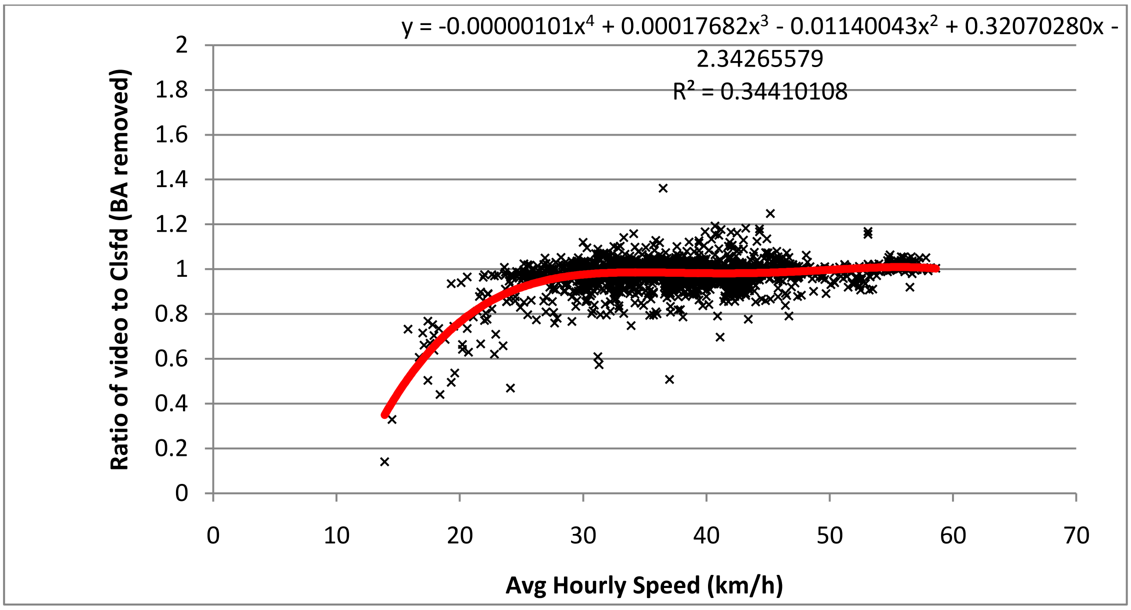


Figure C8: Relationship between other modes combined flow and average speed for Site 7: Before Access and Previous Trial survey

The model for all modes excluding cycles and motorcycles showed quite a clear trend and this was applied to scale up the ATC classified counts for cars, LGVs, HGVs and buses. The model was valid between 15 kph and 35 kph; outside of these bounds the fixed undercounting values 0.448 and 0.982 were applied, respectively.

The corresponding motorcycle and pedal cycle models are shown in Figure C9 and Figure C10. For these models, only observations with an hourly flow of greater than 50 per hour were included in the model.

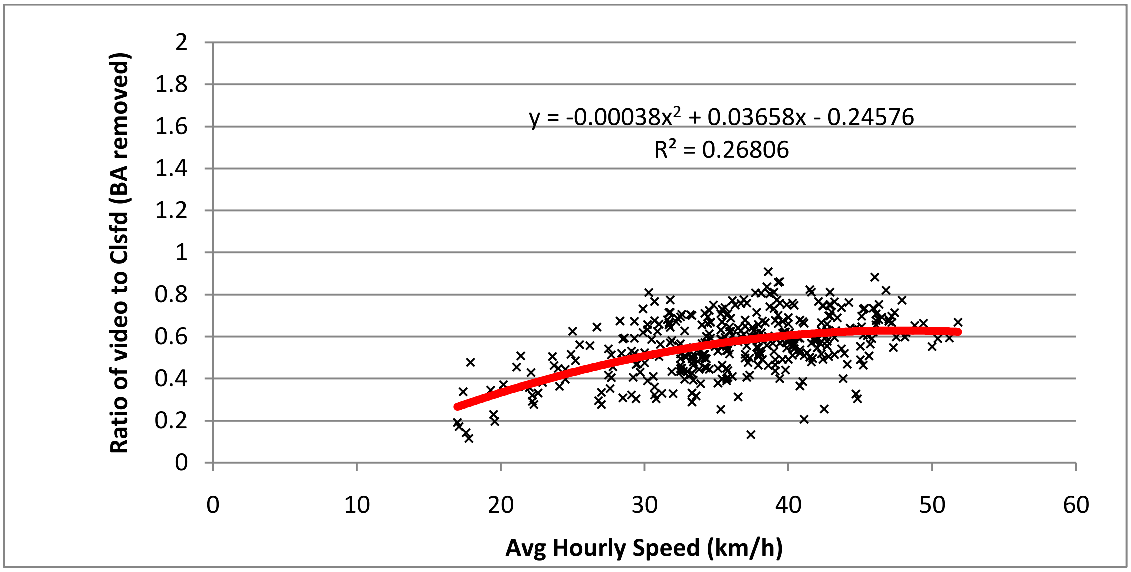


Figure C9: Relationship between motorcycle flow and average speed for all sites: Before Access and Previous Trial survey

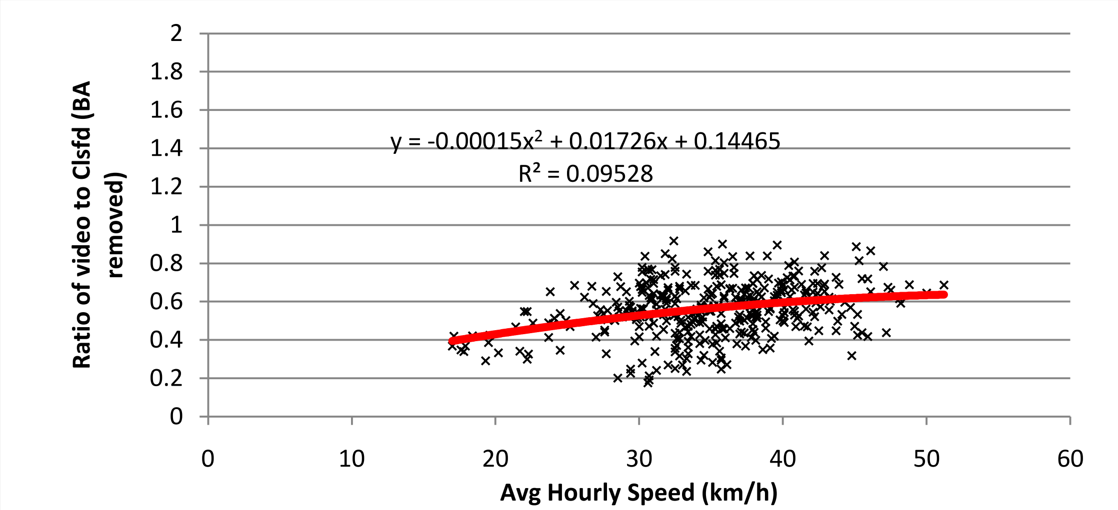


Figure C10: Relationship between cycle flow and average speed for all sites: Before Access and Previous Trial survey

The models were not as robust as the models for the other modes, but did show a trend of an average undercounting of 40% for high speeds and average undercounting of approximately 60% for lower speeds.

These undercounting percentages were applied to the motorcycles and pedal cycles, based on the average speed in each hour. This scaled up the totals and accounted for the undercounting.

C.5 Generating annual flows - applying seasonal factors

In order to scale weekly flows to annual flows, TfL count from the TLRN was analysed to produce the seasonal factors for motorcycles and cycles. Available data from 2004 to 2010 was analysed; so as to not include data from before the Congestion Charge was implemented. The average seasonal trend was taken across the six years. 9-monthly flows (August to May, excluding December) were created for use with the collision data.

The seasonal factors for motorcycles and cycles are shown in Figure C11 and Figure C12, respectively. In both graphs, October is taken as the base month, with a value of 100, and all other months have a seasonal factor relative to October.

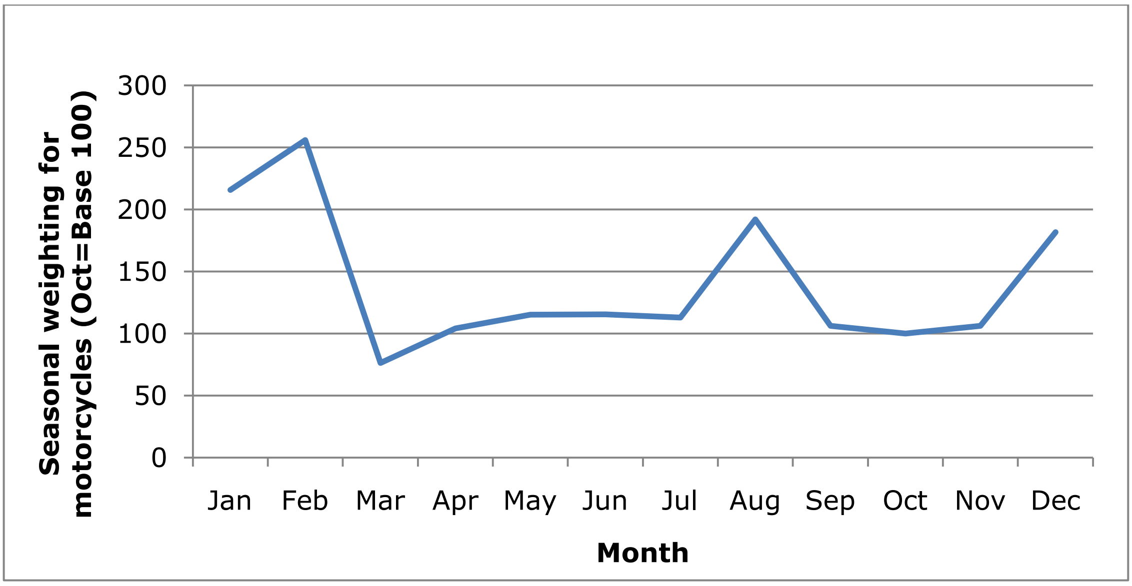


Figure C11: Motorcycle Seasonal Variations (Data Provided by TfL)

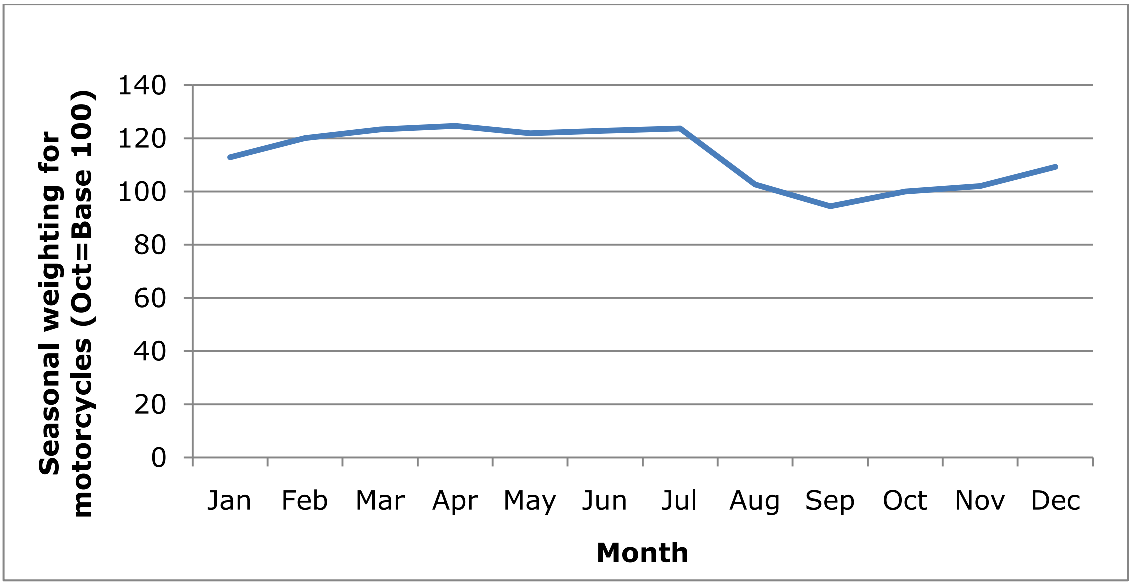


Figure C12: Pedal Cycle Seasonal Variations (Data Provided by TfL)

For motorcycles there was a large peak in usage in December to February, also with a peak in August. For cycles, there was a smaller rise in flows for February to August.

The collisions were analysed in three time periods:

A. August 2007-May 2008

B. August 2009-May 2010

C. August 2010-May 2011

The Before Access (Autumn 2008) flows were used for Time Period A, and the Previous Trial (Autumn 2009) flows were used for Time Period B.

For Time Period C, both the Current Trial 1 (Autumn 2010) and Current Trial 2 (Spring 2011) fell within the period. However, for consistency with the other periods the Autumn survey was used. This is summarised in Table C2– Collision analysis time periods and flow surveys used.

Table C2: Collision analysis time periods and flow surveys used.

Time Period	A	B	C
ACCSTATS data period used	August 2007-May 2008	August 2009-May 2010	August 2010-May 2011
ATC classified data used	Before (Autumn 2008)	Previous Trial (Autumn 2009)	Current 1 (Autumn 2010)
Relationship to motorcycles being permitted access to bus lanes	Before	After	After
Relationship to enforcement measures	Before	Before	After

The two main comparisons of interest between the time periods were:

- Change between Time Period A and Time Period B
- Change between Time Period B and Time Period C

C.6 Scaling up for sites, corridors and the network – gravity model

It was necessary to scale the link flows by the length of road required for the four geographical areas in the collision analyses:

- Network (TLRN Bus Lanes compared to Remainder of London's Road Network)
- Network Sites (TLRN compared to Borough)
- Corridors (Enforcement compared to Non-enforcement)
- Corridors Sites (Enforcement compared to Non-enforcement)

The methods used to do this are discussed in this section.

The collision analysis was done for motorcycles, pedal cycles and pedestrians. Three sets of flows were therefore required: motorcycles, pedal cycles and all vehicles.

C.6.1 Network-wide gravity model

Two 'gravity models' were created to scale the link flows and estimate flows for the whole TLRN network and the Borough road network in London. These models were based on the flows for the 14 TLRN sites and 14 Borough sites for which ATC data was collected in the this study.

The models took the average TLRN link flow and Borough link flow for each London Borough, in which there were any sites. The approximate centre of each borough was plotted and then the model estimated the link flows for the boroughs in which there were no sites[3]. The modelled flows were most influenced by neighbouring boroughs. Finally, the average link flows for each borough were multiplied by the total TLRN and Borough road lengths in each borough.

The models provided an estimate of the TLRN network and Borough network flows that could be used in determining the collision rates for the whole network.

The selection of the 56 sites in the previous study was done randomly across all suitable TLRN sites and partner Borough sites across London. A large proportion of London's bus lanes are located in North London and as such a large proportion of the sites were selected in North London. This resulted in a slight limitation of the gravity models, because the sites outside of North London had greater impact on the network-wide flows.

C.6.2 Other 28 sites and 5 new sites

Flow data was readily available for the 56 original sites for the comparison of Time Period A and Time Period B. However, for comparison of Time Period B and Time Period C, flow data was only available for half of the sites.

The average change between Time Period B and Time Period C was computed for the 14 TLRN sites and 14 Borough sites, for which data was available. These two averages were then applied to the other 28 sites in Time Period B to determine the flows in Time Period C. For the 5 new sites, the TLRN Gravity Model was used to estimate flows in all three time periods.

Each of the link flows on the sites were then multiplied by the site length, which ranged from 200 to 1500 metres. The 27 TLRN sites[4] that were on a corridor were then aggregated into two groups for the collision analysis: those on Enforcement Corridors and those on Non-enforcement Corridors.

3 Various gravity models were tested and 1/(distance squared) was used.

[4] Site 28 was excluded from the collision analysis – see §A.1.3 for further information.

C.6.3 Corridors and bus lanes on Corridors

The middle point of each corridor was plotted and the TLRN Gravity Model was used to estimate flows on each of the 28 corridors. Each of the link flows on the Corridors were then multiplied by the length of the corridor. The 28 corridors were then aggregated into two groups for the collision analysis: those with enforcement and those without enforcement.

Data was provided by TfL on the length and location of all bus lanes in London. For each bus lane it was determined if they were on a corridor and if so, which corridor they were on.

Appendix D Detailed collision analysis

The collision data analysis considered safety trends across the TLRN Bus Lanes (with the Remainder of London's Roads as a comparison), Network Sites (TLRN and Borough), Enforcement (and Non-enforcement) Corridors and Corridor Sites (Enforcement and Non-enforcement). Trends starting from before motorcycles were permitted access to the bus lanes, during the previous trial and in the current trial have been investigated: i.e. in three time periods each containing 9 comparable months.

The detailed analysis has only been performed for the TLRN Bus Lanes dataset, as it is the largest to consider the sub-categories of manoeuvres that were performed and locations in which the collision occurred. The following sections examine each of the vulnerable road users in detail: Motorcyclists, Cyclists and Pedestrians.

D.1 Motorcyclists

D.1.1 Severity

The maximum severity sustained by any person in each collision was considered. Severity is classified in three levels, slight, serious and fatal. An injury is classified as:

- fatal if the death occurs in 30 days of the collision,
- serious if it involves fractures, concussion and severe cuts,
- slight injury if it includes slight cuts, whiplash and sprains.

The number of collisions with such injures are summarised in Figure D1 and Table D11.

Most of the collisions (over 80%) were slight. However, the percentage of serious collisions significantly decreased (at the 95% confidence level), but the percentage of fatalities (although relatively small numbers) significantly increased on the TLRN Bus Lanes in the Current Trial.

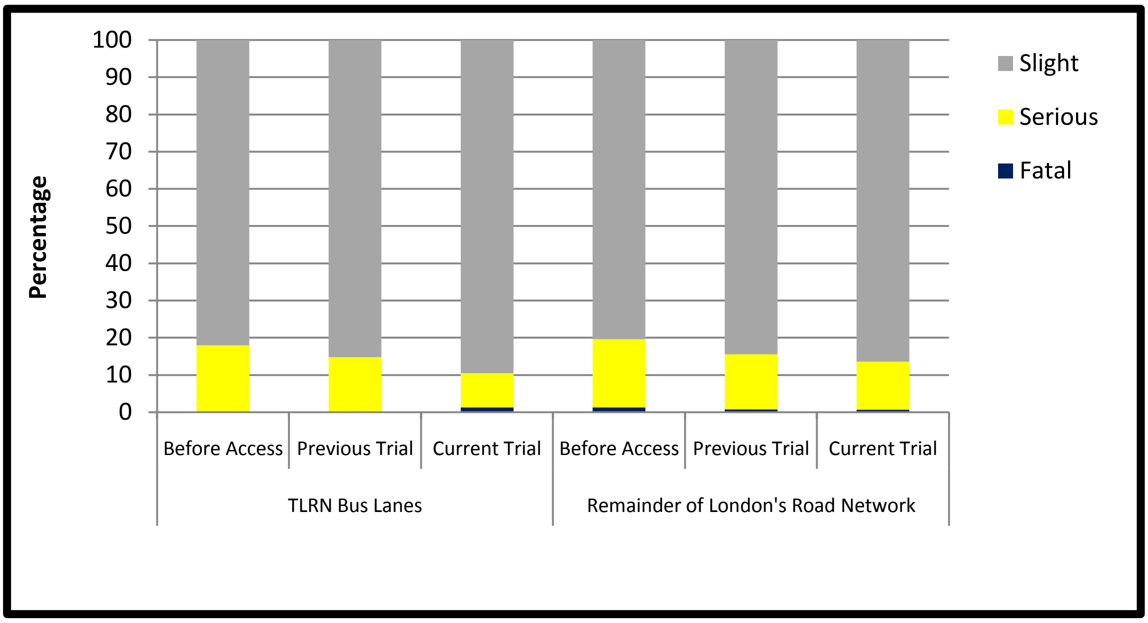


Figure D1: Maximum severity of injuries in collisions involving a motorcycle on the London Road Network

Table D11: Number of motorcycle collisions with different severities

	Severity	Before Access	Previous Trial	Current Trial
TLRN Bus Lanes	Fatal	1	1	7
	Serious	80	79	51
	Slight	370	460	495
Remainder of London's Road Network	Fatal	39	22	22
	Serious	557	458	407
	Slight	2,451	2,601	2,730

D.1.2 Location

The road location of the motorcycles involved in collisions is recorded in the ACCSTATS database. These have been summarised in Figure D2 for the TLRN Bus Lanes and the Remainder of London's Road Network averaged over all time periods studied, and in Figure D3 for the TLRN Bus Lanes in each time period.

Most motorcycle collisions (over 70%) occurred at, or near to, a junction. On the TLRN Bus Lanes 79% occurred in such locations before motorcyclists were permitted access to bus lanes. This significantly increased (at the 95% confidence level) to 88% in both the Previous and Current Trials. Also, the percentage occurring in the middle of junctions almost doubled from 37% to 67% (and 68%) in the Previous and Current Trials.

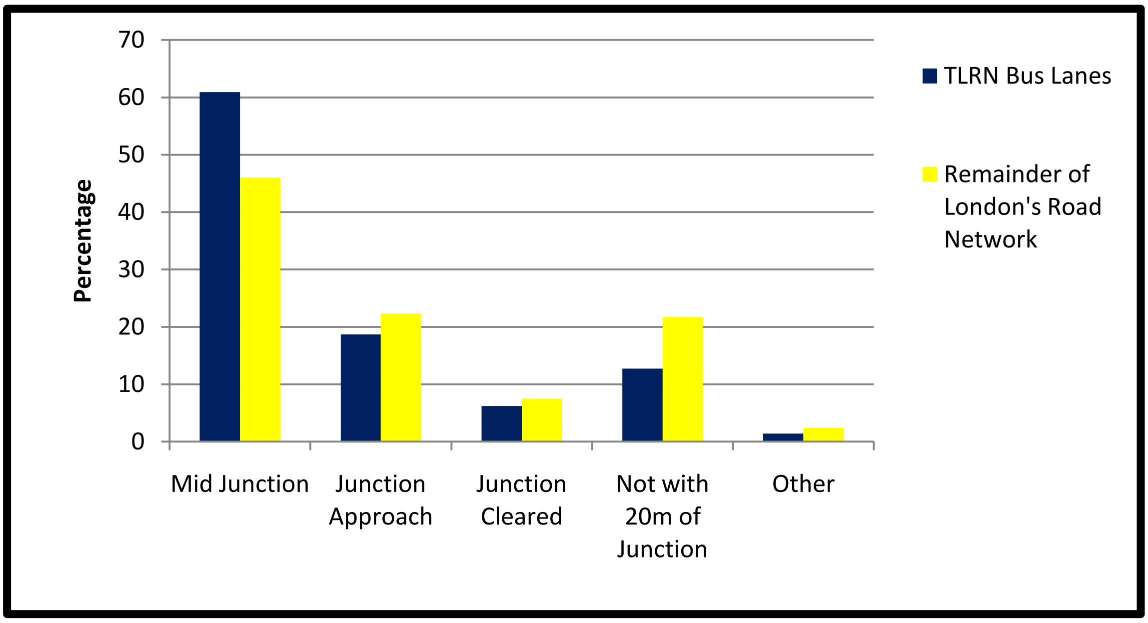


Figure D2: Percentage of motorcycle collisions occurring in different locations on the London Road Network (across all three surveys)

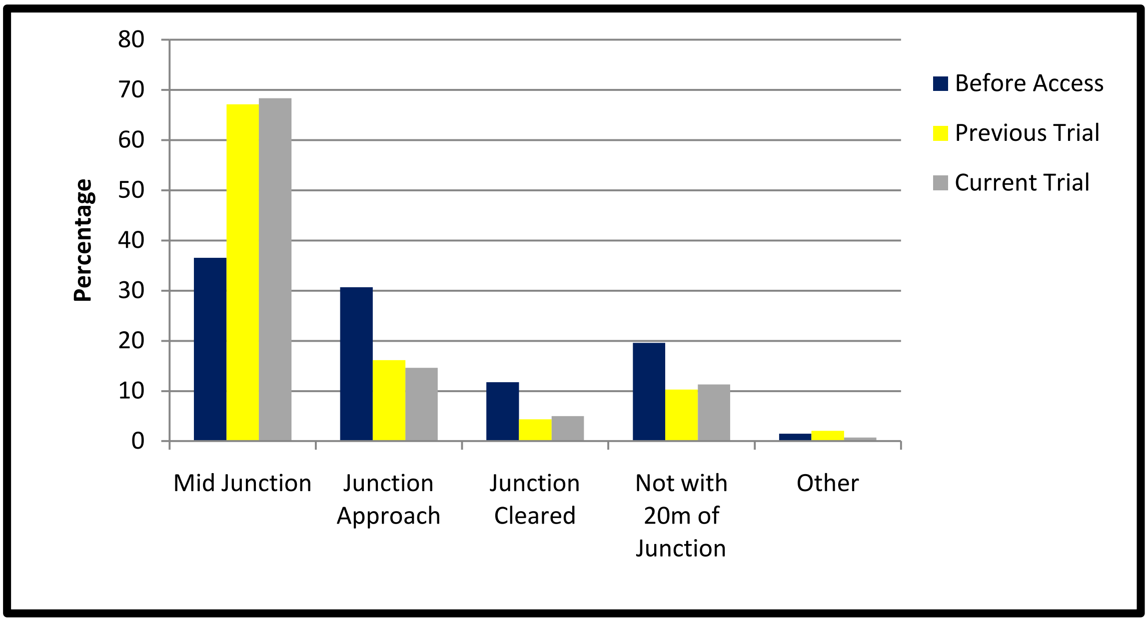


Figure D3: Percentage of motorcycle collisions occurring in different locations on the TLRN Bus Lanes

D.1.3 Manoeuvres by motorcyclist prior to collision

The manoeuvre being performed by each vehicle prior to the collision is recorded in the ACCSTATS database. The manoeuvre performed by the motorcyclists is summarised in Figure D4 for the TLRN Bus Lanes and the Remainder of London's Road Network averaged over all time periods studied, and in Figure D5 for the TLRN Bus Lanes in each time period. Most motorcyclists (over 58%) were going straight ahead just before the collision. The next most common manoeuvre was overtaking (on either side) which occurred in approximately 20% of collisions. There was a statistically significant increase (at the 95% confidence level) in the percentage of motorcyclists going straight ahead from before motorcycles were permitted access to the bus lane to the Previous Trial.

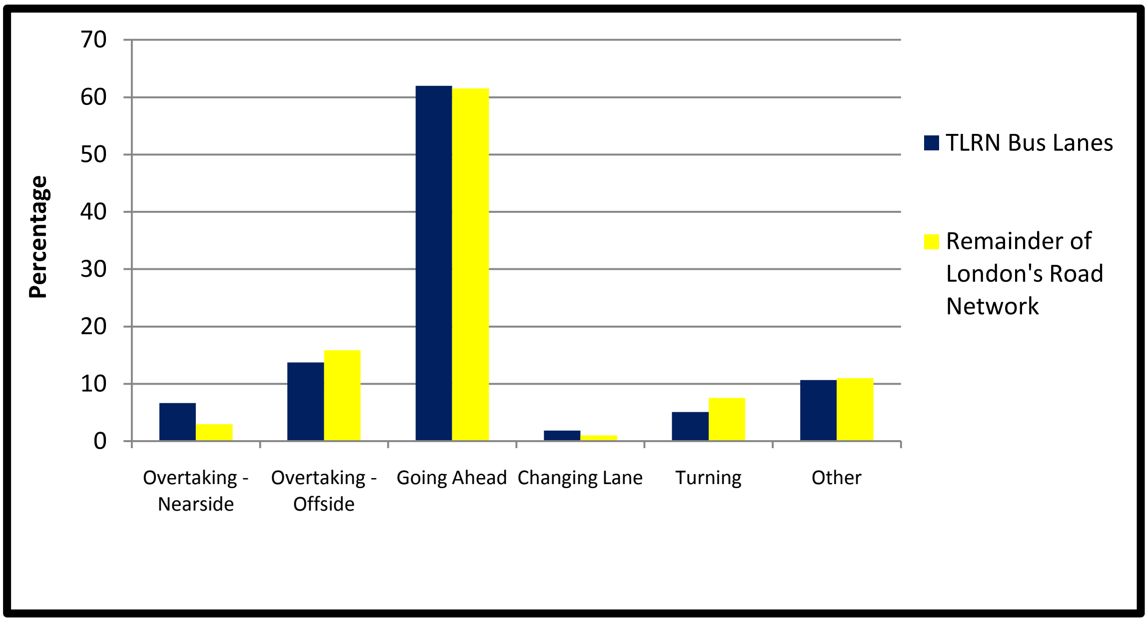


Figure D4: Percentage of motorcycle collisions occurring whilst motorcyclist is making different manoeuvres on the London Road Network (across all three surveys)

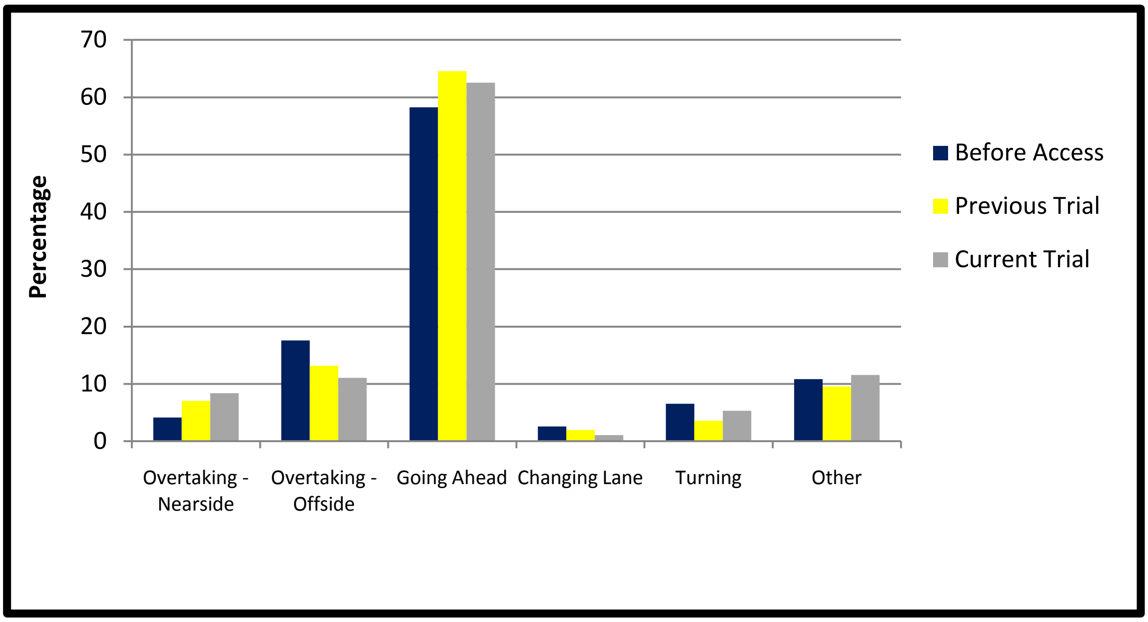


Figure D5: Percentage of motorcycle collisions occurring whilst motorcyclist is making different manoeuvres on the TLRN Bus Lanes

D.1.4 Manoeuvres by cars prior to collision

Similarly, the manoeuvre performed by the other vehicles is contained in the ACCSTATS database. As most collisions involved a car, the manoeuvre being performed by car drivers is summarised in Figure D6 for the TLRN Bus Lanes and the Remainder of London's Road Network averaged over all time periods studied, and in Figure D7 for the TLRN Bus Lanes in each time period.

Most drivers (over 53%) were turning just before the collision, and this did not vary significantly during the analysis periods.

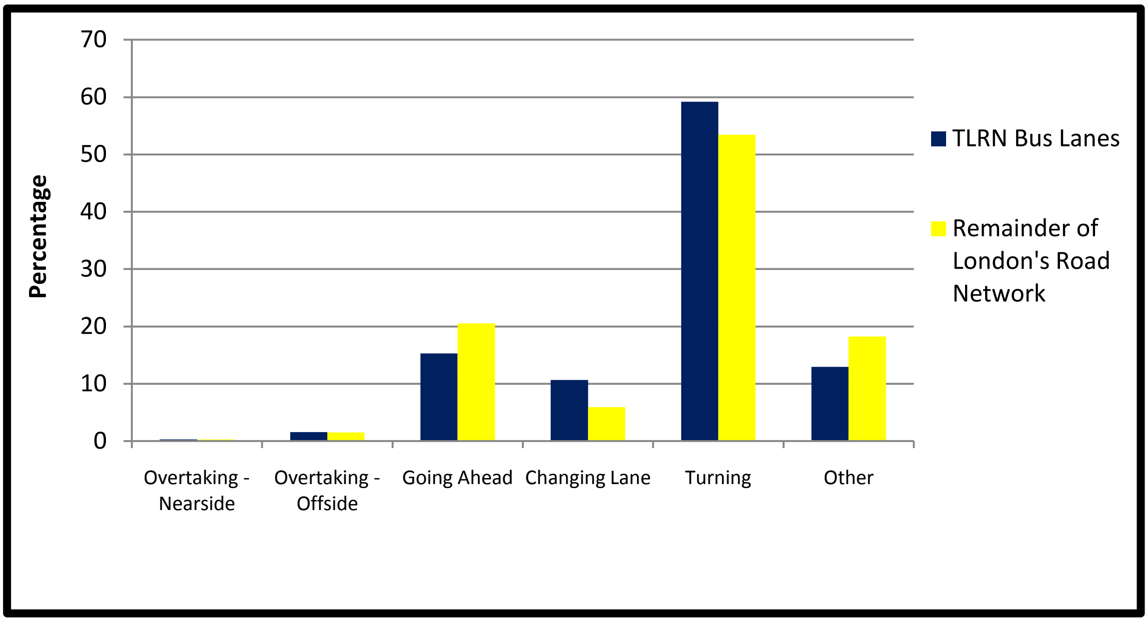


Figure D6: Percentage of motorcycle collisions occurring whilst motorist is making different manoeuvres on the London Road Network (across all three surveys)

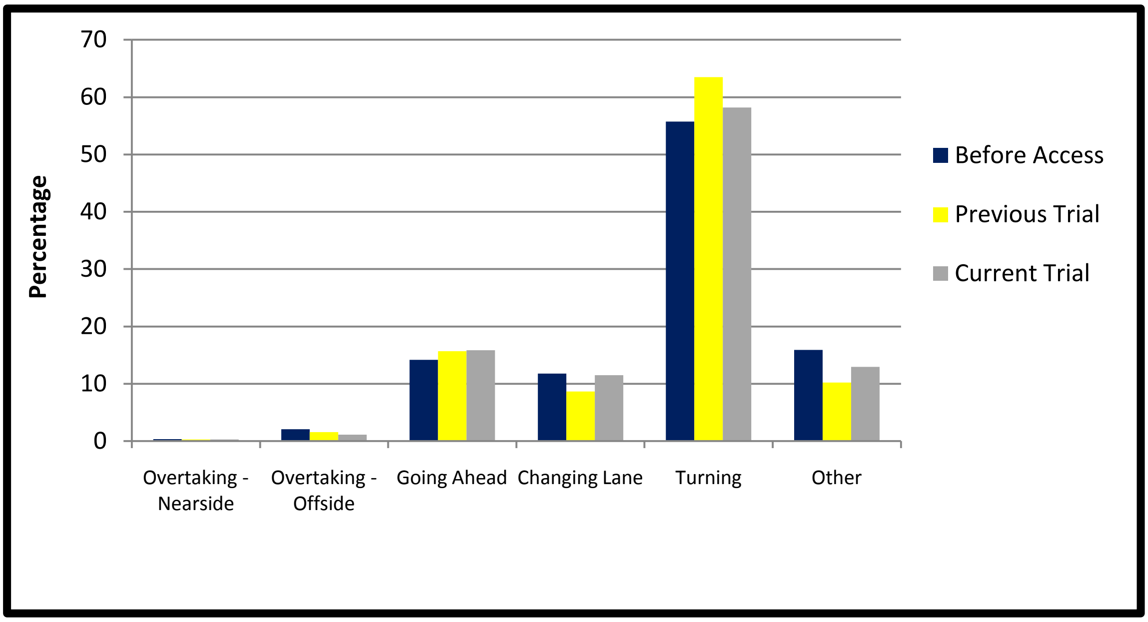


Figure D7: Percentage of motorcycle collisions occurring whilst motorist is making different manoeuvres on the TLRN Bus Lanes

D.2 Cyclists

D.2.1 Severity

The number of cycle collisions with different categories of injury are summarised in Figure D8 and Table D12. The severity of the collisions did not vary significantly during the time periods studied, and over 84% were a slight severity.

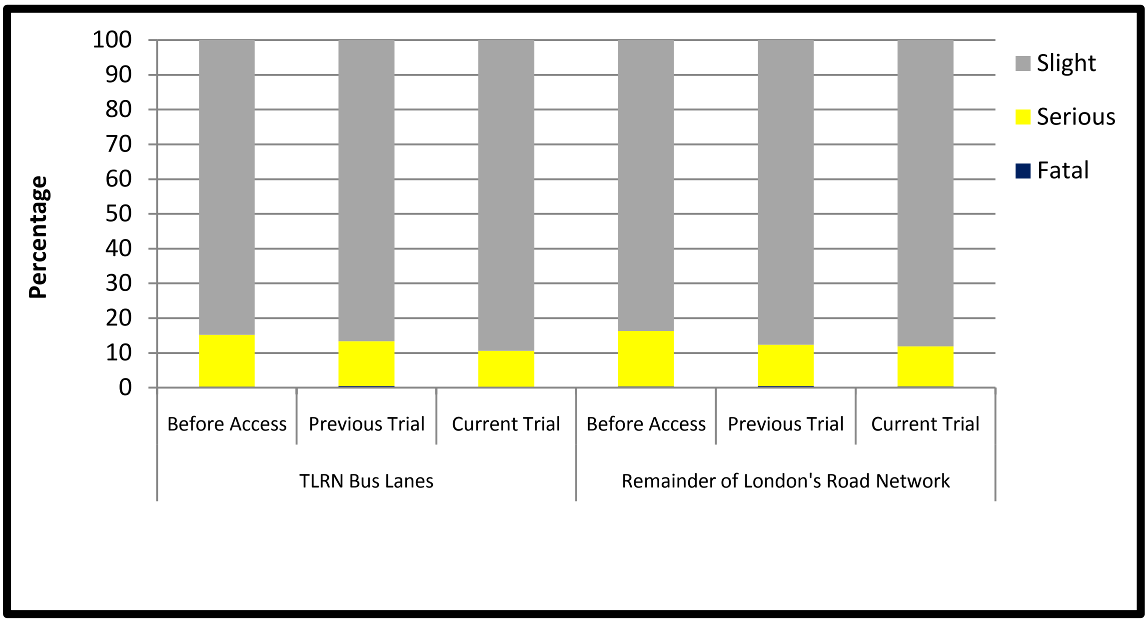


Figure D8: Maximum severity of injuries in collisions involving a cycle on the London Road Network

Table D12: Number of cycle collisions with different severities

	Severity	Before Access	Previous Trial	Current Trial
TLRN Bus Lanes	Fatal	1	2	0
	Serious	46	50	47
	Slight	262	336	395
Remainder of London's Road Network	Fatal	8	11	11
	Serious	307	292	321
	Slight	1,620	2,151	2,458

D.2.2 Location

The location of the cycles involved in collisions is recorded in the ACCSTATS database. These have been summarised in Figure D9 for the TLRN Bus Lanes and the Remainder of London's Road Network averaged over all time periods studied, and in Figure D10 for the TLRN Bus Lanes in each time periods.

As with motorcycles, most cycle collisions (over 70%) occurred at, or near to, a junction. On the TLRN Bus Lanes 83% occurred in such locations before motorcyclists were permitted access to bus lanes. This increased (significantly at the 95% confidence level) to 90% in both the Previous and Current Trials.

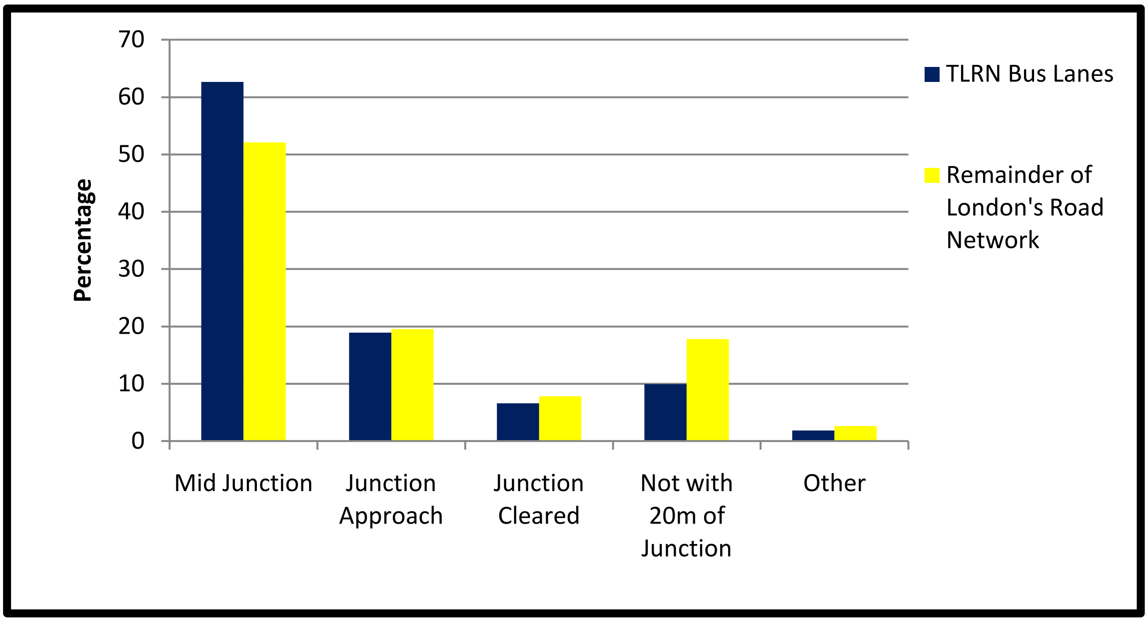


Figure D9: Percentage of cycle collisions occurring in different locations on the London Road Network (across all three surveys)

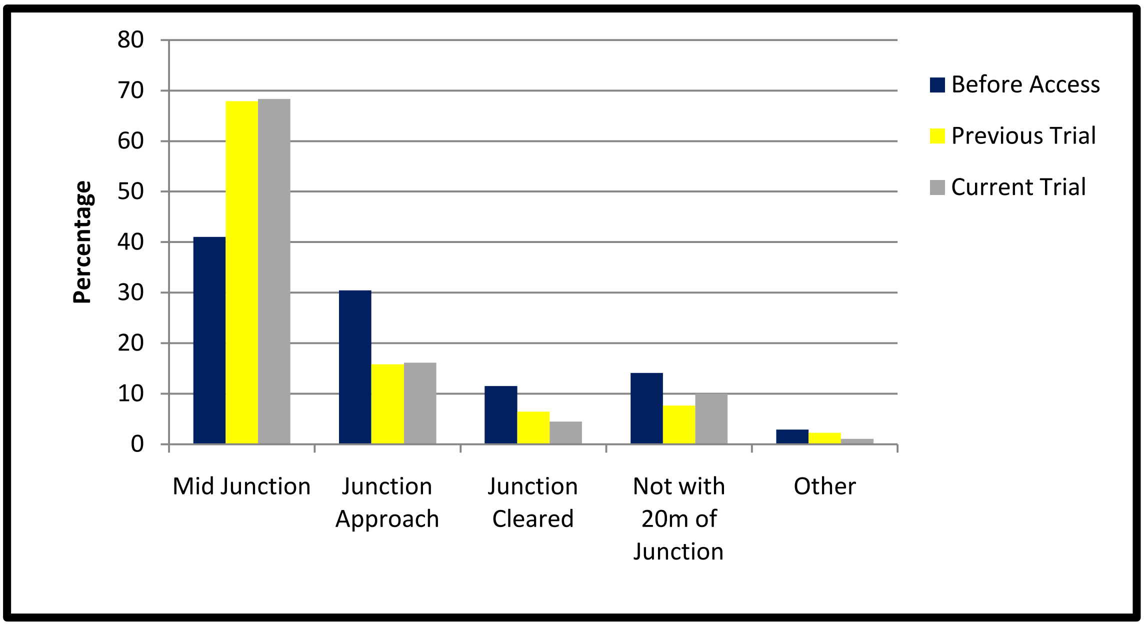


Figure D10: Percentage of cycle collisions occurring in different locations on the TLRN Bus Lanes

D.2.3 Manoeuvres by cyclist prior to collision

The manoeuvre being performed by each vehicle prior to the collision is recorded in the ACCSTATS database. The manoeuvre performed by the cyclists is summarised in Figure D11 for the TLRN Bus Lanes and the Remainder of London's Road Network averaged over all time periods studied, and in Figure D12 for the TLRN Bus Lanes in each time period. Most cyclists (over 70%) were going straight ahead just before the collision. There were no significant changes in the manoeuvres involved in the collisions between the time periods.

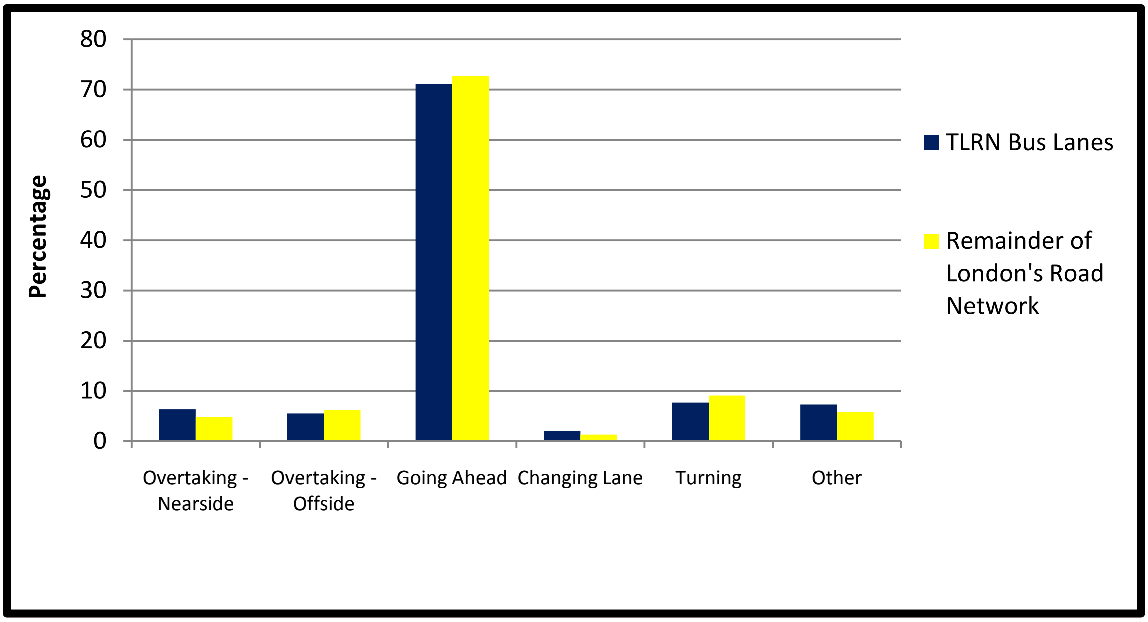


Figure D11: Percentage of cycle collisions occurring whilst cyclist is making different manoeuvres on the London Road Network (across all three surveys)

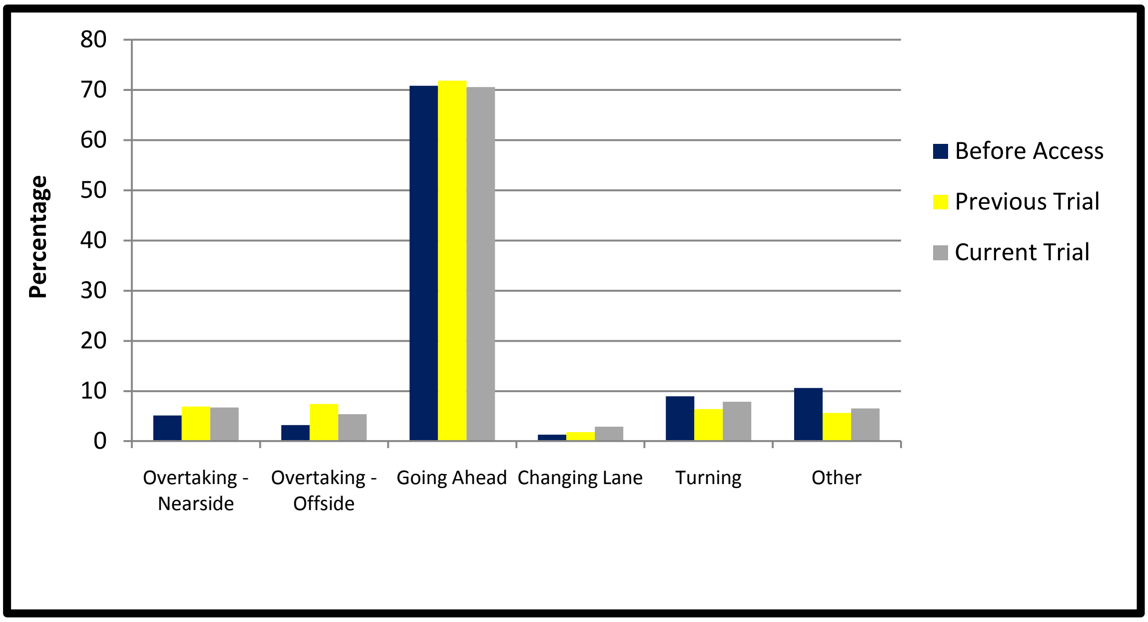


Figure D12: Percentage of cycle collisions occurring whilst cyclist is making different manoeuvres on the TLRN Bus Lanes

D.2.4 Manoeuvres by cars prior to collision

As most cycle collisions involved a car, the manoeuvre being performed by car drivers is summarised in Figure D13 for the TLRN Bus Lanes and the Remainder of London’s Road Network averaged over all time periods studied, and in Figure D14 for the TLRN Bus Lanes in each time period.

The most common manoeuvre performed by car drivers before a collision with a cyclist (over 45%) was turning, and this did not vary significantly during the analysis periods.

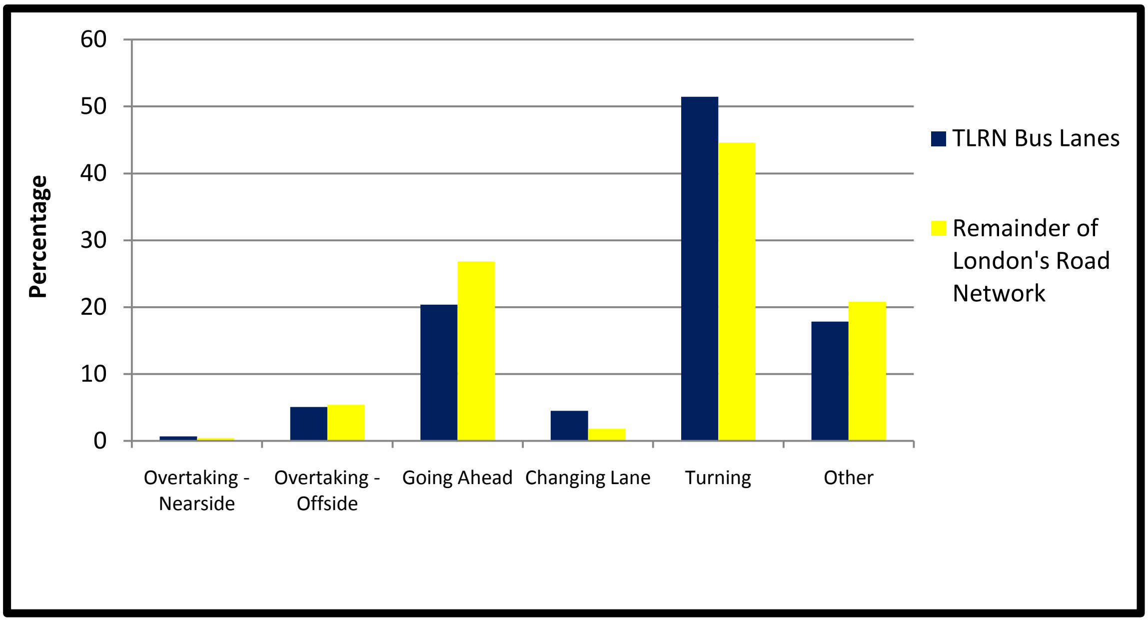


Figure D13: Percentage of cycle collisions occurring whilst car driver is making different manoeuvres on the London Road Network (across all three surveys)

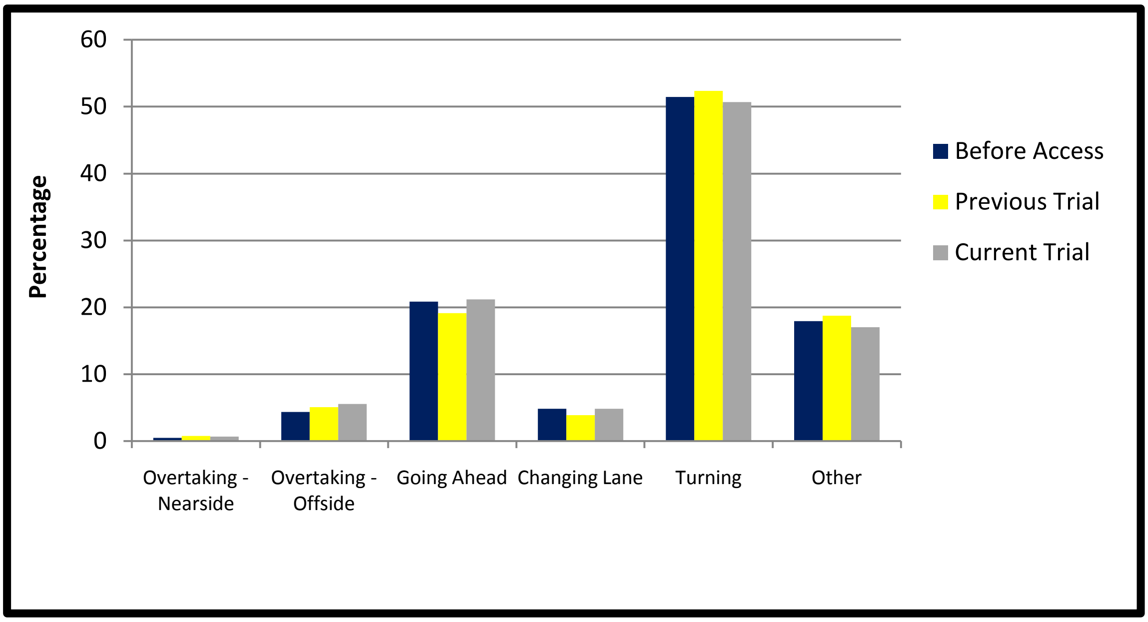


Figure D14: Percentage of cycle collisions occurring whilst car driver is making different manoeuvres on the TLRN Bus Lanes

D.3 Pedestrians

D.3.1 Severity

The severity sustained by any person in each pedestrian collision was considered. The number of collisions with such injures are summarised in Figure D15 and Table D13. The severity of the collisions did not significantly vary between the time periods studied.

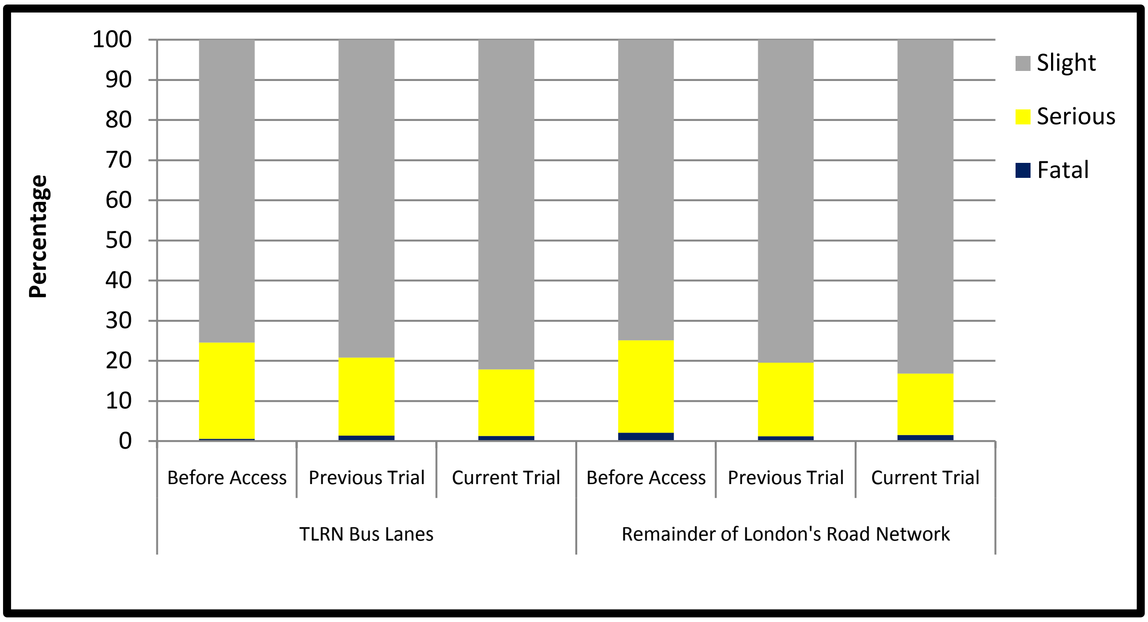


Figure D15: Maximum severity of injuries in collisions involving a pedestrian on the London Road Network

Table D13: Number of pedestrian collisions with different severities

	Severity	Before Access	Previous Trial	Current Trial
TLRN Bus Lanes	Fatal	2	5	5
	Serious	82	71	63
	Slight	258	289	312
Remainder of London's Road Network	Fatal	75	44	55
	Serious	807	650	539
	Slight	2,629	2,858	2,937

D.3.2 Manoeuvres by cars prior to collision

The ACCSTATS database does not include information on the location of pedestrians and their movements before the collision. However, information on the manoeuvres made by cars before collisions with pedestrians can be examined, and are summarised in Figure D16 for the TLRN Bus Lanes and the Remainder of London's Road Network, and for each time period studied on the TLRN Bus Lanes in Figure D17. Most (over 60%) of pedestrian collisions occurred with cars that were carrying straight on. Apart from this category, other manoeuvres that constituted over ten percent of the collisions were the car turning and "other". Further, the main contributing manoeuvres in the other category were reversing, slowing/stopping and moving off. The percentage of cars making each manoeuvre before the collision with the pedestrian remained consistent, except there was a significant increase (at the 95% confidence level) in the cars carrying straight on in the Current Trial.

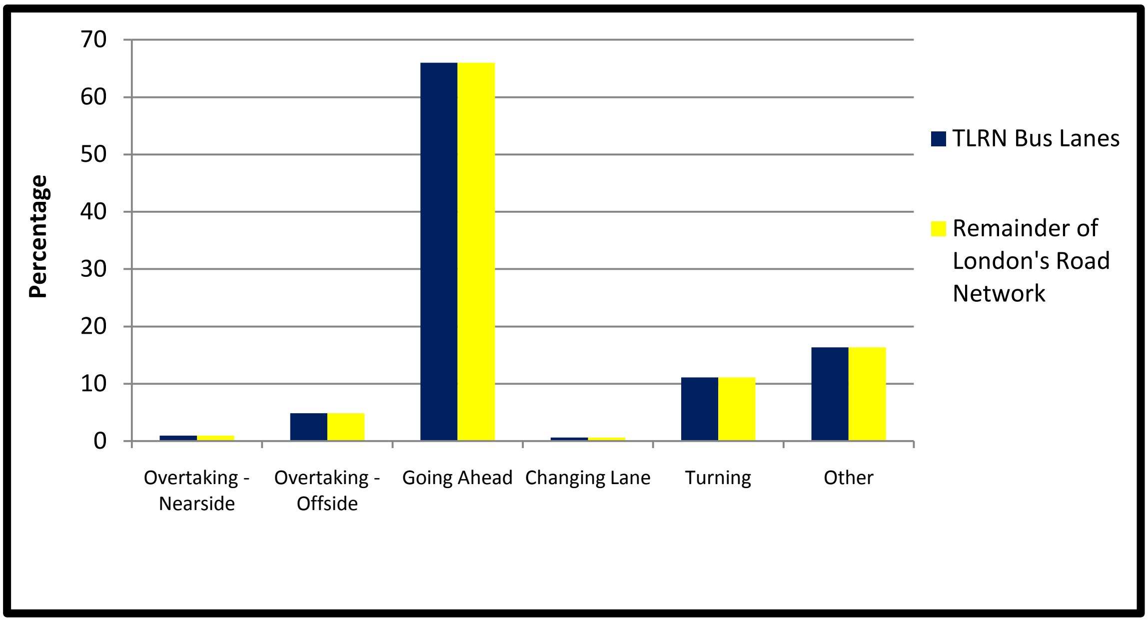


Figure D16: Percentage of pedestrian collisions occurring whilst motorist is making different manoeuvres on the London Road Network (across all three surveys)

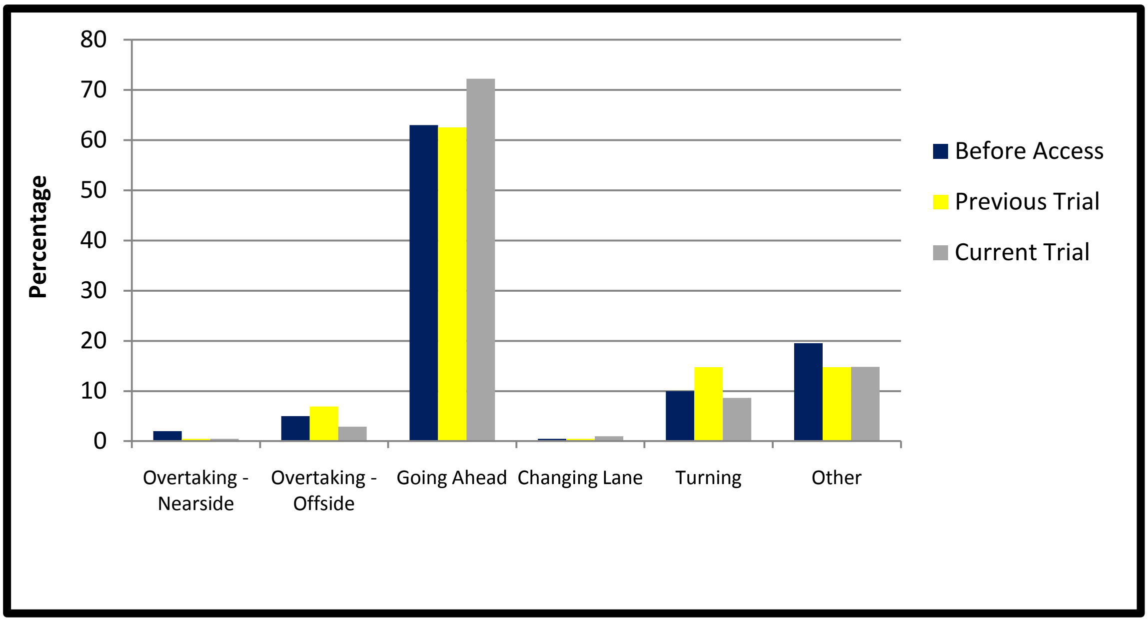


Figure D17: Percentage of pedestrian collisions occurring whilst motorist is making different manoeuvres on the TLRN Bus Lanes

Appendix E Analysis of factors in collisions involving vulnerable road users on corridors

E.1.1 Motorcycle Collisions

A total of 835 collisions involving motorcycles were on enforcement corridors and in the Previous and Current Trial. Comparison of collisions showed that there were no major differences in the circumstances or contributory factors recorded between the two trials. Hence the results in this analysis are over both trials. The other vehicles involved in these collisions are shown in Table E1.

Table E1: Other vehicles involved

Other Vehicles involved	Percentage of collisions
One car	58%
One 'other' vehicle (e.g. HGV, minibus)	12%
Pedestrian only	11%
One Motorcycle	6%
One cyclist	3%
One taxi	3%
One bus	2%
Two or more other vehicles.	2%

Motorcycle collisions involving one car only

As this was the largest single group of collisions, it was selected for more detailed analysis. In total there were 483 collisions and of location and circumstance of these collisions is shown in Table E2.

Table E2: Location and circumstance of collisions

	Other Vehicles involved	Percentage of collisions
Location	At staggered or T-junctions	55%
	At signal-controlled junctions	22%
	Not within 20m of a junction	9%
Circumstance	In daylight	70%
	In Fine Weather	90%

The main[5] contributory factors recorded by the police for these collisions between a motorcycle and a car are shown in Table E3.

[5] Recorded in at least 10% of cases

Table E3: Contributory factors

Other Vehicles involved	Percentage of collisions
Failed to look properly	95%
Poor turn or manoeuvre	47%
Failed to judge other person's path or speed	40%
Careless, reckless or in a hurry	32%
Vision affected by stationary or parked vehicle(s)	15%

Speed was recorded as a factor in a small proportion of cases: 'exceeding the speed limit' in 5% of cases, and 'travelling too fast for the conditions' in 3% of cases. However, where speed was recorded and it was possible to ascertain from the collision description which vehicle was cited: it was mainly attributed to the motorcycle, 19 out of 23 collisions. Further, in most of the cases where speed was recorded as a contributory factor, one of the vehicles involved in the collision was carrying out a turning manoeuvre.

The main causal factors attributed to collision were similar in both the Previous and Current Study.

Motorcycle collisions involving one car only at staggered or T-junctions

Most of the motorcycle and car collisions were at staggered or T-junctions. These were investigated further. Some difference were found between those occurring in bus lane hours, see Table E4.

Table E4: Factors according to bus lane hours

Other Vehicles involved	Percentage of collisions	
	In Hours	Outside Hours
Poor turn or manoeuvre	56%	42%
Vision affected by stationary or parked vehicle(s)	26%	15%

The collision descriptions often did not attribute the manoeuvre to a given vehicle. However, it was possible to isolate that 15% involved a car turning across the path of a motorcycle and 9% involved a car failing to give way to a motorcycle or pulling out in front of it.

Summary

In the Previous and Current Trial, over half of the collisions involving motorcyclists on the monitored corridors involved only the motorcycle(s) and one car, approximately 10% involved a motorcycle and a pedestrian and 3% involved a motorcyclist and a pedal cyclist.

Most collisions involving a motorcycle and a car showed they were at or near a junction, and a majority were in daylight and in fine weather.

The most commonly recorded contributory factor[6] in these collisions was 'failure to look properly' which was recorded in the case of over 90% of the collisions, both at junctions and away from them. The other three most common contributory factors (at junctions and away from junctions) were: 'poor turn or manoeuvre', 'failed to judge other person's path or speed' and 'careless, reckless or in a hurry'. Very few cases mentioned speed as a contributory factor but where specific vehicles could be identified in the description of the collision, there were more cases where speed was attributed to the motorcycle than to the car. The manoeuvres involved in collisions at junctions were vehicles turning across the path of another, u-turns, turning while another was overtaking, and changing lanes.

In a small proportion of cases, the collision descriptions mentioned a motorcycle in a bus lane. Typically a vehicle turning left would cross the path of a motorcycle on its nearside in the bus lane. At signal-controlled junctions, many of the descriptions did not appear to be associated with motorcycles using the bus lane: red light running, rear end collisions and u-turns, but there were some cases of a car and a motorcycle crossing paths.

Away from junctions, changing lanes, overtaking, u-turns and vehicles moving off into the path of another were the manoeuvres involved in most of the collisions between a motorcycle and a car.

The site data includes only small numbers of collisions involving motorcycles. The analysis did not add any new insights to those obtained from the corridor data.

E.1.2 Cycles

A total of 789 collisions involving cycles were on enforcement corridors and in the Previous and Current Trial. Comparison of collisions showed that there were no major differences in the circumstances or contributory factors recorded for collisions between the trials. Hence the results in this analysis are over both trials. The other vehicles involved in these collisions are shown in Table E5.

[6] Contributory factors are recorded by the police officer using a standard list; up to six can be recorded for each collision. They reflect the officer's view on the most likely factors involved, but are not necessarily based on a detailed investigation of the collision. As the information recorded is admissible as evidence in court, they need to be supported by clear evidence. There is some evidence that factors allocating 'blame' are less likely to be recorded, which includes relating to speed.

Table E5: Other vehicles involved

Other Vehicles involved	Percentage of collisions
One car	66%
One ‘other’ vehicle (e.g. HGV, minibus)	15%
No other vehicles	6%
One bus	5%
One taxi	4%
One Motorcycle	3%
Two or more other vehicles.	1%

The location and circumstance of these collisions is shown in Table E6.

Table E6: Location and circumstance of collisions

	Other Vehicles involved	Percentage of collisions
Location	At staggered or T-junctions	49%
	At signal-controlled junctions	31%
	Not within 20m of a junction	10%
Circumstance	In daylight	75%
	In Fine Weather	90%

Contributory factors that accounted for at least 10% of pedal cyclist collisions are summarised in Table E7.

Table E7: Contributory factors

Other Vehicles involved	Percentage of collisions
Failed to look properly	31%
Failed to judge other person’s path or speed	13%
Careless, reckless or in a hurry	12%
Poor turn or manoeuvre	10%
Travelling too fast for the conditions	1%

The text descriptions of the cycle collisions were examined. Whilst some of these involved a vehicle turning right or crossing a junction, there was also a wider range of other circumstances recorded than with the motorcycle collision. Only 2% of the collisions identified that the cyclist was in the bus lane at the time of the collision, and only two of these collisions involved a motorcyclist.

Summary

In the Previous and Current Trial, two-thirds of collisions involving pedal cyclists on the monitored corridors involved a pedal cycle and a car, 6% involved no other vehicles and 3% involved a pedal cycle and a motorcycle. Most collisions were at or near a junction, three-quarters were in daylight and almost all were in fine weather.

The most commonly recorded contributory factors in these collisions were 'failure to look properly', 'failed to judge another person's path or speed', 'careless, reckless or in a hurry' and 'poor turn or manoeuvre'. Unlike motorcycle collisions, 'failure to look properly' was recorded in just a third of the pedal cycle collisions.

A small proportion of the collision descriptions mentioned that the cyclist was in the bus lane. Some of these were similar to the typical circumstances when motorcycles in a bus lane collided with a car: left turning vehicle collides with pedal cycle on inside in bus lane. There were some cases where the vehicle was turning right or crossing a junction and collided with the cyclist, but a range of other circumstances were also recorded – more so than in the case of the motorcycle collisions in bus lanes.

E.1.3 Pedestrians

A total of 687 collisions involving pedestrians were on enforcement corridors and in the Previous and Current Trial. Comparison of collisions showed that there were no major differences in the circumstances or contributory factors recorded for collisions between the trials. Hence the results in this analysis are over both trials. The other vehicles involved in these collisions are shown in Table E8.

Table E8: Other vehicles involved

Other Vehicles involved	Percentage of collisions
One car	55%
One 'other' vehicle (e.g. HGV, minibus)	8%
One cycle	5%
One bus	11%
One taxi	4%
One Motorcycle	14%
Two or more other vehicles.	3%

The location and circumstance of these collisions is shown in Table E9.

Table E9: Location and circumstance of collisions

	Other Vehicles involved	Percentage of collisions
Location	At staggered or T-junctions	40%
	Within 50m of pedestrian crossing facilities	61%
	At signal-controlled junctions	34%
	Not within 20m of a junction	21%
Circumstance	In daylight	62%
	In Fine Weather	86%

Contributory factors associated with the pedestrian collisions are summarised in Table E10 split according to whether the collision was at a junction or not.

Table E10: Contributory factors

	Other Vehicles involved	Percentage of collisions	
		At Junctions	Not at junctions
Pedestrian	Failed to look properly	75%	75%
	Careless, reckless or in a hurry	40%	36%
	Failed to judge other person's path or speed	20%	24%
	Wrong use of pedestrian crossing	18%	[redacted]
	Masked by stationary or parked vehicle	13%	27%
Driver	Failed to look properly	27%	25%
	Careless, reckless or in a hurry	13%	[redacted]
	Vision affected by stationary/parked vehicle	[redacted]	10%

There were some differences found between the collisions involving a pedestrian and a motorcycle, compared to those with other types of vehicle. They were more likely to be a distance from junctions (29% compared to 20%), occur in the daylight (73% compared to 60%), involved the pedestrian not looking properly (87% compared to 74%), be attributed to the pedestrian being masked by a stationary or parked vehicle (35 compare to 13%) and attributed to vision being affected bya stationary or parked vehicle (15 compare to 6%).

Summary

In the Previous and Current Trial, just over half of the collisions on the monitored corridors involving a pedestrian also involved in car, and approximately a sixth involved a motorcycle. Almost two-thirds were within 50m of a pedestrian crossing and the majority were at or near a junction. Almost all occurred in fine weather and nearly two-thirds were in daylight.

There were some differences between the collisions involving a pedestrian and a motorcycle compared with those involving a pedestrian and other vehicles; where a motorcycle was involved the collisions were rather more likely to involve the pedestrian crossing the road being masked by a stationary or parked vehicle, and vision being affected by a stationary or parked vehicle.

Many of the contributory factors recorded were attributed to pedestrians rather than vehicles: pedestrian failed to look properly, and pedestrian careless reckless or in a hurry were the two most commonly recorded.

Appendix F Lane use and Position

F.1 Motorcyclists

Motorcyclists are able to use any of the lanes on the road, including the inside lane; the left hand lane containing a bus lane. Their choices are summarised in Figure F1 and Figure F2 for the Enforcement Sites, and Figure F3 and Figure F4 for Non-enforcement Sites, across the Previous and the Current Trial. The percentage using the bus lane remained consistent at between all the surveys: ranging from 43% and 46% on Enforcement Sites and 57% to 60% on Non-enforcement Sites.

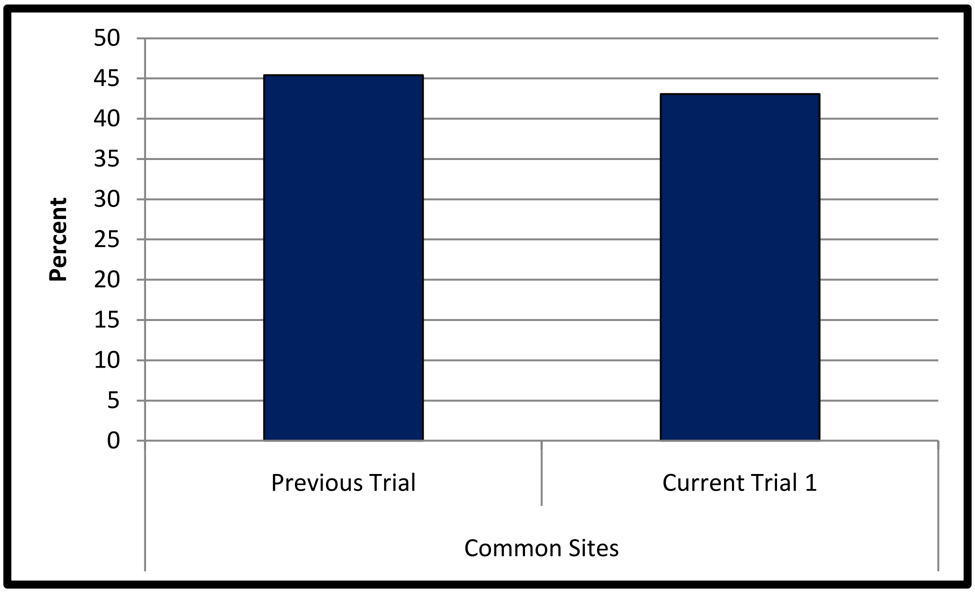


Figure F1: Motorcyclists using the bus lane: Common Enforcement Sites

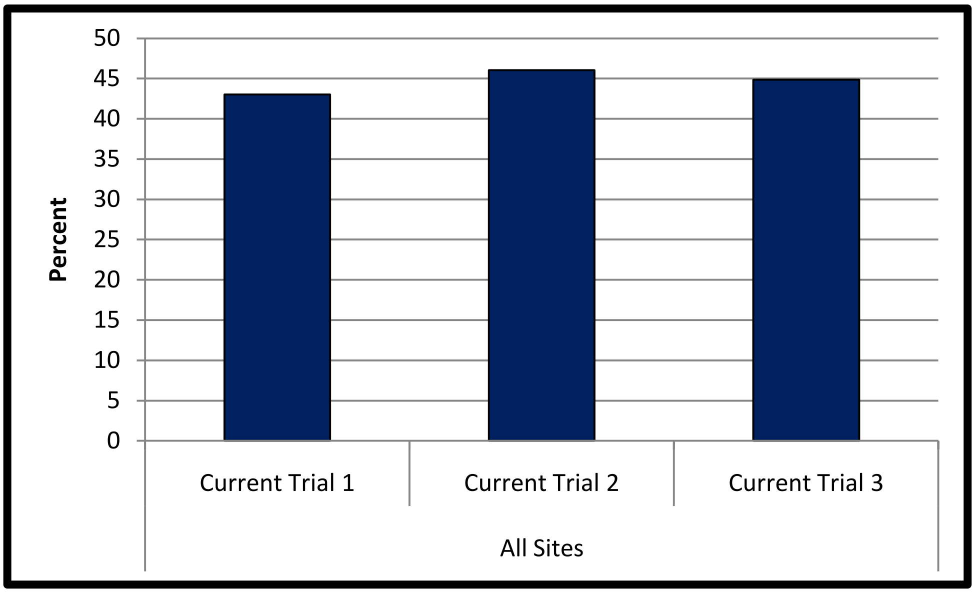


Figure F2: Motorcyclists using the bus lane: All Enforcement Sites

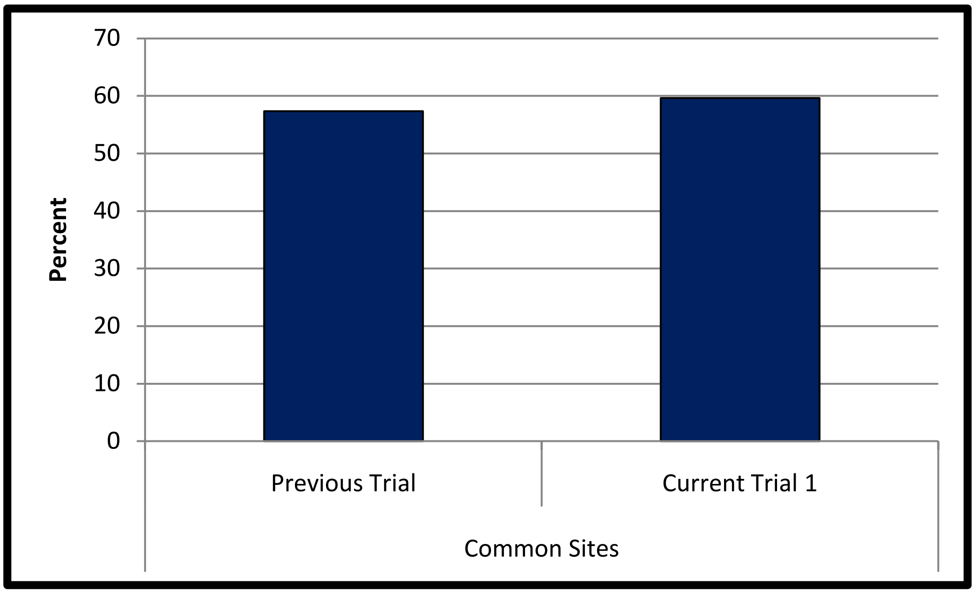


Figure F3: Motorcyclists using the bus lane: Common Non-enforcement Sites

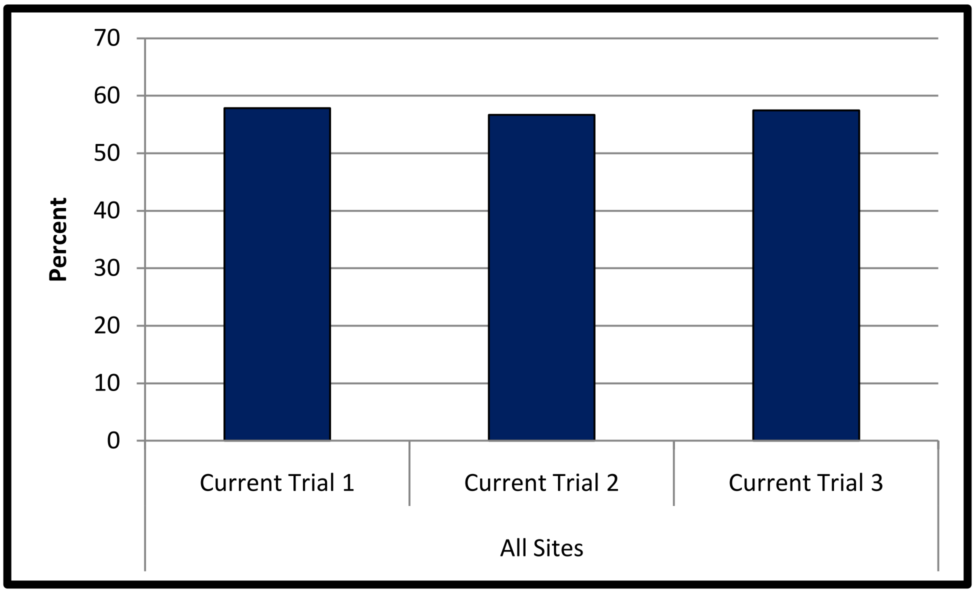


Figure F4: Motorcyclists using the bus lane: All Non-enforcement Sites

Motorcyclists are relatively narrow and can therefore choose a position in the lane: left, middle or right. In the middle position they generally remain part of the traffic flow. However, in the other positions they may decide to filter through the traffic.

The lane position chosen by the observed motorcyclists are summarised in Figure F5 and Figure F6 for the Enforcement Sites, and Figure F7 and Figure F8 for Non-enforcement Sites, across the Previous and the Current Trials. Nearly all motorcycles in the bus lane (over 94%) travelled in the middle, or right of the lane. Also, generally the percentages in each of these positions were approximately the same.

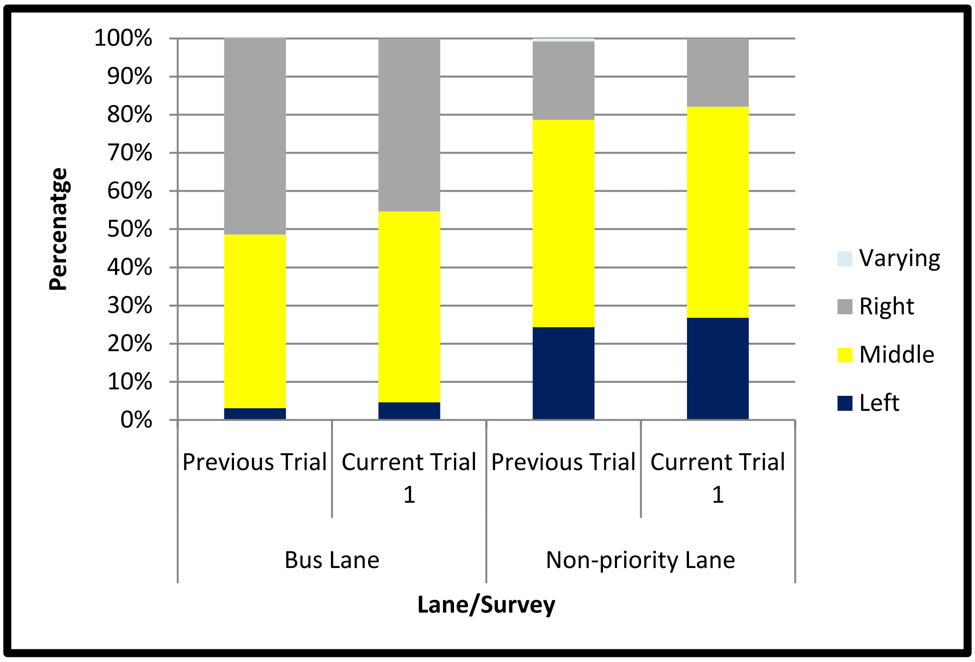


Figure F5: Motorcyclists lane position: Common Enforcement Sites

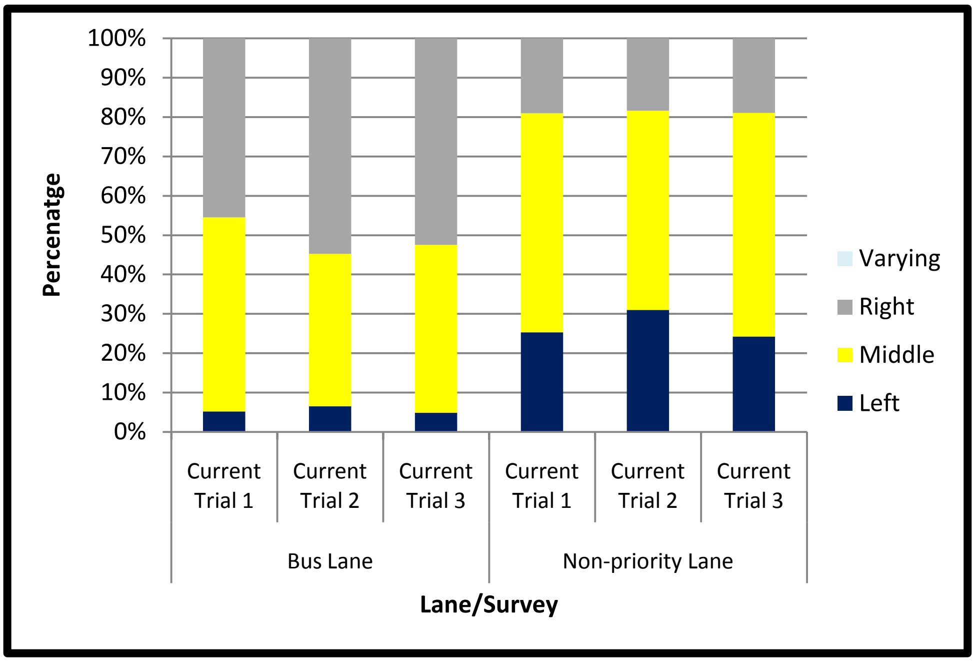


Figure F6: Motorcyclists lane position: All Enforcement Sites

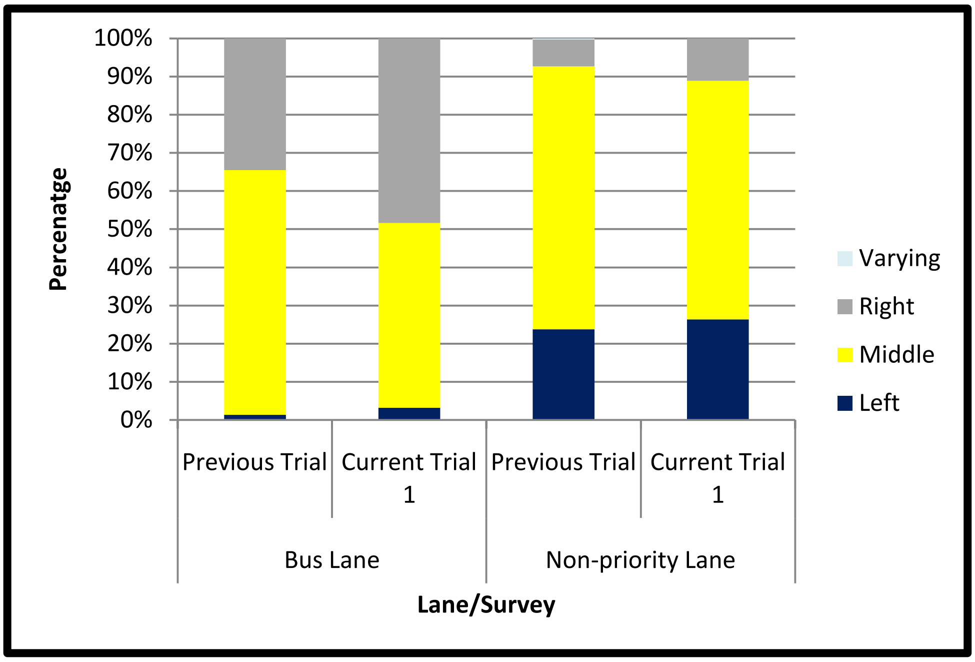


Figure F7: Motorcyclists lane position: Common Non-enforcement Sites

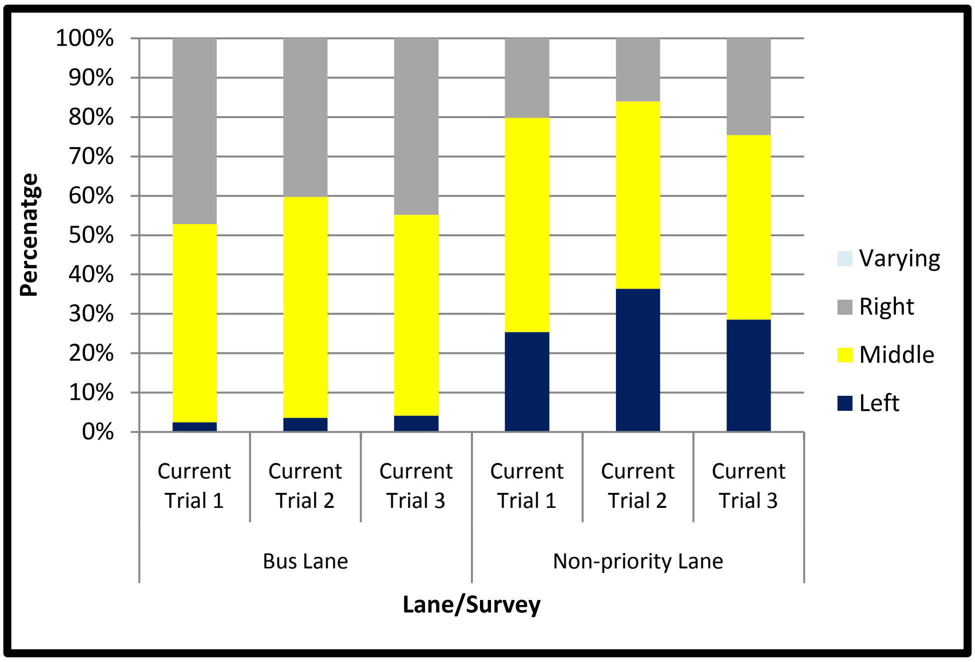


Figure F8: Motorcyclists lane position: All Non-enforcement Sites

F.2 Cyclists

Cyclists are also able to use any of the lanes on the road, including bus lanes. Their choices are summarised in Figure F9 and Figure F10 for the Enforcement Sites, and Figure F11 and Figure F12 for Non-enforcement Sites, across the Previous and the Current Trial. The percentage using the bus lane remained consistent and high in all surveys: over 92% using the bus lane.

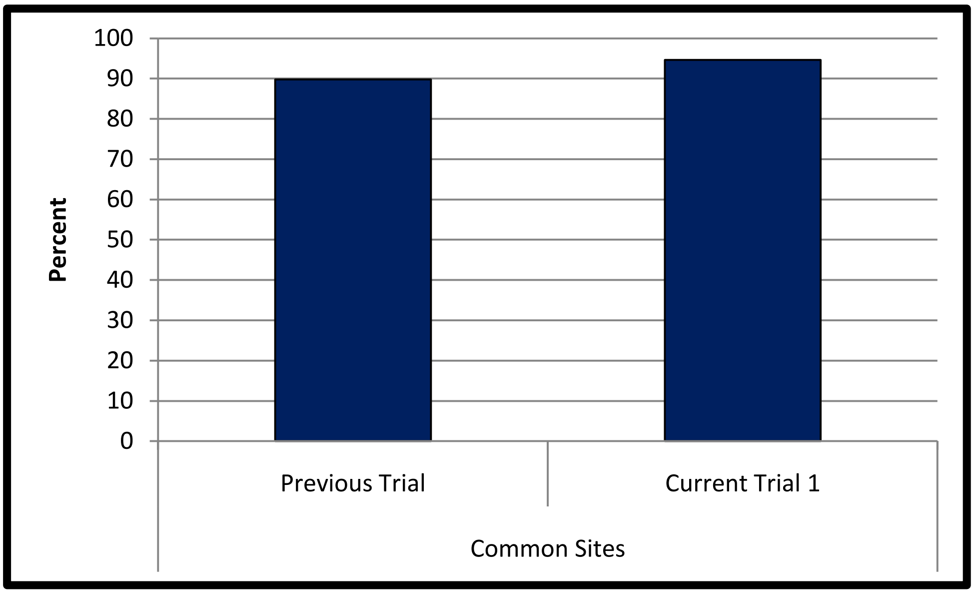


Figure F9: Cyclists using the bus lane: Common Enforcement Sites

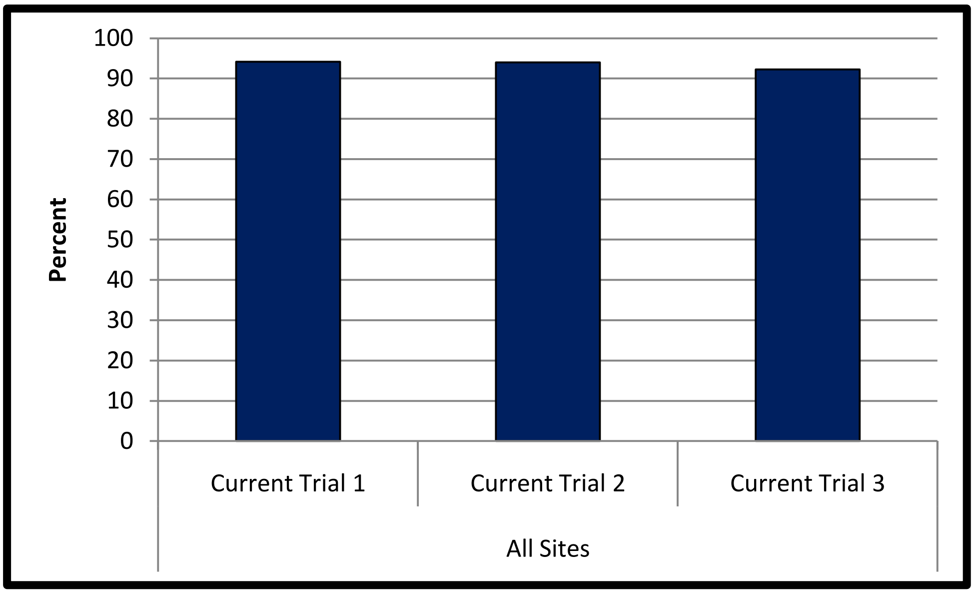


Figure F10: Cyclists using the bus lane: All Enforcement Sites (Current 1, 2, 3)

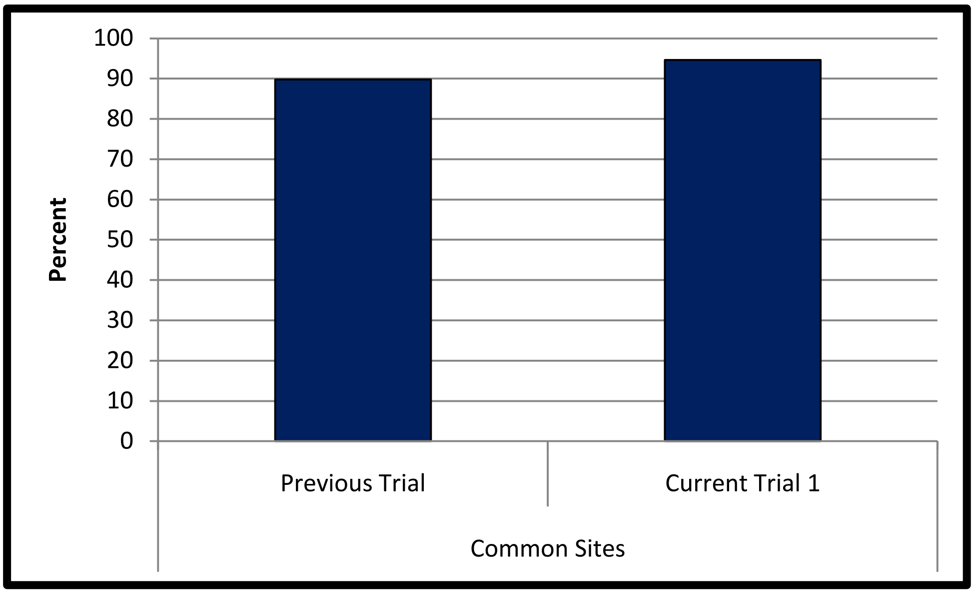


Figure F11: Cyclists using the bus lane: Common Non-enforcement Sites

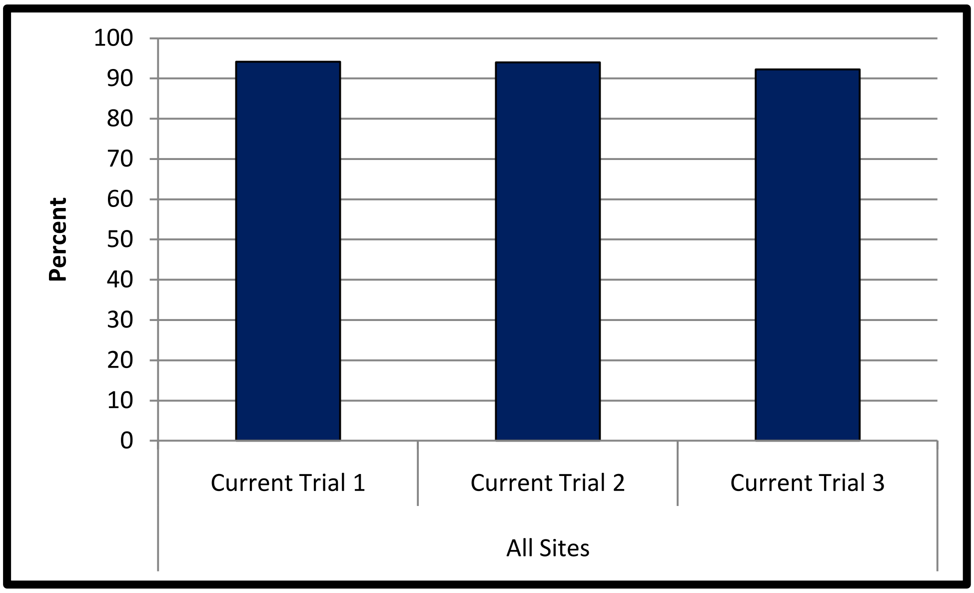


Figure F12: Cyclists using the bus lane: All Non-enforcement Sites

Cyclists often choose to travel in the left of the lane, as they are generally slower than other modes of travel. The lane position chosen by the observed cyclists are summarised in Figure F13 and Figure F14 for the Enforcement Sites, and Figure F15 and Figure F16 for Non-enforcement Sites, across the Previous and the Current Trials. Most cycles in the bus lane (over 60%) travelled in the left of the lane. Also, generally the percentages in each of these positions were approximately the same, although there was a consistent slight reduction in the percentage using the left-hand position in the Current Trial compared to the Previous Trial, with cyclists riding in the middle of the bus lane. This may have been observed because of the increase in the number of cyclists using London's Roads.

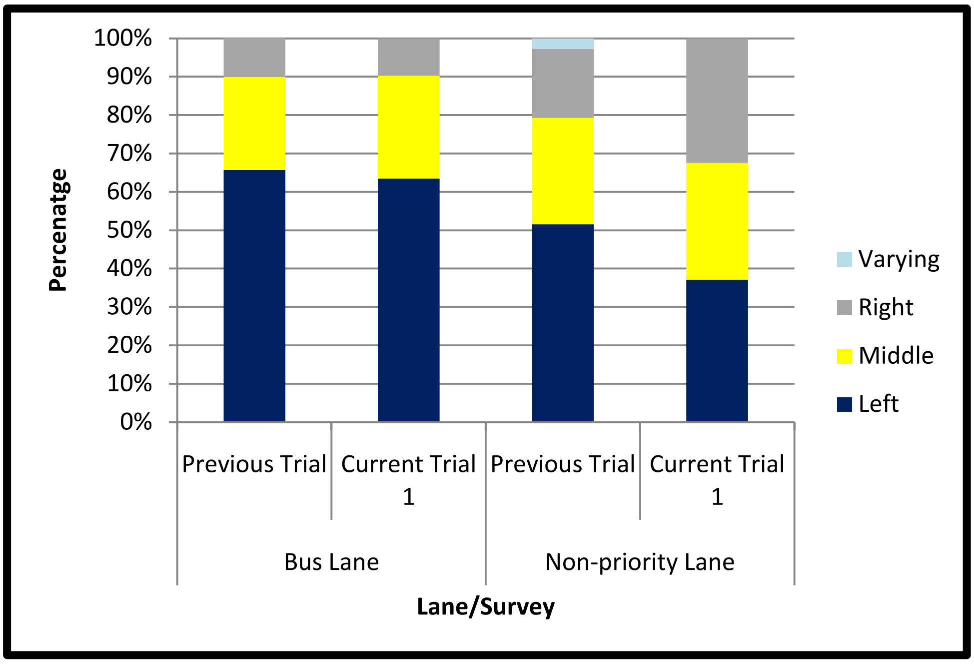


Figure F13: Cyclists lane position: Common Enforcement Sites

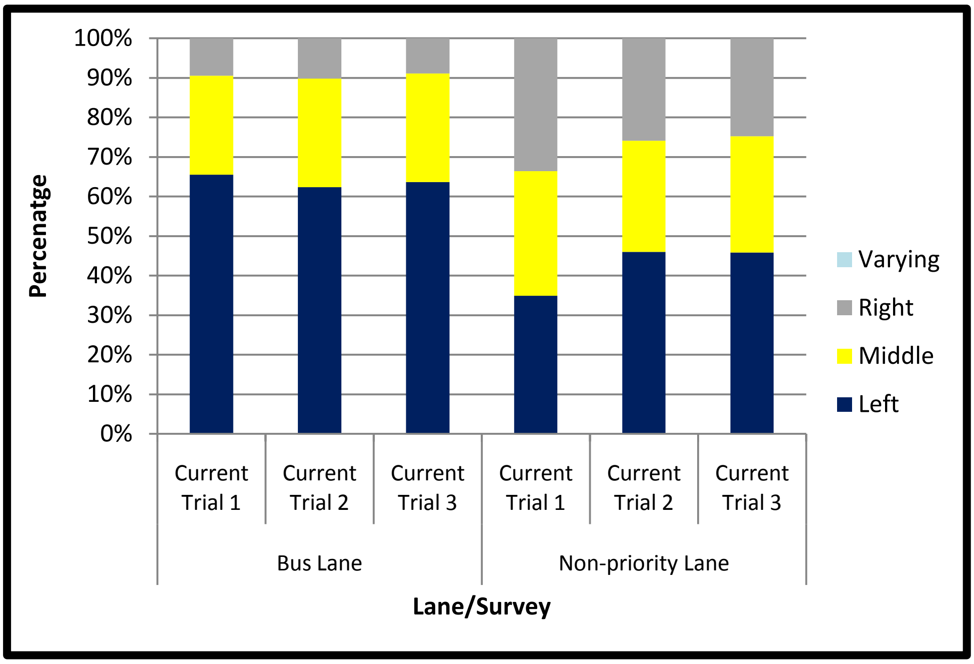


Figure F14: Cyclists lane position: All Enforcement Sites

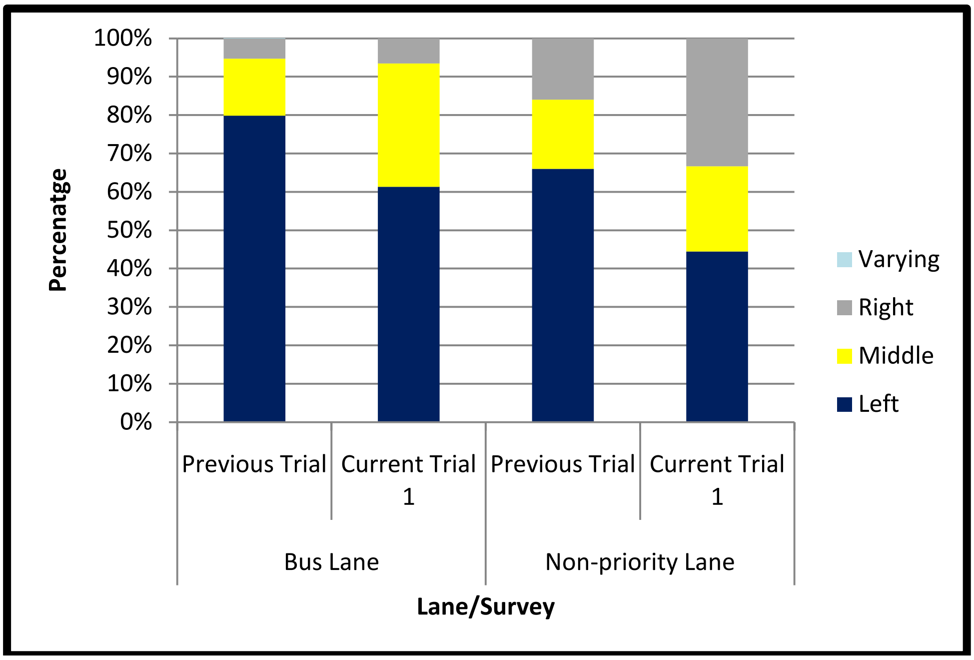


Figure F15: Cyclists lane position: Common Non-enforcement Sites

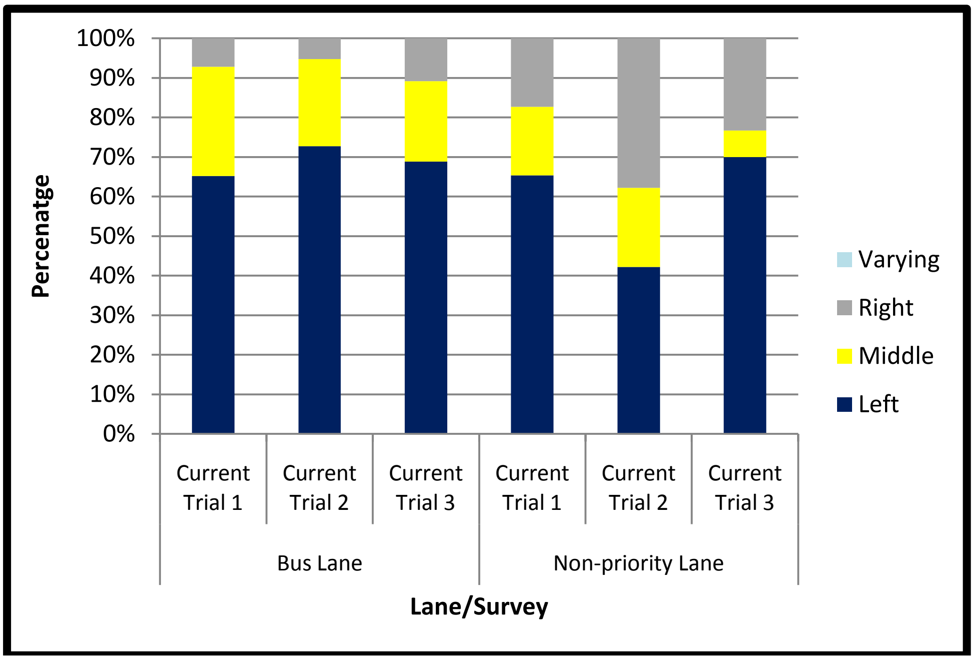


Figure F16: Cyclists lane position: Common Non-enforcement Sites

Appendix G Collision rates on the Network and Borough Sites

G.1 Motorcyclists

Table G1: Motorcycle Collisions on the Network and Borough Sites

Flows per million vehicle kms	TLRN with Bus Lanes		Remainder of Road Network	
	Motorcycles involved in collisions	Estimated 9 month cycle flow	Motorcycles involved in collisions	Estimated 9 month cycle flow
Previous Trial	32	3.4	13	2.1
Current Trial	27	3.6	10	2.2
Percentage change	-15.6%	7.9%	-23.1%	5.1%

Table G2: Motorcycle Collision Rates on the Network and Borough Sites

Rates per million	TLRN with Bus Lanes	Remainder of Road Network
Previous Trial	9.504	6.304
Current Trial	7.435	4.616
Rate change	78.2%	73.2%

G.2 Cyclists

Table G3: Cycle Collisions on the Network and Borough Sites

Flows per million vehicle kms	TLRN with Bus Lanes		Remainder of Road Network	
	Cycles involved in collisions	Estimated 9 month cycle flow	Cycles involved in collisions	Estimated 9 month cycle flow
Previous Trial	24	2.4	1	2.5
Current Trial	14	3.1	1	2.8
Percentage change	-41.6%	27.5%	0.0%	11.4%

Table G4: Cycle Collision Rates on the Network and Borough Sites

Rates per million	TLRN with Bus Lanes	Remainder of Road Network
Previous Trial	9.886	0.404
Current Trial	4.523	0.362
Rate change	45.8%	89.7%

G.3 Pedestrians

Table G5: Pedestrian Collisions on the Network and Borough Sites

Flows per million vehicle kms	TLRN with Bus Lanes		Remainder of Road Network	
	Cycles involved in collisions	Estimated 9 month vehicle flow	Cycles involved in collisions	Estimated 9 month vehicle flow
Previous Trial	25	54.1	13	36.9
Current Trial	19	56.1	17	37.2
Percentage change	-24.0%	3.7%	30.8%	1.0%

Table G6: Pedestrian Collision Rates on the Network and Borough Sites

Rates per million	TLRN with Bus Lanes	Remainder of Road Network
Previous Trial	0.462	0.353
Current Trial	0.339	0.456
Rate change	73.3%	129.4%

Appendix H Motorcycle collisions according to lane and bus lane hours

It was possible to investigate the collisions on Network Sites according to whether they occurred inside, or outside of bus lane hours, this classification of the data is summarised in Figure H 1 and Table H 1. There were no major differences between these time periods.

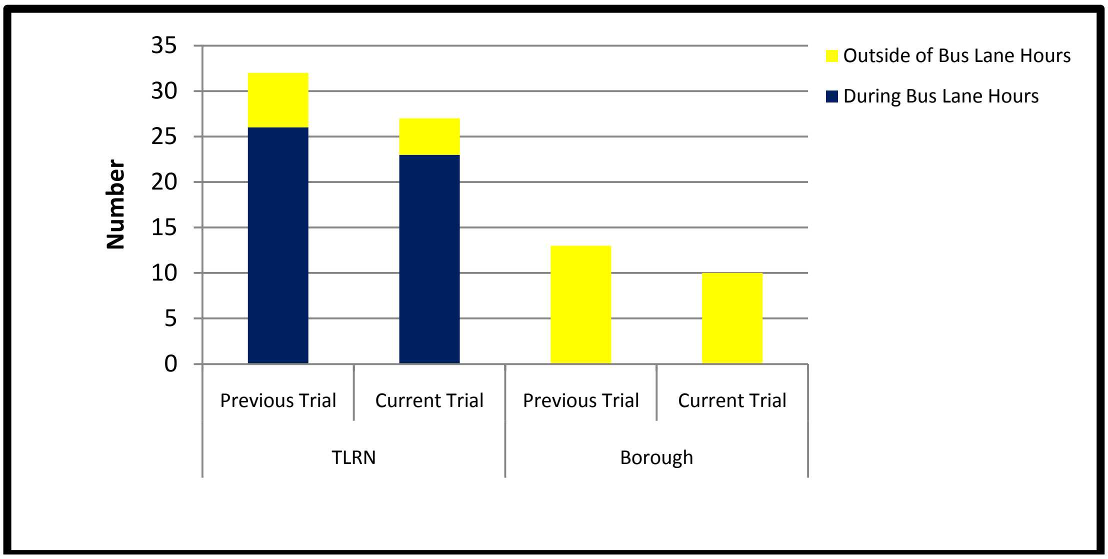


Figure H 1 Motorcycle Collisions on the Network and Borough Sites

Table H 1: Motorcycle Collisions on the Network and Borough Sites

Network Site Type	During Bus Lane Hours		Outside of Bus Lane Hours		Total	
	Previous Trial	Current Trial	Previous Trial	Current Trial	Previous Trial	Current Trial
TLRN Sites	26	23	6	4	32	27
Borough Sites	0	0	13	10	13	10

The number of motorcyclists involved in collisions, according to lane used and whether in bus lane hours are summarised in Figure H 2 and Table H 2 for the Enforcement and Non-enforcement Corridors. Generally, there were increases on both Enforcement and Non-enforcement Corridors in bus lanes during bus lane hours, although the increases on Non-enforcement Corridors were greater: 38% compared to 14%. The number also slightly increased on Non-enforcement Corridors in the non-priority lanes during bus lane hours, but decreased on the Enforcement Corridors. The numbers of collisions were low and were too small for robust results.

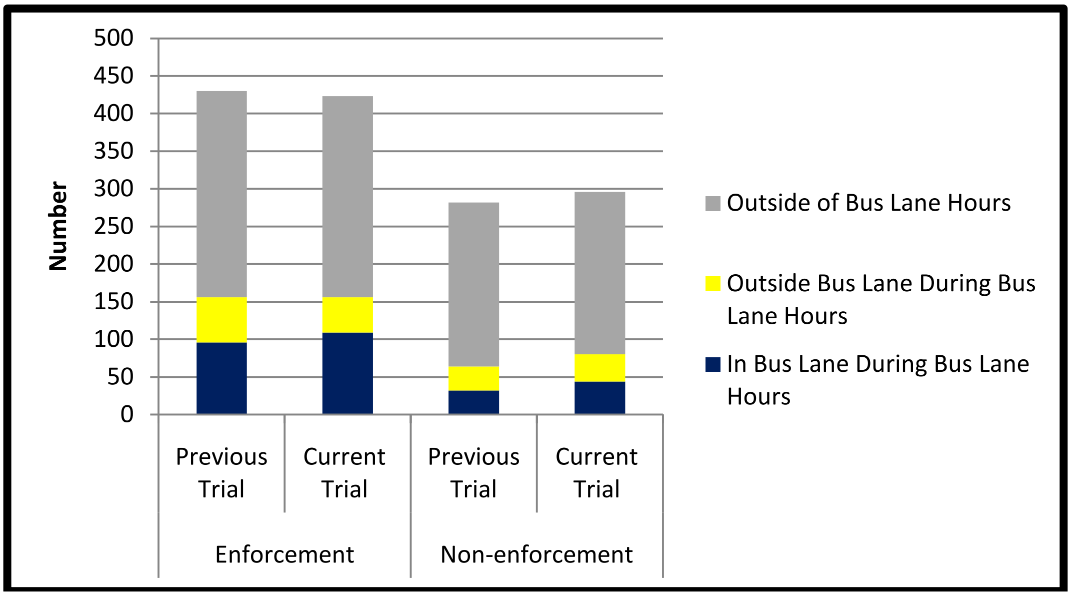


Figure H 2: Number of motorcycles involved in collisions on corridors

Table H 2: Number of motorcyclists involved in collisions on corridors

Corridor Type	Time Period	In Bus Lane During Bus Lane Hours	Outside Bus Lane During Bus Lane Hours	Outside of Bus Lane Hours	All motorcycle collisions
Enforcement	Previous Trial	96	60	274	430
	Current Trial	109	47	267	423
Non-enforcement	Previous Trial	32	32	218	282
	Current Trial	44	36	216	430

Appendix I Hauer Tests

The Hauer test is used when collision data needs to be combined from a number of trial sites (Main Sites) that have undergone a similar change, and where a control for these sites is available (Control Sites). The model developed using the Hauer approach measures the change on the Main Sites, assuming that any changes on the Control Sites are from other underlying changes across the network. Also, by considering the collision rate the Hauer test takes account of any underlying changes in flow on the Main Sites and the Control Sites.

The statistical tests associated with the Hauer approach consider if the relative change between the Main and Control Sites could occur within natural variation, or whether it is the result of the changes made on the Main Sites. The following terminology is used in the Hauer summary tables:

- Lambda Actual number observed
- ratio c Change observed in control sites allowing for flow differences
- Pi Expected number of collisions
- Delta Increase in collisions from expected
- Theta Proportion more than expected
- 1-theta Fitted percentage increase
- SD (delta) Standard deviation of difference
- SD (theta) Standard deviation of increase

The full Hauer tests for the period before motorcycles were permitted access to Bus Lanes, the previous trial and the current trial for motorcycles, pedal cycles and pedestrians are below in Tables I.1 through to I.6.

I.1 Motorcycle Collisions on Network, Current Trial compared to the Previous Trial

		TLRN Bus Lanes	Remainder of London's Road Network
Summary			No significant change
Collisions	Previous Trial	553	3,129
	Current Trial	561	3,201
Collision Rate	Percentage change	-5.8%	-2.5%
Calculation Steps	Lambda		561.00
	ratio c		0.99
	Pi		580.67
	Difference		-19.67
	var lambda		561.00
	var pi		822.82
	Delta		-19.67
	Theta		0.96
	1-theta		-3.62
	SD (delta)		37.20
	SD (theta)		0.06
	delta/SD(delta)		0.53
Probability			59.70

I.2 Motorcycle Collisions on Network, Previous Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		No significant change	
Collisions	Previous Trial	460	3,082
	Current Trial	553	3,129
Collision Rate	Percentage change	8.5%	5.3%
Calculation Steps	Lambda		553.00
	ratio c		1.05
	Pi		536.91
	Difference		16.09
	var lambda		553.00
	var pi		812.33
	Delta		16.09
	Theta		1.03
	1-theta		0.03
	SD (delta)		36.95
	SD (theta)		0.07
	delta/SD(delta)		0.44
Probability			66.32

I.3 Motorcycle Collisions on Network, Current Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		No significant change	
Collisions	Before Access	460	3,082
	Current Trial	561	3,201
Collision Rate	Percentage change	2.1%	2.7%
Calculation Steps	Lambda		561.00
	ratio c		1.03
	Pi		563.95
	Difference		-2.95
	var lambda		561.00
	var pi		893.94
	Delta		-2.95
	Theta		0.99
	1-theta		-0.80
	SD (delta)		38.14
	SD (theta)		0.07
	delta/SD(delta)		0.08
Probability			93.83

I.4 Pedal cycle Collisions on Network, Current Trial compared to the Previous Trial

		TLRN Bus Lanes	Remainder of London's Road Network
Summary			No significant change
Collisions	Previous Trial Current Trial	391 445	2,473 2,809
Collision Rate	Percentage change	-8.5%	1.8%
Calculation Steps	Lambda ratio c Pi Difference var lambda var pi Delta Theta 1-theta SD (delta) SD (theta) delta/SD(delta)		445.00 1.02 494.82 -49.82 445.00 812.36 -49.82 0.90 -10.36 35.46 0.07 1.41
Probability			16.01

I.5 Pedal cycle Collisions on Network, Previous Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary			Significant decrease (95% confidence)
Collisions	Before Access Current Trial	312 391	1,946 2,473
Collision Rate	Percentage change	-1.2%	16.7%
Calculation Steps	Lambda ratio c Pi Difference var lambda var pi Delta Theta 1-theta SD (delta) SD (theta) delta/SD(delta)		391.00 1.17 461.56 -70.56 391.00 878.45 -70.56 0.84 -0.16 35.63 0.07 1.98
Probability			4.77

I.6 Pedal cycle Collisions on Network, Current Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		Significant decrease (95% confidence)	
Collisions	Before Access Current Trial	312 445	1,946 2,809
Collision Rate	Percentage change	-11.6%	16.6%
Calculation Steps	Lambda ratio c Pi Difference var lambda var pi Delta Theta 1-theta SD (delta) SD (theta) delta/SD(delta)		445.00 1.17 587.00 -142.00 445.00 1404.12 -142.00 0.76 -24.50 43.00 0.06 3.30
Probability			0.10

I.7 Pedestrian Collisions on Network, Current Trial compared to the Previous Trial

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		No significant change	
Collisions	Previous Trial Current Trial	365 380	3,552 3,531
Collision Rate	Percentage change	0.4%	-2.0%
Calculation Steps	Lambda ratio c Pi Difference var lambda var pi Delta Theta 1-theta SD (delta) SD (theta) delta/SD(delta)		380.00 0.98 371.03 8.97 380.00 454.90 8.97 1.02 2.08 28.90 0.08 0.31
Probability			75.62

I.8 Pedestrian Collisions on Network, Current Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		No significant change	
Collisions	Before Access	342	3,511
	Current Trial	365	3,552
Collision Rate	Percentage change	8.4%	3.6%
Calculation Steps	Lambda		365.00
	ratio c		1.04
	Pi		348.80
	Difference		16.20
	var lambda		365.00
	var pi		424.64
	Delta		16.20
	Theta		1.04
	1-theta		0.04
	SD (delta)		28.10
	SD (theta)		0.08
	delta/SD(delta)		0.58
Probability			56.43

I.9 Pedestrian Collisions on Network, Current Trial compared to the period before motorcycles were allowed access to TfL Bus Lanes

		TLRN Bus Lanes	Remainder of London's Road Network
Summary		No significant change	
Collisions	Before Access	342	3,511
	Current Trial	380	3,531
Collision Rate	Percentage change	8.8%	-1.0%
Calculation Steps	Lambda		380.00
	ratio c		1.02
	Pi		354.66
	Difference		25.34
	var lambda		380.00
	var pi		439.24
	Delta		25.34
	Theta		1.07
	1-theta		6.77
	SD (delta)		28.62
	SD (theta)		0.08
	delta/SD(delta)		0.89
Probability			37.61