

# Low Level Cycle Signals used as repeaters of the main traffic signals – Appendices

Track trial report

This document contains the appendices to accompany the report from the first sub-trial of a larger track trial investigating the reactions of road users to Low Level Cycle Signals (LLCS) used as repeaters for standard traffic signals on the same pole (Trial code: M14).

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# Appendix A Table of findings against each research question

Table A-1 summarises the findings against the research questions. These are reproduced from the end of each sub-section in Section 3 of the main report.

| Research question   | ID   | Finding  |
|---|------|--|
| RQ1: Did people   | F1.a | Most (75% to 95%) understood the repeater LLCS.  |
| understand the LLCS?  | F1.b | A small percentage (less than 5%) of pedestrians, cyclists<br>and car drivers misinterpreted the LLCS as indicating<br>when pedestrians should cross the road, so they could<br>have incorrectly judged that they had priority.  |
|   | F1.c | All partially sighted participants who experienced the signals understood that either the LLCS were not for them or that they were explicitly for cyclists.  |
| RQ2: What attitudes<br>did people have<br>towards the LLCS? | F2.a | 90% of cyclists, car drivers and pedestrians and almost<br>80% of motorcyclists and HGV drivers thought that<br>cyclists on the road would benefit from LLCS. The main<br>reason given was that it was a useful additional piece of<br>information, provided at an appropriate height for cyclists.  |
|   | F2.b | About 80% of cyclists were in favour of LLCS. With the exception of motorcyclists, over 90% of most other road user groups were not negative towards LLCS, with about 45% to 65% being in favour of the LLCS.  |
|   | F2.c | The most commonly mentioned suggestions for<br>improvements were to provide an early release (from<br>cyclists) and to make the signals bigger and more obvious<br>(from all road users).  |
|   | F2.d | Over three-quarters of the cyclists said that the height was 'about right' and about 70% of cyclists thought the angle was 'about right'.  |
| RQ3: Did people use<br>the LLCS<br>information?             | F3.a | Most of the cyclists tended to use the LLCS as an extra<br>source of information. In particular approximately 70% to<br>80% of cyclists used the near-side LLCS when waiting to<br>turn left; about 50% to 70% when waiting to go straight<br>on; and about 20% to 30% when waiting to turn right.<br>About half of cyclists turning right used the off-side signal<br>heads where these were available. |
|   | F3.b | At the uncontrolled crossing, about half of the pedestrians<br>said that they used the LLCS, with approximately 10%<br>stating they were the most important factor when deciding<br>to cross. Of those who used the LLCS, none<br>misinterpreted their meaning.  |
| RQ4: Did the LLCS   | F4.a | LLCS slightly reduced the percentage of observations   |

|--|



| Research question  | ID   | Finding   |
|--|------|---|
| affect compliance: i)<br>whether cyclists  |      | where participants went through the junction on a red signal.   |
| stopped at a red<br>light: ii) where   | F4.b | LLCS did not affect the lateral stopping position of cyclists.  |
| people waited?   | F4.c | For most scenarios, LLCS did not affect the longitudinal<br>stopping position of participants, with the exception of an<br>indicative increase in stop line compliance for left-turning<br>cyclists and a possible increase in HGV drivers<br>encroaching the ASL on the two-lane approach. In the car<br>trial the compliance with the ASL was greater in the<br>scenario where there was a controlled cyclist in front.                                       |
| RQ5: Did the LLCS<br>affect how people<br>moved off as the<br>signals changed to<br>green? | F5.a | LLCS did not affect when cyclists and car drivers started<br>moving or entered the junction, although the car drivers<br>were delayed entering the junction by approximately one<br>second in the scenario with a cyclist in front.   |
| RQ6: Did the LLCS affect safety?   | F6.a | Of the cyclists who commented on the safety impacts of LLCS, none said that junction was more unsafe, about half said the junction was either safer or much safer.  |
|  | F6.b | Of the cyclists that said LLCS had a positive impact on<br>safety, most said it was because they provided clearer<br>information at a convenient height. Some said that LLCS<br>made them feel more confident and some suggested that<br>LLCS may make drivers more aware of cyclists.  |
|  | F6.c | Of the other road users who commented on the safety<br>impacts of LLCS, about a quarter of motorcyclists and a<br>quarter of car drivers said the impacts were positive,<br>whereas a quarter of motorcyclists and a fifth of car<br>drivers said the impacts were negative. Most pedestrians<br>thought that LLCS had no effect on them, and none said<br>that the junction was more unsafe.   |
|  | F6.d | Of the other road users who said LLCS had a positive<br>impact on safety for them, some said that this was<br>because they found the extra information useful, while<br>others said it made them more aware of cyclists. Of the<br>few car drivers and motorcyclists who thought the LLCS<br>made the junction more unsafe, reasons given included<br>confusion, distraction, too much information and the<br>potential for other road users using the signals. |



### Appendix B Further details on methodology

This appendix contains information on the sample size collected in the M14 Trial, the routes followed by the cyclists; car drivers; motorcyclists; HGV drivers and pedestrians, and the location of the cameras.

### **B.1 Sample size**

Table B-1 shows the sample size collected for cyclists, car drivers and motorcyclists from the video data of the M14 Trial. There was a target of 40 observations (for each manoeuvre) for cyclists and 25 observations for car drivers.

| User group | Vehicles                              | Arm/Turn |          | Covered | Uncovered | Total |
|------------|---------------------------------------|----------|----------|---------|-----------|-------|
| Cvclist    |                                       | ۸        | Left     | 61      | 61        | 122   |
| .,         |                                       | ~        | Right    | 60      | 60        | 120   |
|            |                                       | Б        | Left     | 48      | 53        | 101   |
|            | Dortioinant evaluat                   | D        | Straight | 48      | 54        | 102   |
|            | Participant cyclist,                  | ~        | Left     | 58      | 61        | 119   |
|            | no car                                | J        | Right    | 61      | 61        | 122   |
|            |                                       | P        | Straight | 55      | 59        | 114   |
|            |                                       | U        | Right    | 54      | 58        | 112   |
|            |                                       |          | Total    | 445     | 467       | 912   |
|            |                                       |          | Left     | 42      | 52        | 94    |
|            |                                       | A        | Right    | 42      | 51        | 93    |
|            |                                       | 6        | Left     | 37      | 48        | 85    |
|            | Dertisia ent evolist                  | В        | Straight | 37      | 45        | 82    |
|            | Participant cyclist,<br>car behind    | С        | Left     | 40      | 50        | 90    |
| •          |                                       |          | Right    | 44      | 53        | 97    |
|            |                                       | п        | Straight | 43      | 49        | 92    |
|            |                                       | U        | Right    | 41      | 49        | 90    |
|            |                                       |          | Total    | 326     | 397       | 723   |
|            |                                       | Α        | Right    | 61      | 58        | 119   |
| Car driver |                                       | R        | Left     | 20      | 19        | 39    |
|            | Participant car<br>driver, no cyclist |          | Straight | 18      | 22        | 40    |
|            |                                       | c        | Left     | 23      | 24        | 47    |
|            |                                       |          | Right    | 21      | 23        | 44    |
|            |                                       | р        | Straight | 25      | 24        | 49    |
|            |                                       |          | Right    | 26      | 25        | 51    |
|            |                                       |          | Total    | 194     | 195       | 389   |
|            | Participant car                       | Α        | Right    | 54      | 63        | 117   |
|            |                                       | R        | Left     | 22      | 20        | 42    |
|            |                                       | В        | Straight | 18      | 20        | 38    |
|            |                                       | С        | Left     | 22      | 20        | 42    |
|            | front                                 |          | Right    | 22      | 22        | 44    |
|            | nont                                  | р        | Straight | 23      | 22        | 45    |
|            |                                       | U        | Right    | 22      | 19        | 41    |
|            |                                       |          | Total    | 183     | 186       | 369   |

Table B-1 – Collected sample size

### LLCS repeaters (M14) - Appendices



| User group   | Vehicles  | Arm/Turn        |          | Covered | Uncovered | Total |
|--------------|---|-----------------|----------|---------|-----------|-------|
|              |   | ۸               | Left     | 26      | 32        | 58    |
|              |   | ×               | Right    | 27      | 31        | 58    |
|              |   | D               | Left     | 18      | 24        | 42    |
|              | Participant                                     | D               | Straight | 23      | 23        | 46    |
| Motorcyclist | behind no                                       | C               | Left     | 28      | 31        | 59    |
|              | cyclist   | 0               | Right    | 27      | 29        | 56    |
|              | -   | п               | Straight | 23      | 31        | 54    |
|              |   | D               | Right    | 30      | 32        | 62    |
|              |   |                 | Total    | 202     | 233       | 435   |
| HGV driver   | Participant HGV<br>driver, no other<br>vehicles | А               | Straight | 83      | 85        | 168   |
|              |   | D               | Straight | 42      | 39        | 81    |
|              |   |                 | Total    | 125     | 124       | 249   |
| Pedestrian   | Controlled                                      | A               |          |         | 89        | 89    |
|              | crossing at junction                            | В               |          |         | 89        | 89    |
|              |   |                 | D        |         | 89        | 89    |
|              | Duffin grossing                                 | LLCS side       |          |         | 89        | 89    |
|              | Further crossing                                | Pedestrian side |          |         | 89        | 89    |
|              | Uncontrolled<br>crossing at<br>junction         |                 | С        |         | 89        | 89    |
|              |   |                 | Total    |         | 534       | 534   |



### **B.2 Routes**

#### **B.2.1** Cyclists, car drivers and motorcyclists

Figure B-1 shows Routes 1, 2, 3 and 4 followed by participant cyclists and Figure B-2 shows Routes 1, 2, 3 and 4 followed by participant car drivers and motorcyclists.







Figure B-2 – Routes 1-4 used by car drivers and motorcyclists



Figure B-3 shows Routes 5, 6, 7 and 8 followed by the participant cyclists, car drivers and motorcyclists. Car drivers did not follow Route 5 due to the tight turn required at Arm A.



Figure B-3 – Routes 5-8 used by cyclists, car drivers and motorcyclists

### **B.2.2 HGV routes**

Figure B-4 shows the routes followed by the participant HGV drivers.



Figure B-4 – Routes used by HGV drivers (all straight on)



### **B.2.3 Pedestrian routes**

Figure B-5 shows the routes followed by the participant pedestrians.



Figure B-5 – Routes used by pedestrians

### **B.3** Location of the cameras

For the cyclist, car, motorcycle and HGV trial, a total of ten video cameras were positioned around the junction, as described below and as colour-coded in Figure B-6.

- Four cameras facing downstream: at 20m, covering a point 15m before the stop line up to the stop line (BLUE)
- Four cameras facing upstream: at the junction, covering the pedestrian studs, stop lines and cycle reservoir (BLACK)
- Two cameras facing into the middle of the junction: covering the conflict area in junction (RED)



Figure B-6 – Camera locations and angles



### Appendix C Further analysis of video data

### C.1 Stopping behaviour

This section presents more detailed results for the stopping behaviour of participants in the M14 trials; see Section 3.4 of the main report for the summary analysis.

### C.1.1 Cycle trial

The results discussed here focus on the behaviour of the participant cyclists only and data on the cars controlled by TRL staff is not included. The longitudinal position (i.e. the position along the road) of cyclists stopped at the traffic lights is summarised in Table C-1. Participant cyclists approached the junction either by themselves or in a pair with another cyclist. In some sessions a TRL-controlled car was released 10 seconds after the participants and in other sessions there were no other road users.

Table C-1 – Cycle trial: longitudinal position by participant group and LLCSscenario

| Participant group                     | Scenario  | Before<br>ASL | Within<br>ASL | 0-1m after<br>ASL Exit | More than 1m after ASL Exit | Sample<br>size |
|---------------------------------------|-----------|---------------|---------------|------------------------|-----------------------------|----------------|
| Dertisinent evoliet (ne per)          | Covered   | 0.7%          | 93.7%         | 5.7%                   | 0.0%                        | 441            |
| Participant cyclist (no car)          | Uncovered | 0.4%          | 92.5%         | 6.6%                   | 0.4%                        | 467            |
| Deuticinent explicit (con behind)     | Covered   | 0.3%          | 94.2%         | 5.5%                   | 0.0%                        | 326            |
| Participant cyclist (car benind)      | Uncovered | 0.5%          | 95.2%         | 4.3%                   | 0.0%                        | 397            |
| Two participant cyclists (no car)     | Uncovered | 0.0%          | 95.1%         | 4.5%                   | 0.4%                        | 246            |
| Two participant cyclists (car behind) | Uncovered | 0.0%          | 93.0%         | 6.1%                   | 0.9%                        | 229            |

Table C-2 looks at the stopping position data from the point of view of the arm and turning movement involved, excluding those with two cyclists released at the same time.

| Arm | Turn     | Scenario  | Before ASL | Within ASL | 0-1m after<br>ASL Exit | More than<br>1m after<br>ASL Exit | Sample size |
|-----|----------|-----------|------------|------------|------------------------|-----------------------------------|-------------|
|     | Loff     | Covered   | 1.0%       | 92.2%      | 6.8%                   | 0.0%                              | 103         |
| ۸   | Leit     | Uncovered | 0.9%       | 97.3%      | 1.8%                   | 0.0%                              | 113         |
| А   | Diabt    | Covered   | 1.0%       | 96.0%      | 3.0%                   | 0.0%                              | 101         |
|     | Right    | Uncovered | 0.9%       | 92.8%      | 5.4%                   | 0.9%                              | 111         |
|     | l off    | Covered   | 0.0%       | 95.3%      | 4.7%                   | 0.0%                              | 85          |
| В   | Len      | Uncovered | 1.0%       | 92.1%      | 6.9%                   | 0.0%                              | 101         |
|     | Straight | Covered   | 0.0%       | 94.1%      | 5.9%                   | 0.0%                              | 85          |
|     |          | Uncovered | 1.0%       | 89.9%      | 9.1%                   | 0.0%                              | 99          |
| с – | l off    | Covered   | 0.0%       | 93.9%      | 6.1%                   | 0.0%                              | 98          |
|     | Leit     | Uncovered | 0.0%       | 93.7%      | 6.3%                   | 0.0%                              | 111         |
|     | Right    | Covered   | 0.0%       | 98.1%      | 1.9%                   | 0.0%                              | 104         |
|     |          | Uncovered | 0.0%       | 93.9%      | 6.1%                   | 0.0%                              | 114         |
|     | Straight | Covered   | 0.0%       | 87.6%      | 12.4%                  | 0.0%                              | 97          |
|     |          | Uncovered | 0.0%       | 92.6%      | 6.5%                   | 0.9%                              | 108         |
| U   | Diabt    | Covered   | 2.1%       | 93.6%      | 4.3%                   | 0.0%                              | 94          |
|     | Right    | Uncovered | 0.0%       | 97.2%      | 2.8%                   | 0.0%                              | 107         |

Table C-2 – Cycle trial: longitudinal position by junction layout, turningmovement and LLCS scenario



### C.1.2 Car trial

The results discussed here focus on the behaviour of the participant cars only and data on the controlled cyclists is not included. Table C-3 shows the longitudinal position of car drivers stopped at the traffic lights data for the covered and uncovered scenarios for the two different participant groups that were trialled. This shows that for the scenarios without controlled cyclists, approximately 5% of car drivers stopped with their front bumper just past the ASL Entrance. In contrast, for scenarios with controlled cyclists ahead, approximately 1% stopped with their front bumper just past the ASL Entrance.

| Participant<br>group                 | Scenario  | Before<br>ASL<br>Entrance | 0 to 1.25m<br>past ASL<br>Entrance | 1.25 to 2.5m<br>past ASL<br>Entrance | 2.5 to 3.75m<br>past ASL<br>Entrance | 3.75 to 5m<br>past ASL<br>Entrance | Up to 1m<br>after ASL<br>Exit | Sample<br>size |
|--------------------------------------|-----------|---------------------------|------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|-------------------------------|----------------|
| Participant                          | Covered   | 93.8%                     | 4.6%                               | 1.0%                                 | 0.0%                                 | 0.0%                               | 0.5%                          | 194            |
| car driver<br>(no cyclist)           | Uncovered | 94.4%                     | 4.1%                               | 1.0%                                 | 0.5%                                 | 0.0%                               | 0.0%                          | 195            |
| Participant                          | Covered   | 97.8%                     | 1.6%                               | 0.0%                                 | 0.0%                                 | 0.5%                               | 0.0%                          | 183            |
| car driver<br>(cyclist in-<br>front) | Uncovered | 98.4%                     | 0.5%                               | 0.0%                                 | 1.1%                                 | 0.0%                               | 0.0%                          | 186            |

| Table C-3 – Car trial: longitudinal position by participant group and LLCS |
|--|
| scenario   |

Table C-4 looks at the stopping position data from the point of view of the arm and turning movement involved.

| Arm | Turn     | Scenario  | Before<br>ASL<br>Entrance | 0 to 1.25m<br>past ASL<br>Entrance | 1.25 to 2.5m<br>past ASL<br>Entrance | 2.5 to 3.75m<br>past ASL<br>Entrance | 3.75 to 5m<br>past ASL<br>Entrance | Up to<br>1m after<br>ASL Exit | Sample<br>size |
|-----|----------|-----------|---------------------------|------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|-------------------------------|----------------|
| ۸   | Diabt    | Covered   | 93.9%                     | 3.5%                               | 1.7%                                 | 0.0%                                 | 0.9%                               | 0.0%                          | 115            |
| A   | Right    | Uncovered | 93.4%                     | 4.1%                               | 0.8%                                 | 1.7%                                 | 0.0%                               | 0.0%                          | 121            |
|     | l off    | Covered   | 97.6%                     | 2.4%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 42             |
| D   | Leit     | Uncovered | 97.4%                     | 2.6%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 39             |
| D   | Straight | Covered   | 97.2%                     | 2.8%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 36             |
|     | Straight | Uncovered | 97.6%                     | 2.4%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 42             |
|     | l off    | Covered   | 97.8%                     | 2.2%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 45             |
| C   | Leit     | Uncovered | 95.5%                     | 2.3%                               | 0.0%                                 | 2.3%                                 | 0.0%                               | 0.0%                          | 44             |
| C   | Diabt    | Covered   | 95.3%                     | 2.3%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 2.3%                          | 43             |
|     | Right    | Uncovered | 100.0%                    | 0.0%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 45             |
|     | Straight | Covered   | 93.8%                     | 6.3%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 48             |
| П   | Straight | Uncovered | 97.8%                     | 0.0%                               | 2.2%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 46             |
| U   | Diabt    | Covered   | 97.9%                     | 2.1%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 48             |
|     | Right    | Uncovered | 97.7%                     | 2.3%                               | 0.0%                                 | 0.0%                                 | 0.0%                               | 0.0%                          | 44             |

 
 Table C-4 – Car trial: longitudinal position by junction layout, turning movement and LLCS scenario

### C.1.3 Motorcycle trial

In all sessions in the motorcycle trial, a controlled car was released 5 seconds after the participants; there were no controlled cyclists in any sessions. Table C-5 shows the longitudinal position of motorcyclists stopped at the traffic lights for the covered and uncovered scenarios.



## Table C-5 – Motorcycle trial: longitudinal position by participant group and LLCSscenario

| Participant<br>group         | Scenario  | Before<br>ASL<br>Entrance | 0 to 1.25m<br>past ASL<br>Entrance | 1.25 to 2.5m<br>past ASL<br>Entrance | 2.5 to 3.75m<br>past ASL<br>Entrance | 3.75 to 5m<br>past ASL<br>Entrance | Up to<br>1m after<br>ASL Exit | Sample<br>size |
|------------------------------|-----------|---------------------------|------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|-------------------------------|----------------|
| Participant                  | Covered   | 93.6%                     | 3.5%                               | 0.0%                                 | 0.0%                                 | 3.0%                               | 0.0%                          | 202            |
| motorcyclist<br>(car behind) | Uncovered | 95.3%                     | 3.0%                               | 0.0%                                 | 0.0%                                 | 1.7%                               | 0.0%                          | 233            |

Table C-6 looks at the stopping position data from the point of view of the arm and turning movement involved.

### Table C-6 – Motorcycle trial: longitudinal position by junction layout, turning movement and LLCS scenario

| Arm | Turn     | Scenario  | Before         0 to 1.25m         1.25 to 2.5m         2.5 to 3.75m         3.75 to 5m           cenario         ASL         past ASL         past ASL         past ASL         past ASL         1           Entrance         Entrance <th>Up to<br/>1m after<br/>ASL Exit</th> <th>Sample<br/>size</th> |       | Up to<br>1m after<br>ASL Exit | Sample<br>size |      |      |    |
|-----|----------|-----------|---|-------|-------------------------------|----------------|------|------|----|
|     | Loft     | Covered   | 96.2%   | 0.0%  | 0.0%                          | 0.0%           | 3.8% | 0.0% | 26 |
| ^   | Leit     | Uncovered | 93.8%   | 3.1%  | 0.0%                          | 0.0%           | 3.1% | 0.0% | 32 |
| ~   | Diabt    | Covered   | 92.6%   | 3.7%  | 0.0%                          | 0.0%           | 3.7% | 0.0% | 27 |
|     | Right    | Uncovered | 96.8%   | 3.2%  | 0.0%                          | 0.0%           | 0.0% | 0.0% | 31 |
|     | Loft     | Covered   | 94.4%   | 5.6%  | 0.0%                          | 0.0%           | 0.0% | 0.0% | 18 |
| D   | Leit     | Uncovered | 95.8%   | 4.2%  | 0.0%                          | 0.0%           | 0.0% | 0.0% | 24 |
| D   | D        | Covered   | 95.7%   | 0.0%  | 0.0%                          | 0.0%           | 4.3% | 0.0% | 23 |
|     | Straight | Uncovered | 95.7%   | 0.0%  | 0.0%                          | 0.0%           | 4.3% | 0.0% | 23 |
|     | Loft     | Covered   | 96.4%   | 0.0%  | 0.0%                          | 0.0%           | 3.6% | 0.0% | 28 |
| C   |          | Uncovered | 93.5%   | 3.2%  | 0.0%                          | 0.0%           | 3.2% | 0.0% | 31 |
| C   | Diabt    | Covered   | 92.6%   | 3.7%  | 0.0%                          | 0.0%           | 3.7% | 0.0% | 27 |
|     | Right    | Uncovered | 93.1%   | 6.9%  | 0.0%                          | 0.0%           | 0.0% | 0.0% | 29 |
|     | Straight | Covered   | 86.7%   | 13.3% | 0.0%                          | 0.0%           | 0.0% | 0.0% | 30 |
| D   | Straight | Uncovered | 96.9%   | 0.0%  | 0.0%                          | 0.0%           | 3.1% | 0.0% | 32 |
| U   | Diabt    | Covered   | 95.7%   | 0.0%  | 0.0%                          | 0.0%           | 4.3% | 0.0% | 23 |
|     | Right    | Uncovered | 96.8%   | 3.2%  | 0.0%                          | 0.0%           | 0.0% | 0.0% | 31 |

### C.1.4 HGV trial

The longitudinal stopping position (i.e. the position along the road) of HGV drivers is summarised in Table C-7 for the covered and uncovered scenarios.

### Table C-7 – HGV trial: longitudinal position by junction layout, turningmovement and LLCS scenario

| Arm      | Scenario  | Before ASL Entrance | 0 to 1.25m past ASL Entrance | Sample size |
|----------|-----------|---------------------|------------------------------|-------------|
| Arm A    | Covered   | 98%                 | 2%                           | 83          |
| AIIII A  | Uncovered | 93%                 | 7%                           | 85          |
| Arm D    | Covered   | -                   | -                            | 5           |
| Arm B    | Uncovered | -                   | -                            | 5           |
| Arm D    | Covered   | 95%                 | 5%                           | 42          |
| Arm D    | Uncovered | 87%                 | 13%                          | 39          |
| All ormo | Covered   | 97%                 | 3%                           | 130         |
| Airanns  | Uncovered | 90%                 | 10%                          | 129         |



### Appendix D Further analysis of questionnaire data

### **D.1 Introduction**

This appendix presents further questionnaire analysis and is structured as follows:

- Section D.2 summarises the participant characteristics and level of experience;
- Sections D.3, D.4 and D.5 relate to participants' experiences from the trial;
- Section D.6 relates to their attitudes towards the LLCS.

### **D.2 The sample**

### D.2.1 Participant characteristics

Most participants were aged between 35 and 65<sup>1</sup> as shown in Figure D-1. All of the HGV drivers and most of the motorcyclists and pedestrians were male; there was a fairly even gender split with cyclists and car drivers (see Figure D-2).



Figure D-1 - Age characteristics



Figure D-2 - Gender characteristics

<sup>&</sup>lt;sup>1</sup> For insurance purposes drivers were restricted to ages over 25



More than half of cyclists usually cycled at least once a week, whereas other participant groups cycled less regularly (shown in Figure D-3).



**Figure D-3 - Cycle frequency** 

When cycling, most of the participants said that their most frequent journey was for leisure purposes; these journeys cover a range of distances with most more than five miles except for pedestrians who mostly cycled between one to three miles.

Of the cyclist participants, most usually cycle "on roads (in traffic) / cycle lane on road" (55%), with smaller proportions usually cycling "on separate cycle paths / shared paths" (28%) or "off-road" (17%). Only a few of the cyclist participants regularly cycled in London (8%).

Except for motorcyclists most of the participants were also regular car drivers as shown in Figure D-4.



Figure D-4 - Driving frequency

For the participants driving cars as part of the trials, the most common journeys were to work or education or for business. There was an even mixture of journey lengths for the car driving participants: 26% driving less than five miles; 31% driving between five and ten miles; 24% driving between 10-20 miles and 17% driving over 20 miles.

Most of the HGV drivers had driven a lorry for over five years, with one participant driving for less than one year. The most common distance driven was between 200 and 300 miles a week.



The motorcyclists were mostly regular motorcyclists riding at least once a week, with the most frequent journey purpose being for leisure.

### **D.2.2 Experience of traffic signal junctions**

### D.2.2.1 Junctions with traffic signals

Cyclists were asked how often they use junctions with traffic signals when they are cycling. Many of the cyclists were not accustomed to cycling through signal-controlled junctions, with 29% saying 'never' and 30% saying 'less than once a week' (shown in Figure D-5).



Figure D-5 - Experience of junctions with traffic signals

Excluding cyclists who said 'never' to the previous question, they were then asked how often, if ever, they go through the signals when they are red. About a third said either 'rarely' (15%) or 'some times' (16%). Figure D-6 shows this.



### Figure D-6 - Compliance with red signals

Of the 23 cyclists who sometimes or rarely went through red lights, the most common reasons were when there was no traffic, when the signals have not detected them, or when turning left. The most common reasons for going through a red and amber signal were associated with trying to get ahead of traffic, as well as turning left and when there was no traffic. These are shown in Figure D-7.





Figure D-7 - Reasons for going through red signals

### D.2.2.2 Low Level Cycle Signals

Participants were shown photographs of the Low Level Cycle Signals. Participants were asked whether they had seen or heard of the signals before. Responses are displayed in Figure D-8. About a quarter said they had seen them in another country, while about half said they had not seen or heard about them. About 15% said they had seen them in the UK; these people may have been mistaken or they might have been referring to TfL media coverage about the trials.



Figure D-8 - Previous experience of LLCS

### D.2.2.3 Advanced Stop Lines

Participants were shown photographs of Advanced Stop Lines (ASLs). They were asked whether they had seen such markings before.



Many participants (75% of cyclists and about 70% of car drivers) said they had seen them and almost all of the motorcyclists, HGV drivers and pedestrians had seen them.

All participants who had seen them (except for pedestrians) were asked how often they use junctions with these markings – cyclists were asked about using them when they are cycling, car drivers when they are driving, and so on. Figure D-9 shows the responses. Over 20% of cyclists and HGV drivers, 10% of car drivers and a few motorcyclists said 'never'. Around half of the participants encountered them less than once a week.



Figure D-9 - How often participants use junctions with ASLs

Cyclists were then asked how often they enter the area with the cycle symbol while waiting for the signals to change (see Figure D-10). Approximately 90% of the cyclists said they waited there 'every time' or 'most times'.



Figure D-10 - How often cyclists wait in ASLs

Other participants were asked the same question, for situations with and without cyclists (shown in Figure D-11). For situations where there were cyclists about, most of the car drivers and HGV drivers said they 'never' waited there and a few said 'rarely'. About 25% of the motorcyclists said they 'rarely' stopped in the ASL and one (out of 28) said 'often'.

For situations where there are no cyclists about, 25% of motorcyclists and one (out of 30) car driver said they use the ASLs 'often'. However 50% of motorcyclists over 70% of car drivers, and nearly 90% of HGV drivers said they never stopped in ASLs.





Figure D-11 - Compliance of motorists staying out of ASLs

The motorcyclists who said they would stop in the ASL referred to getting ahead of the traffic and having a better view; some mentioned only stopping there if there were no cyclists, others said they would make space for cyclists, but some said they would stop in the ASL regardless of whether there were any cyclists.

"If there is plenty of space for me I will use it regardless of who else is in there. This way I can accelerate from other traffic users quickly and efficiently and I would prefer to not have cyclists in front of me when stopped at lights."

One car driver said they would stop in the ASL if they were in a queue of traffic and the signal had changed to red.

The drivers who said they might stop in some circumstances generally talked about misjudging the time the queue would take to clear before the signals changed, unexpected situations such as making room for emergency vehicles, and stopping there late at night. Safety reasons were the predominant reason given by motorcyclists.

"If filtering to the front of a queue to get me out of harm's way."

### **D.3 Understanding of the signals and the junction**

### D.3.1 Understanding of Advanced Stop Lines

Participants were asked about the meaning of the ASLs shown in the photographs. Almost all cyclists, motorcyclists, HGV drivers and pedestrians showed a good understanding and all car drivers understood them.

Of those who did not fully understand, two motorcyclists thought motorcyclists are allowed to use them and one cyclist thought motorcyclists might be allowed. One of the HGV drivers and one of the pedestrians thought it marked a cycle crossing and another thought it is a "no parking zone".

### **D.3.2 Understanding of Low Level Cycle Signals**

The understanding of the LLCS is covered in Section 3.1.1 in the main report.

### D.3.3 Views on who would benefit

After being asked about their experiences in the trial, participants were asked about who they thought would benefit from the Low Level Cycle Signals. They were offered a list of road user types, and the opportunity to suggest others (shown in Figure D-12).



Figure D-12 - Views on who would benefit from LLCS

One of the car drivers mentioned that the cycle signals would be useful for drivers at junctions where there are no secondary signals.

In general the pedestrians thought the LLCS were beneficial, for example:

"The more information on the roads we have, I believe the safe we will all become. I think cars and traffic have "regular traffic lights", pedestrians have "pedestrian lights" so it stands to reason that cyclists should have the same care, protection, guidance and to concentrate on their signals too".

The perceived benefits of the LLCS are also covered in Section 3.2.1 of the main report.

### D.4 Stopping at the signals during the trial

### D.4.1 Noticing the ASL

Car drivers, HGV drivers, motorcyclists and cyclists (but not pedestrians) were shown photographs of the ASLs. When asked whether they noticed the ASL when they first approached the junction, almost all participants said that they did.

### D.4.2 Noticing the LLCS

Participants took part in two or three sessions, making eight turns (or 'runs') through the junction in each session. In some sessions the LLCS were covered to provide a baseline for relative comparisons. Participants were asked for their first 'uncovered' session, how many runs through the junction it was before they noticed the signals. A substantial proportion of participants didn't notice the LLCS at all: 33% of car drivers; 27% of HGV drivers; 23% of motorcyclists and 7% of cyclists. 80% of cyclists noticed the LLCS after two runs and almost 80% of motorcyclists noticed them after a few runs. Results are shown in Figure D-13.

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### Figure D-13 - Experience of noticing the LLCS

One cyclist appeared to be given extra confidence in the ASL by the Low Level Cycle Signals:

"ASL gave confidence, cyclist signals reinforced this."

### D.4.3 Height and angle of the LLCS

Participants were asked what they thought about the height and angle of the LLCS.

Over three quarters of the cyclists said that the height was 'about right', 15% thought the signals would be better if they were higher and a few would have preferred them lower. About 50 to 60% of the drivers, HGV drivers and motorcyclists said the signal height is about right; a quarter of the HGV drivers and just over 15% of drivers and motorcyclists thought the signals would be better higher. Over 80% of the pedestrians thought the height was 'about right'. Figure D-14 shows the results.

HGV Drivers suggested that they were unable to, or had difficulty seeing the LLCS. They were asked how easy it was to see the cycle signals when they were stopped at the red light. Most of them said it was easy or very easy, just over 10% said it was either 'difficult' or 'very difficult'.



Figure D-14 - Views on the height of the LLCS

About 70% of cyclists thought the angle was 'about right' and just over 20% thought they would be better if they were angled so that they pointed more towards the road



(see Figure D-15). A similar proportion of pedestrians also thought they would be better pointed more towards the road; half of these gave the reason that the angle may confuse pedestrians. Of the pedestrians that stated that they did not know, some stated that they had not noticed or paid much attention to the cycle signals.

"Some seemed to point in the direction of pedestrians which could be confusing or cause pedestrians to think it is green for them rather than cyclists."



"As I was a pedestrian in the trial I didn't pay much attention to these signals"

### Figure D-15 - Views on the angle of the LLCS

### D.4.4 Stopping position relative to the ASL

Participants were asked how often they waited in the area with the cycle symbol while waiting for the signals to change and to explain their answer. Almost all of the cyclists (98%) said they stopped there every time, and a few of the drivers and motorcyclists said they stopped there some times. Two of the HGV drivers said they stopped there every time.

Four car drivers said they stopped in the ASL every time, one explained that this was while waiting for the cyclist to go whilst one driver stated that:

### "I waited at [the] red traffic light".

The participants who said they did not stop in the ASL generally explained this was because the area was for cyclists only.

Cyclists were asked whether having a car behind them ever affected their stopping position. 80% said 'never', about 20% said sometimes and two said 'every time'.

Several of the cyclists said they modified their cycling to be more defensive if there was a car behind them.

"I try to make sure the car cannot get past me so got in the middle."

"Would stop where it was easier for a car to pass."

"If turning at a junction, I would sometimes use my road position to make my intentions clear and to not allow the car to cut me up at the junction."

"I wanted to see if the car was indicating to turn, so I positioned myself accordingly."



Some mentioned stopping in the centre of the road if they were about to turn right with a car behind them. One cyclist tried to avoid stopping, unless there was a car behind, so would approach more rapidly if there was a car behind.

"If the car wasn't behind me, I'd slow down more before the junction to try and maintain momentum by not stopping."

### D.4.5 Effect of LLCS on stopping position

Participants were asked whether the LLCS affected their stopping position. The results are shown in Figure D-16.

Almost 30% of cyclists said their stopping position was affected by the LLCS, either every time (12%) or sometimes (17%). The cyclists who said this tended to say that they stopped where they could see the LLCS; several mentioned stopping further back from the stop line, particularly if they were turning right. Others said that they could not see them for turning right, so used the secondary traffic signals.

"The signals were on the left-hand post only and so if I was turning right I wanted to position myself in the right hand side of the box up against the stop line, but I could not really see the signals properly here so I had to stop some distance back from the stop line."

"I stopped earlier so I could see them beside me."

"Sometimes I stopped so I could see the lights more easily without turning my head so much."



Figure D-16 - Effect of LLCS on stopping position

### **D.4.6** Whether participants would react to an 'early start'

Car drivers, HGV drivers and motorcyclists were asked whether during normal driving they thought they would ever start moving into the junction when the LLCS were green and the main signal was red (see Figure D-17). 10% or less of each road user group said 'yes' and about 40% of motorcyclists said 'it depends'<sup>2</sup>.

<sup>&</sup>lt;sup>2</sup> Following this result it was decided to conduct an M18 'early start' trial for motorcyclists as well in addition to those already planned for other road users





Figure D-17 - Hypothetical early release situation

Car drivers and motorcyclists who said they would start moving during a green cycle and red traffic phase referred to confusion and errors, such as responding to a green light without realising that it was a cycle signal. Motorcyclists and one HGV driver said this would depend on whether there were any cyclists ahead. Motorcyclists tended to say that they would move if they were trying to get ahead of the traffic or as a defensive strategy if the vehicle behind them was moving. A few motorcyclists said they would go ahead on the green cycle signal if it was legal for them to do so.

### D.5 Using the Low Level Cycle Signals during the trial

### D.5.1 Summary

Participants were presented with photographs of each arm of the junction and asked which of the signals they looked at as they approached, and while they were waiting to turn; they were then asked to note which was the most important to them. Cyclists were also asked whether the presence of a car behind them affected what they looked at. Pedestrians were asked about using the signals while crossing the road at each arm of the junction and the Puffin crossing; these results are presented separately in Section D.5.8. Figure D-18 shows the proportion of participants who said they looked at the LLCS.







### Figure D-18 - Proportion of participants who said they looked at the LLCS when approaching and waiting at the junction to go left, straight on or right

The remainder of this section gives further context on what participants said they looked at when approaching and waiting at the junction.

### D.5.2 Arm A

Arm A was a two-lane, one way street. Low Level Cycle Signals were provided below the main signals on each side of the road. A secondary signal was provided on the far side of the junction.



### D.5.2.1 Approaching the junction

As participants approached, two thirds of car drivers and slightly more motorcyclists said they looked at the main traffic signals on the left (Figure D-19). More car drivers and fewer motorcyclists said they looked at the main traffic signals on the right, but only 43% of cyclists looked at these. Between 50% and 60% of car drivers, cyclists and motorcyclists said they looked at the secondary signals.

Just under a third of cyclists said they looked at the signals for cyclists on the left while they were approaching the junction; about 10% of car drivers and motorcyclists said they looked at these signals.

In the 'other' responses, 4 cyclists and 1 motorcyclist mentioned looking at the pedestrian signals.



One (out of 15) cyclists said they looked at the cycle signal on the right as they approached the junction. More data from this day will be available in the M18 report.



Figure D-19 - What cues participants said they looked at when approaching Arm A

When approaching the junction, the main traffic signal in front on the left was mentioned to be the most important by 61% of cyclists, 32% of motorcyclists and 31% of car drivers. Car drivers found the main signals on the right equally as important. Cyclists found the secondary signal on the other side of the junction the second most important (16%), and motorcyclists found the Traffic signals for cyclists on the right the second most important (18%).

### D.5.2.2 Turning left at the junction

When participants were waiting at the signals prior to turning left, they were rather less likely to say they looked at the main signals on the left than when they were approaching, but more likely to say that they looked at the signals for cyclists on the left (shown in Figure D-20). Just over 70% of cyclists and about a fifth of motorcyclists said they looked at the signals for cyclists on the left. For cyclists, this proportion was higher than that of any of the other categories.

Motorcyclists were more likely to say they looked at the secondary signal rather than at the signals for cyclists on the left.

Relatively few participants said they looked at the main signals on the right while they were waiting to turn left.

In the 'other' responses, a few participants mentioned looking at the pedestrian signals: five cyclists and one motorcyclist said they looked at these. One explained:

"[I looked at the] pedestrian lights to give indication of when to get ready".

In the session in which 15 cyclists were also offered the option of recording whether they looked at the signals for cyclists on the right, two of them said they looked at the cycle signals on the right as they were waiting to turn left.





Figure D-20 - What cues participants said they looked at when turning left at Arm A

### D.5.2.3 Turning right at the junction

When participants were waiting to turn right at the signals, around two-thirds of cyclists and three-quarters of drivers and motorcyclists said they looked at the main traffic signal on the right. Almost as many said they looked at the secondary signal. Between about 10% and 25% said they looked at the main signal on the left. Results are shown in Figure D-21.

Just over 20% of cyclists and 10% of motorcyclists said they looked at the signals for cyclists on the left; cyclists were as likely to say they looked at the signals on other roads into the junction as the signals for cyclists.

In the 'other' responses, a few participants again mentioned looking at the pedestrian signals: four cyclists and one motorcyclist said they looked at these.

In the session in which 15 cyclists were also offered the option of recording whether they looked at the signals for cyclists on the right, just under half of them said they looked at the cycle signals on the right as they were waiting to turn right.







Figure D-21 - What cues participants said they looked at when turning right at Arm A

### D.5.3 Arm B

Arm B was a two-way street with a central island separating the two carriageways. Low Level Cycle Signals were provided below the main signals on the left and on the central island. A closely associated secondary signal was provided beyond the pedestrian crossing, before the junction itself.



### D.5.3.1 Approaching the junction

When participants were approaching, over 80% of the participants said they looked at the main traffic signal on the left. Similar proportions of car drivers and motorcyclists also looked at the main traffic signal in the centre of the road, whereas about half of

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cyclists looked at this. Half of cyclists and about two-thirds of car drivers and motorcyclists said they looked at the secondary signal (see Figure D-22).

Almost a third of cyclists said they looked at the signal for cyclists on the left as they were approaching; about 10% of car drivers and 20% of motorcyclists said they looked at these signals. About 10% of cyclists said they looked at the signal for cyclists in the centre of the road; about 15% of car drivers and motorcyclists said they looked at these.



Figure D-22 - What cues participants said they looked at when approaching Arm B

When approaching the junction, the main signal on the left was the most important for 70% of cyclists, 38% of car drivers and 37% of motorcyclists. The main signals in the centre of the road were also the most important to a relatively large proportion of car drivers and motorcyclists. The traffic signal for cyclists on the left was the most important to 7% of cyclists; the LLCS on the right were not the most important for any group.

### D.5.3.2 Turning left at the junction

When cyclists were waiting at the signals prior to turning left, they were more likely to say they looked at the signal for cyclists on the left than at other signals: over 70% said they looked at these, compared with around 60% who said they looked at the main signals on the left; few of the cyclists (about 10%) said they looked at the signal for cyclists in the centre of the road.

Car drivers and motorcyclists were most likely to say the looked at the main signals on the left. Just over 30% of car drivers and motorcyclists said they would look at the signals for cyclists, which was higher than for when approaching the signals. Results are shown in Figure D-23





Figure D-23 - What cues participants said they looked at when turning left at Arm B

When waiting to turn left, the cycle signals on the left were most important for 4% of car drivers. The LLCS on the right was not the most important signal for any participant. The main traffic signal on the left was most important for 58% of car drivers and 60% of motorcyclists.

### D.5.3.3 Going straight on at the junction

While waiting to go straight on, the secondary signal was most frequently mentioned by cyclists (57%) followed by the traffic signal for cyclists on the left (47%) and the main signals on the left and in the centre of the road (around 40%). Just over a fourth of cyclists looked at the signal for cyclists in the centre of the road while waiting to go straight on (Figure D-24).

Motorcyclists and car drivers most frequently said they looked at the secondary signal and the main signal in the centre of the road while waiting to go straight on. 24% of car drivers and 16% motorcyclists said they looked at the cycle signal in the centre of the road, while about 16% of drivers and 19% of motorcyclists said they looked at the cycle signal on the left while waiting to go straight on.





## Figure D-24 - What cues participants said they looked at when going straight on at Arm $\ensuremath{\mathsf{B}}$

When waiting to go straight on, the secondary signal was the most important for motorcyclists (45%), whereas the main traffic signal in front centre was most important for car drivers (37%). The main traffic signals on the left were most important for cyclists (27%) and no car drivers or motorcyclists. The off-side cycle signals were most important for 9% of cyclists, no car drivers and 5% of motorcyclists.

### D.5.4 Arm C

Arm C was a two-way street, with Low Level Cycle Signals below the main signals on the left. A secondary signal was provided on the far side of the junction.



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### D.5.4.1 Approaching the junction

Almost all participants said they looked at the main traffic signal on the left as they approached the junction. About 60% of cyclists and car drivers, and 84% of motorcyclists said they looked at the secondary signal (shown in Figure D-25).

A third of cyclists said they looked at the cycle signals on the left and over 20% of car drivers and motorcyclists said they looked at these signals as they approached.



#### Figure D-25 - What cues participants said they looked at when approaching Arm C

When approaching the junction, the main traffic signals on the left were most important for 68% of cyclists, 64% of car drivers and 39% of motorcyclists. 8% of cyclists and no car drivers or motorcyclists found the cycle signals most important.

### D.5.4.2 Turning left at the junction

While waiting to turn left, cyclists were more likely (80%) to say they looked at the signals for cyclists on the left than at the other signals; 58% said they looked at the main signal on the left and 39% at the secondary signal.

About 30% of car drivers and motorcyclists said they looked at the cycle signals on the left; car drivers and motorcyclists were more likely to say they looked at the main signal on the left and the secondary signal than the cycle signals. Results are shown in Figure D-26.





Figure D-26 - What cues participants said they looked at when turning left at Arm C

When waiting to turn left, 6% of motorcyclists and 3% of car drivers found the cycle signals most important. 55% of car drivers and 59% of motorcyclists found the main traffic signal on the left most important.

### D.5.4.3 Turning right at the junction

When waiting to turn right, cyclists and motorcyclists were most likely to say they looked at the secondary signal (80% of cyclists and 90% of motorcyclists). About half of car drivers said they looked at this signal, and half said they looked at the main signal on the left.

About 30% of cyclists said they looked at the signals for cyclists on the left when they were turning right, as did about 20% of motorcyclists and less than 10% of car drivers (Figure D-27).





Figure D-27 - What cues participants said they looked at when turning right at Arm C

When waiting to turn right, the secondary signal was most important for 48% of cyclists, 62% of car drivers and 29% of motorcyclists. No car drivers or motorcyclists found the cycle signals most important.

### D.5.5 Arm D

Arm D was a two-way street with Low Level Cycle Signals below the main signals on the left. A secondary signal was provided on the opposite side of the junction. The Advanced Stop Line area was painted green, in contrast to the other three arms, which were left black.



### D.5.5.1 Approaching the junction

Figure D-28 shows that on approaching the junction, about 90% of participants said they looked at the main traffic signal on the left. Around 60% of cyclists and car drivers and 80% of motorcyclists said they looked at the secondary signal. Around 40% of cyclists and around 20% of car drivers and motorcyclists said they looked at the signal for cyclists on the left.





Figure D-28 - What cues participants said they looked at when approaching Arm D

When approaching the junction, the main traffic signals on the left were most important for 71% of cyclists, 64% of car drivers and 61% of motorcyclists; whereas 8% of cyclists and no car drivers or motorcyclists found the cycle signals to be the most important.

### D.5.5.2 Going straight on at the junction

While waiting to go straight on, two thirds of cyclists said they looked at the signal for cyclists on the left, but only about 15% of car drivers and motorcyclists said they did so. Almost as many cyclists said they looked at the secondary signal and half said they looked at the main signal on the left (see Figure D-29).



Figure D-29 - What cues participants said they looked at when going straight on at Arm D



When waiting to go straight on, the cycle signals were most important for 3% of car drivers and no motorcyclists. The secondary signals were most important for 25% of cyclists, 40% of car drivers and 25% of motorcyclists. The main signals were most important for 23% of cyclists, 31% of car drivers and 38% of motorcyclists.

### D.5.5.3 Turning right at the junction

While waiting to turn right, cyclists and motorcyclists were most likely to mention looking at the secondary signal (around 80%). About a quarter of cyclists said they looked at the cycle signals on the left and a similar proportion said they looked at the main signal on the left (shown in Figure D-30).



Figure D-30 - What cues participants said they looked at when turning right at Arm D

The secondary signals were the most important factor for 46% of cyclists, 56% of car drivers and 20% of motorcyclists. Only 6% of cyclists and no car drivers or motorcyclists found the cycle signals the most important factor.

### D.5.6 Effect of other vehicles

Car drivers were asked whether having a cyclist in front of them affected which signals they looked at. About 70% said they were not affected and about 15% said they were affected every time. Figure D-31 shows the results.

One driver said that because of the slower speed of cyclists, they checked the signals again in case they had changed while the cyclist was moving off. Another said the signal they looked at depended on the position, speed and direction of the cyclist.





Figure D-31 - Occasions when the cyclist in front had an effect on what car drivers said they looked at

### D.5.7 HGV drivers

### D.5.7.1 Approaching the junction

As shown in Figure D-32, when approaching the junction, 80% of HGV drivers said they looked at the main traffic signals and 60% looked at whether the junction was empty. At Arm A, 40% of HGV drivers said they looked at the LLCS on the left. At Arm B, the LLCS in the centre of the road and the LLCS on the left were both looked at by 20% of drivers. At Arm D, the LLCS on the left were used by 15% of HGV drivers.



Figure D-32 - What cues HGV drivers said they looked at when approaching the junction (Arm A, B and D)

### D.5.7.2 Going straight on at the junction

When entering the junction, what the HGV drivers said they looked at was evenly distributed across all the categories (see Figure D-33). The LLCS on the left were used



by about 50% of HGV drivers on all arms, whereas the LLCS in the centre of the road at Arm B were used by just over 30% of HGV drivers.



Figure D-33 - What cues HGV drivers said they looked at when going straight on at the junction (Arm A, B and D)

### D.5.8 Pedestrians

Pedestrians were presented with photographs of each arm of the junction, and the Puffin crossing, and asked what they looked at when deciding when to cross. Having identified these, pedestrians were asked to note which was the most important to them.

For the pedestrians Arm A, Arm B and Arm D were controlled, Arm C was uncontrolled and the Puffin crossing had near side pedestrian signals only. The results from Arm A, B and D were often similar and so have been combined in several of the graphs in this section.

### D.5.8.1 Deciding when to cross

Most of the participants said that the main signals and the presence of traffic were the main factors in deciding when to cross (Figure D-34). At Arm A, Arm B, Arm D and the Puffin crossing, between 80% and 90% of participants stated that they used the pedestrian signals, and over a third stated that these were the most important for them when deciding when to cross.







Figure D-34 - What cues pedestrians looked at when deciding to cross



Figure D-35 - What cues pedestrians thought were most important when deciding when to cross

For the participants who stated that the pedestrian signals were the most important factor in deciding to cross the road at Arm A, B or D, 25% used the traffic signals for cyclists at the uncontrolled crossing (Arm C), as shown in Figure D-35.







### D.5.8.2 The Puffin crossing

At the Puffin crossing, pedestrians were also asked if they noticed the cycle signals as they approached the crossing (see Figure D-36). Two-thirds of pedestrians said they had noticed the cycle signals.



### Figure D-36 - Proportion of pedestrians who noticed the LLCS

They were then asked about whether seeing both the red man and the green cycle signal showing affected their initial decision to cross. A third of participants said that this did affect their initial decision. Results are shown in Figure D-37.

When asked to explain their answer, 15% of participants suggested that the signals had confused them, with 25% of participants stating that the signals had made them more aware of cyclists or made them hesitate.

"I caught a glimpse of green and at first thought it indicated safe to cross."

"No [it did not impact my initial decision] although it did make me hesitate whilst gathering information."

"Green cycle sign "reinforced" red man sign."







### Figure D-37 - Proportion of pedestrians who said that seeing both the red man and the green cycle signal showing affected their initial decision to cross

Few participants said they altered their initial decision about when to cross; of these only two stated that this change was due to the Low Level Cycle Signals, most of them citing other reasons, such as a lack of traffic:

"Crossed road on red man only when traffic permitted."

### D.5.8.3 Crossing the road

Pedestrians were asked about where they had crossed the road during the trial – specifically whether they had walked in the ASL and whether they had walked between the dotted lines marking the crossing. Results are shown in Figure D-38.

Almost 60% of participants said they had never walked across the ASL; just a few said they had done so 'most times' or 'every time'.



### Figure D-38 - Did pedestrians walk in the ASL

Almost half (47%) of participants said they had crossed between the dotted lines of the crossing 'every time', a fifth said they had done so 'a few times' and just two (6%) said they had 'never' crossed between the dotted lines (see Figure D-39).

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### Figure D-39 - How often pedestrians crossed between the dotted lines

At each crossing point, pedestrians were asked to think about the amount of information to help them when they were deciding when to cross the road, and to say whether this was 'too little', 'about right', or 'too much'. Between about 10% and 20% said there was 'too much' (see Figure D-40). For example:

"A lot of signals make it hard to decide when all changing and making different sounds."

Up to about 10% said it was 'too little', except at the uncontrolled crossing Arm C where over 40% said there was too little information.

At Arms A, B and D and at the Puffin, about three-quarters of pedestrians thought there was the right amount of information for deciding when to cross:



"Enough information to determine safety to cross."

### Figure D-40 - Views of pedestrians on the level of information available to help them decide when to cross the road

From their comments, there was little indication that the Low Level Cycle Signals affected pedestrians' decisions to cross the road. Just a few of the pedestrians made reference to the cycle signals when asked for general comments about the junction. Those who did comment about the LLCS suggested that the signals would not affect them, whereas others said they would provide an extra piece of information:



"As a pedestrian it was quite hard to see the cyclist signals whilst waiting at the junction. This meant it had little effect on the decisions I made about crossing as a pedestrian."

"I love the idea of low level repeaters at all traffic lights. They are a great help to all road users."

What participants looked at is also covered in Section 3.3 of the main report.

### **D.6 Attitudes**

#### D.6.1 Comparisons with an ordinary junction

Participants were asked how easy it would be to use the junction compared with an ordinary one; cyclists were asked about cycling, car and HGV drivers about driving, motorcyclists about motorcycling, and pedestrians were asked about walking. Results are summarised in Figure D-41.

Most of the cyclists said it would be either 'easier' or 'much easier', and none said it would be 'more difficult'. The most common response from other participants was that it would be neither easier nor more difficult and some, followed by 20% to 50%, who found it 'easier'. Just a few car drivers, motorcyclists and pedestrians said it would be 'more difficult' or 'much more difficult'.



### Figure D-41 - How easy the junction was to use compared with an ordinary junction

One of the car drivers who said it would be more difficult was concerned about cyclists holding up the traffic and the other was concerned about confusion between signals for cyclists and those for pedestrians.

The motorcyclists who thought it would be more difficult were concerned about making junctions more complicated and confusing, and where motorcyclists would 'fit' into the traffic; one said it would be difficult for motorcyclists to filter through ahead of the traffic.

"Having two sets of signals is confusing especially if they change at different times and there is a risk of motorcycles being in the cycle zone."



"Lots to take in and motorcyclists are in a strange hinterland of being neither a car nor a bike."

"Increased complication, lack of certainty as to what a cyclist might do or possibly a vehicle might do. Traffic lights do fail, what happens if cyclists' lights get out of synch with the rest?"

"I did not get to use this set-up, but I imagine it will be hard for motorbikes to filter in front of cars."

### **D.6.2** Perception of safety

#### Perception of safety is covered in Section 3.6.3 of the main report.

#### D.6.3 Influence on willingness to cycle

Participants were asked whether they thought it would affect how often they cycle in busy traffic if more junctions were like this. This was used to obtain an indication of whether this would help to encourage cycling in London. These responses should be treated with caution, because they are only what people said they would do theoretically. The decision to cycle or not is based on many factors and it is unclear in reality to what extent LLCS by themselves would have. Nevertheless, these responses are a good indicator on how positively people feel towards them. Responses are shown in Figure D-42.

Most of the cyclists who said they would cycle more often in busy traffic said this was because they would feel safer or more confident. The drivers and pedestrians who said they would cycle more often tended to give similar reasons. For example one of the pedestrians said:

"It would make me feel safer as I would know that the local authority had thought about cyclists when designing the junction."

Some of the cyclists who said it would not influence how often they cycle said they already cycle in busy traffic, while others said they avoid busy traffic and this would not be sufficient to change that. Some said they would continue to use existing signals and a few said that the signals do not have much effect, or that they did not feel any safer.







Figure D-42 – Willingness to cycle in busy traffic if more junctions were like this

### D.6.4 Suggestions for improvements and other comments

Suggestions for improvements and other comments are covered in Section 3.2.2 and Section 3.2.3 of the main report.



# Appendix E Partially sighted pedestrian trial, detailed findings

### **E.1 Introduction**

### E.1.1 Trial setup

This appendix presents the results of a single day trial of ten partially sighted participants who used the junction and the Puffin crossing as pedestrians.

Each participant had an assistant from TRL who guided them and recorded their behaviour and answers to the questionnaire. They were led to a position ten metres from the crossings and asked to approach and use the crossing without assistance, describing what they saw and providing feedback after crossing the road. At the end of the trial they were also asked general questions on what they had experienced. During the trial a TRL-controlled car and two TRL-cyclists were constantly using the junction to add realism to the trial.

The layout of the trial junction and the configuration of each of the arms of the junction are summarised below. The Puffin crossing is located on Arm D, 70 metres away from the junction. Participants crossed the Puffin crossing twice, first approaching with the LLCS facing them, then with the near-side pedestrian signals facing them. They then crossed at Arms C, B, A and D before crossing Arm C again. They then crossed the Puffin crossing another two times, giving nine observations, or "Runs", in total.

Participants encountered the crossings with one of three information sets:

- Traffic signals and LLCS red, pedestrian signals green (R-G);
- Traffic signals and LLCS green, pedestrian signals red (G-R);
- Traffic signals and LLCS red, pedestrian signals red (R-R);



Figure E-1 – Partially sighted pedestrian trial: trial location and walking route



| Arm    | Near-side    | Off-side     | Type of crossing     | Pedestrian signalised        |
|--------|--------------|--------------|----------------------|------------------------------|
|        | LLCS         | LLCS         |                      | crossing                     |
| Α      | $\checkmark$ | $\checkmark$ | At signal junction   | Opposite                     |
| В      | $\checkmark$ | $\checkmark$ | At signal junction   | Opposite                     |
| С      | $\checkmark$ |              | At signal junction   | No pedestrian signals        |
| D      | $\checkmark$ |              | At signal junction   | Opposite                     |
| Puffin | $\checkmark$ |              | Stand-alone crossing | Near-side pedestrian signals |

### Table E-1 – Partially sighted pedestrian trial: types of crossing

### Table E-2 – Partially sighted pedestrian trial: information sets<sup>3</sup>

|     |        | Participant         |     |         |     |     |         |     |        |       |   |         |
|-----|--------|---------------------|-----|---------|-----|-----|---------|-----|--------|-------|---|---------|
|     |        |                     | (   | Group 1 |     |     | Group 2 |     | Ģ      | Group | 3 | Group 4 |
| Run | Colour | Crossing            | 1   | 2       | 3   | 4   | 5       | 6   | 7      | 8     | 9 | 10      |
| 1   | Black  | Puffin (cycle side) | G-R | G-R     | G-R | R-G | R-G     | R-G |        |       |   |         |
| 2   | Red    | Puffin (ped side)   | R-G | R-G     | R-G | G-R | G-R     | G-R |        |       |   |         |
| 3   | Green  | Uncontrolled (C)    | G-x | G-x     | G-x | R-x | R-x     | R-x |        |       |   |         |
| 4   | Blue   | Controlled (B)      | R-R | R-R     | R-R | G-R | G-R     | G-R |        |       |   |         |
| 5   | Orange | Controlled (A)      | R-G | R-G     | R-G | R-G | R-G     | R-G | REPEAT |       |   | Т       |
| 6   | Purple | Controlled (D)      | G-R | G-R     | G-R | R-R | R-R     | R-R |        |       |   |         |
| 7   | Green  | Uncontrolled (C)    | R-x | R-x     | R-x | G-x | G-x     | G-x |        |       |   |         |
| 8   | Black  | Puffin (cycle side) | R-G | R-G     | R-G | G-R | G-R     | G-R |        |       |   |         |
| 9   | Red    | Puffin (ped side)   | G-R | G-R     | G-R | R-G | R-G     | R-G |        |       |   |         |

This appendix is structured as follows:

- Section E.1.2 summarise the participant characteristics.
- Section E.2.1 explores how they crossed the road.
- Sections E.2.2, E.2.3 and E.2.4 explore their interactions with the LLCS.

### E.1.2 Participant characteristics

Six men and four women took part in the trial. Ages ranged between 18 and 75+, with the most common age range being 45-54. The participants were all mobile, with some having minor physical impairments, such as mild arthritis.

The participants had a variety of sight loss; some could see almost nothing and others were able to see but had blind spots or tunnel vision. Details of each participant's sight loss are described below in Table E-3.

 $<sup>^{3}</sup>$  NOTE: on Arm C, there were no pedestrian signals and so this is denoted "G-x" or "R-x".



## Table E-3 – Partially sighted pedestrian trial: participant characteristics, typeand severity of sight loss

| Participant | Type and severity of sight loss   |
|-------------|---|
| 1           | Macular degeneration, central vision affected and strong sunlight makes the condition worse, requires contrast to see Likes to be accompanied on unfamiliar routes and finds it neither easy  |
|             | nor difficult to decide when to cross the road. Uses signs, sounds and can cross away from crossing points in areas with little street clutter.   |
| 2           | Usher's Syndrome, no night vision and tunnel vision during the day. Likes to be accompanied on unfamiliar routes and finds using signalised crossings easy. Uses the kerb edge as a guide and always waits for traffic to stop before crossing.   |
| 3           | Macular degeneration, has good peripheral vision but can't always see cars approaching. Able to negotiate unfamiliar streets and prefers to use pedestrian crossings.   |
| 4           | Retina degeneration, black spots on both eyes and blurry double vision; uses a guide dog.<br>Prefers to be accompanied on unfamiliar routes and finds crossing difficult, struggles to cross<br>roads without seeing a crossing facility close up.  |
| 5           | Rod and cone dystrophy with severe macular degeneration, no visual accuracy with limited colour; bright light makes the condition worse. Likes to be accompanied on unfamiliar routes and is generally capable of using crossing facilities. Uses cane, tactile paving, hearing and hands to understand crossing point.                                       |
| 6           | Right eye sight can be blurred depending on the light and also suffers from double vision. Able<br>to negotiate unfamiliar streets alone but finds it difficult to cross and does so cautiously as<br>eyesight cannot be trusted.   |
| 7           | Congenital nystagmus, can see reasonably well but cannot focus and dislikes crowded areas.<br>Does not go to unfamiliar places and can only use pedestrian crossings when crossing busy<br>roads; when doing so states that the Red Man is a 'red blob'.  |
| 8           | Keratoconus which means that depending on the light conditions details are hazy and can't pick<br>up information as quickly as other people. Usually uses a guide dog and often walks in London.<br>Is able to negotiate unfamiliar streets alone and can cross alone but sometimes find it difficult<br>when it is busy and in low light / rainy conditions. |
| 9           | Retinitis pigmentosa, can only see shadows, uses a cane and regularly walks in London. Prefers to be accompanied on unfamiliar routes, and uses signalised and other pedestrian crossing facilities as a guide to cross safely.   |
| 10          | Tunnel vision and night blindness. Able to negotiate unfamiliar streets alone but sometimes<br>misses street furniture. Finds using crossing facilities easy.   |

All participants walked regularly, and most walked more than five times a week. Four participants stated that they were able to negotiate unfamiliar streets themselves, the rest stated that they like to be accompanied on unfamiliar routes. Two of the participants walked in London more than twice a week.

When participants were asked how easy it is for them to decide when to cross normal roads (Figure E-2): one stated they found it easy to cross; four stated that they found it neither easy nor difficult; four stated that they found it difficult and one stated they found it very difficult. Participants suggested that crossing became easier when the crossing facilities were clearer and more obvious.

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Figure E-2 – Partially sighted pedestrian trial: participant characteristics, ease of crossing normal roads

### **E.2** Findings

### E.2.1 Crossing the road

The participants experienced three controlled crossings and one uncontrolled crossing at the junction, as well as a Puffin crossing. Generally the participants found negotiating the Puffin crossing easiest, the controlled crossings at the junction less easy and the uncontrolled crossing the most difficult. At all crossings there was very little mention of the Low Level Cycle Signals.

### E.2.1.1 Puffin

Most participants found this type of crossing easy to negotiate: two of the participants mentioned the LLCS when using this facility. Participant 3 stated that they were 'not for her'. When Participant 6 was making the first and fourth crossing the LLCS was mentioned as something that he looked at. Both showed the pedestrian signals on red, one was approached facing the LLCS and the other was approached facing the pedestrian signals. He stated that because there were no pedestrian signals on the other side of the road, he had to look for traffic lights. He did not mention the near-side pedestrian signals and he also did not use the LLCS in his decision to cross the road.

The participants reported little difference when arriving at the Puffin crossing facing the LLCS and arriving facing the pedestrian signals. Any differences mentioned were not associated with the Low Level Cycle signals. There was a difference between arriving at the junction with the Green Man already showing and arriving when the Red Man was showing: some stated that the crossing was more difficult to negotiate when the Green Man was showing. Many of these participants mentioned that they prefer to call their own green phase rather than cross on an existing green phase, so they can be sure that they will have the whole green phase to make the crossing.

Each participant had their own techniques for crossing and a number of visual and nonvisual cues were mentioned. These included tactile paving, road markings, the cone, the Red Man, the beeping and whether any cars were approaching. None stated that the LLCS formed part of this mix.

Participants were asked how easy they found deciding when to cross the road after each crossing. Most found this crossing the same or easier than to deciding when to cross a road generally.



### E.2.1.2 Uncontrolled (Arm C)

Each participant crossed Arm C twice, once with a red and once with a green traffic signal. Most participants found this crossing difficult to negotiate and one was unable to cross at all. The participants who did mention the LLCS were also the participants who looked for traffic signals in making the decision to cross. There was little difference between approaching the lights on green or red.

Participants 1, 2 and 3 mentioned seeing the LLCS lights and that they were for cyclists:

Participant 1 said: "I see some little light, below [the main lights], looks like [they are] for cyclists".

Participant 3 said: "...I've never seen one like this before. No, well it says cyclists. I think this is facing the wrong way round. To me, if I'm standing here you would not see that, would you? No."

They then stated that there was nothing to guide them across the junction, although they did use the main traffic lights to help make the decision. This suggests that the position of the LLCS gave a clear indication that they were not intended for pedestrians.

The second time they crossed Arm C, Participants 1 and 3 disregarded the cycle signals. Participant 3 felt the LLCS box, but then ignored them. Participant 2 did not mention the LLCS at all.

Participant 5 noticed the LLCS box, but did not know what it was; it was disregarded and did not form part of the decision to cross the road and did not cause confusion as she stated that there was no pedestrian box.

Participant 6 mentioned seeing the cycle signals on the second run but that it formed no part in the decision to cross the road.

Participant 8 did not cross the road independently; on the second run the LLCS were mentioned as part of the reason for not crossing. He saw green lights but no pedestrian signals and so did not cross. This suggests that he understood that the LLCS form part of the traffic signals.

Participants 4, 7, 9 and 10 did not mention the LLCS at all, also none of them mentioned using any kind of signal to help with the decision to cross. One stated that:

"[The dog brought me to the pole and] I found nothing"

### E.2.1.3 Controlled (Arm A,B,D)

The participants crossed arms A, B and D once each. Their understanding of when to cross at these controlled crossings was generally regarded as 'neither easy nor difficult' or 'difficult', similar to their attitudes to knowing when to cross roads generally. Many of the participants commented on the lack of beeping and no pedestrian signals on the other side of the road. There was one pertinent comment regarding the LLCS: one participant used them on Arm A to understand what the signals were showing for the cars.

### E.2.1.4 Overall

Almost all of the comments on the crossings were not relating to the LLCS. Where the LLCS were commented on, they were either disregarded or used as an extra piece of information to understand what the main signals were showing. Although there were



many negative comments, the crossings were regarded as similar to general crossings; some participants stated that the crossings they had experienced in the trial were like normal crossings.

### E.2.2 Noticing the LLCS

At the end of the guided walk, participants were told that the trial was about the LLCS and they were asked about their experiences from the trial. Most of the participants stated that they had noticed the LLCS. All of the participants, when given the opportunity for closer inspection, were able to make out the green of the cycle signal and nine out of ten could identify the cycle shape.

Participants 1, 2, 6 and 7 and 10 stated that they had noticed the signals, but ignored them as they were not for them. Participant 3 did not ignore the LLCS and said it impacted the decision to cross by providing her with an idea of what was happening on the rest of the junction. Participant 5 first noticed the LLCS on Arm C when he was looking for a push button that was not there, but stated that because it was facing the wrong way he did not pay any more attention to it.

Participants 4, 8 and 9 (two of whom were the guide dog users) did not notice the LLCS until they were pointed out to them after they had completed all of the crossings in the trial.

### E.2.3 Understanding the junction

All of the participants understood that either the LLCS were not for them or that they were explicitly for cyclists. None of the participants suggested that that they would consider crossing when the LLCS showed a green phase at any point on the trial. This did not vary for any of the types of crossing.

Some participants only mentioned the cycle signals when they were pointed out to them after they had completed all of the crossings. Some participants mentioned the cycle signals whilst making the crossings and stated that they were not relevant because of the cycle symbol or that they were facing the wrong way.

Each participant had a set routine and a set of clues which were cautiously used when interpreting the crossing and understanding when it was safe to cross; the LLCS did not appear to interfere with any of these routines. Where they did use the LLCS this was to augment the routine by providing an extra source of information.

Participants 4 and 5 noticed the LLCS box more than the actual signals and stated that they understood that because they were facing the road they were not relevant. Participant 5 went on to state that he would only use cues that he understood. Participants 1, 2 and 10 noticed the LLCS signals but understood they were not for them so did not use them. Participant 7 understood that they were not relevant. He stated that he '...sees the Green Man as a blob' but still understood that the LLCS were not for pedestrians, even when approaching the Puffin crossing and only being able to see the LLCS.

Participant 3 stated that the LLCS did impact the initial decision to cross by providing more information on the crossing, i.e., a green cycle symbol, which suggested that it was not safe to cross. Participant 6 used the traffic signals as a guide because of the lack of pedestrian signals on the other side of the road. On one occasion he also used the



LLCS for the same purpose, which suggests that he understood that they were associated with the main signals.

Participants 8 and 9 did not notice the LLCS until prompted; when using the crossings they both had set routines which were the focus of their understanding of the crossing. On Arm C, which had little to guide them, they still did not notice the LLCS.

### E.2.4 Attitudes towards the LLCS

The participants were generally ambivalent to the LLCS. The LLCS did not interfere with the crossing cues which were used by the participants. In the few instances the LLCS were used it was as part of the wider mix of cues, providing an extra source of information. The rest of the participants either did not use them or ignored them. Some participants mentioned using the main traffic signals as part of the mix of crossing cues.