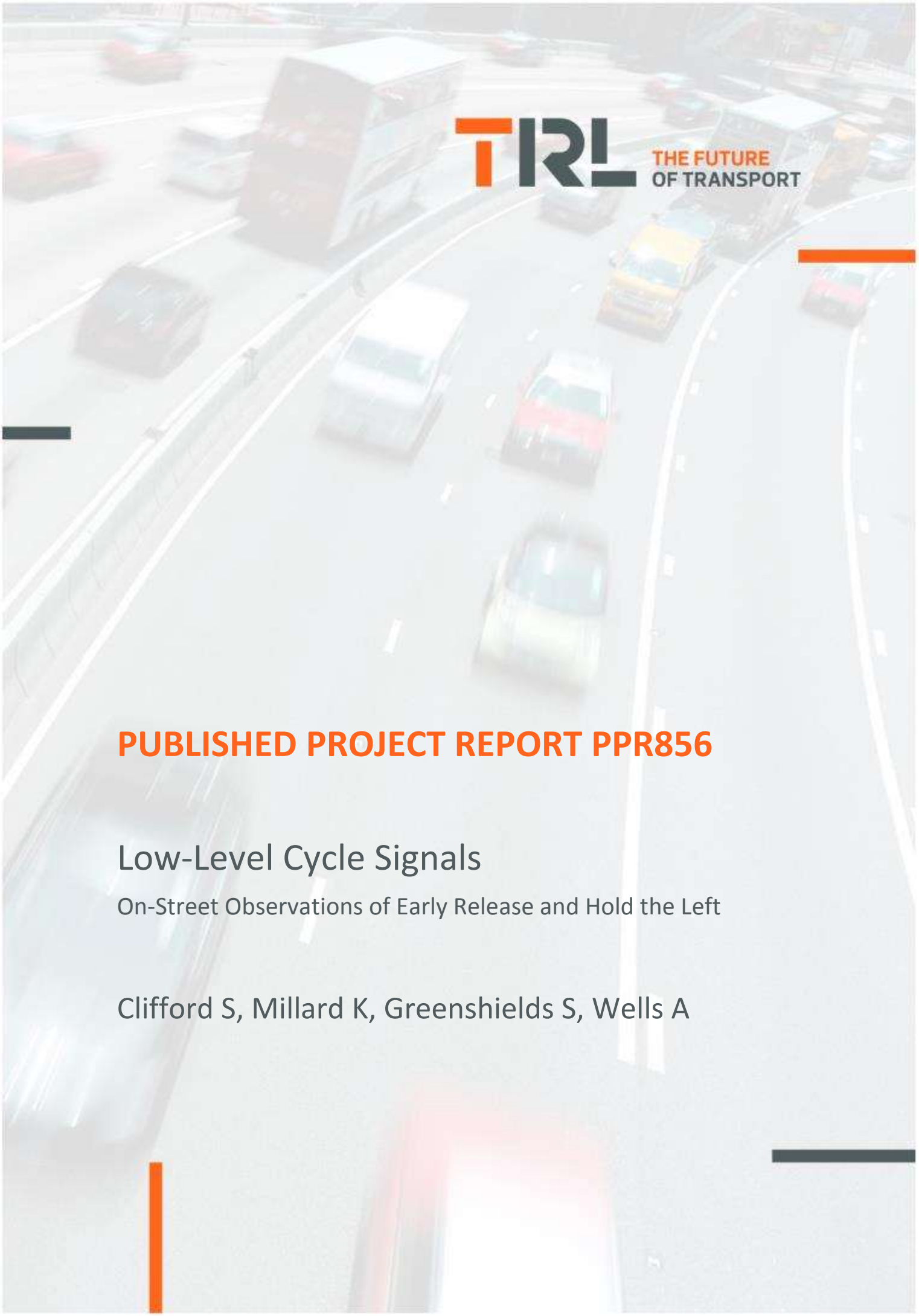

THE FUTURE OF TRANSPORT

PUBLISHED PROJECT REPORT PPR856

Low-Level Cycle Signals

On-Street Observations of Early Release and Hold the Left

Clifford S, Millard K, Greenshields S, Wells A

Report details

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1 Introduction

TfL is introducing innovative infrastructure for cyclists across the capital to improve safety and increase levels of cycling among all types of people in London.

The purpose of this report is principally to present the findings of research on two relatively new infrastructure innovations for cyclists 'Hold the Left' (HTL) and 'Early Release' (ER) that have been implemented at some signalised junctions. The work has also generated data on the use of two-stage turn facilities (2ST).

Research questions were agreed for each innovation. These required video surveys, to record natural human behaviour, complemented by questionnaires to better understand how users perceive these facilities.

Selection of monitoring locations was then agreed in order to address the questions most effectively and efficiently. These locations were as follows:

Location (junction)	**Approach**	**Cycle facilities**
Mile End Road / Burdett Road / Grove Road (CS2)	Mile End Road (eastbound)	HTL, 2ST
	Mile End Road (westbound)	HTL, 2ST
	Burdett Road (northbound)	ER, 2ST
	Grove Road (southbound)	ER, 2ST
Blackfriars Road / Webber Street (CS6 / Quietway 1)	Webber Street (eastbound)	ER
	Webber Street (westbound)	ER
Kennington Park Road / Kennington Road (CS7)	Kennington Park Road (NW- and NE-bound)	HTL
Brixton Road / Camberwell Road (link to CS7)	Brixton Road (northbound)	HTL

1.1 Description of each monitored junction

1.1.1 Mile End Road / Burdett Road / Grove Road

The general location of this junction is shown in Figure 1, and a more detailed junction drawing can be found in Appendix A.

Figure 1 Mile End Road / Burdett Road / Grove Road site

The junction is a 4-arm crossroad junction located in the London Borough of Tower Hamlets. Mile End Road (A11) is part of the Transport for London Road Network (TLRN), and runs along an east – west alignment from Bow Roundabout in the east to the boundary of the City of London at Aldgate to the west. Cycle Superhighway 2 runs the full length of the road and is for the most part segregated by physical kerbs. The entrance to Mile End Underground Station lies just to the east of the junction.

Mile End Road

- At the junction, Mile End Road has three general traffic lanes and a nearside cycle track in each direction. The nearside general traffic lane is a dedicated left-turn only lane, and is separately signalled.
- In both directions, the cycle track has a Hold the Left facility, separating ahead and left-turning cycles from left-turning general traffic.
- Two-stage right turn facilities are provided in both directions for cycles.
- The right turn from Mile End Road (eastbound) into Burdett Road is banned. Cycles can make this turn legally using the two-stage turn facility.

Burdett Road

- Burdett Road (A1205) forms the southern arm of the junction and is also part of the TLRN.
- At the junction, it has two general traffic lanes and a short section of nearside mandatory cycle lane, feeding into an Advanced Cycle Stop-line (ASL).

- Other cycle facilities comprise a 7.5m-deep ASL, low-level cycle signals enabling a four-second early release, and a two-stage right turn facility.
- The right turn is banned. Cycles can only make this turn legally using the two-stage turn facility.

Grove Road

- Grove Road (A1205) forms the northern arm of the junction and is part of the Borough Resilience Network.
- At the junction, it has three general traffic lanes and a short section of nearside mandatory cycle lane, feeding into an ASL.
- Other cycle facilities comprise a 7.5m-deep ASL, low-level cycle signals enabling a four- second early release, and a two-stage right turn facility.
- All movements are permitted at the junction.

1.1.2 Blackfriars Road / Webber Street

The general location of this junction is shown in Figure 2, and a more detailed junction drawing can be found in Appendix B.

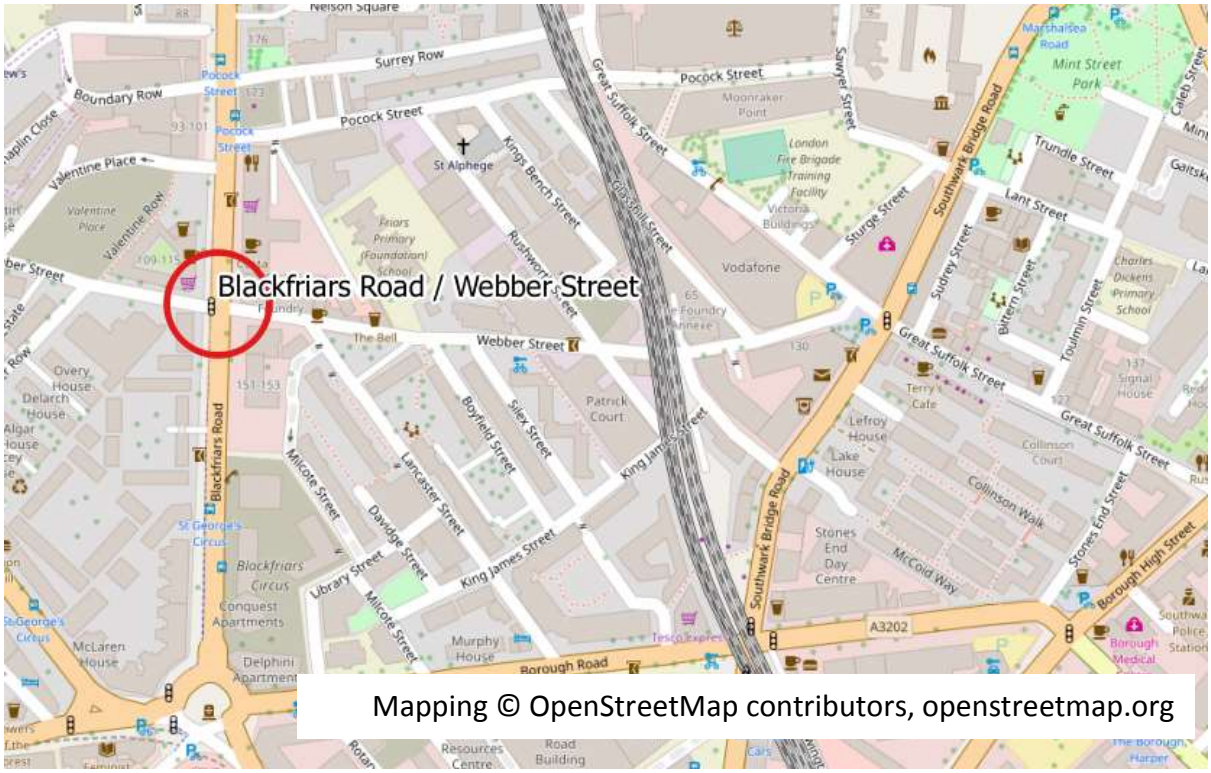


Figure 2 Blackfriars Road / Webber Street site

- The junction is a 4-arm crossroad junction located in the London Borough of Southwark. Blackfriars Road (A201) runs on a north-south alignment from St George's Circus to the south to Blackfriars Bridge to the north, and is part of the TLRN.
- Cycle Superhighway 6 runs along the west side of the road as a fully segregated bi-directional track.
- At the junction, Blackfriars Road (southbound) has a single lane approach with the right turn into Webber Street (westbound) prohibited.
- Blackfriars Road (northbound) has two general traffic lanes and a nearside two-way cycle track. The nearside general traffic lane is left-turn only and the offside lane is ahead only. The right turn is prohibited.
- Cyclists have their own signals, and are permitted to do make movements, with the turns into Webber Street eastbound from both the northbound and southbound directions undertaken in two stages.
- Webber Street is a on an east-west alignment, with a single lane in each direction, and is a borough road. Quietway 1 runs along the road.
- Cyclists on Webber Street in both directions have a 7.5m-deep ASL and an early release facility.

1.1.3 Kennington Park Road / Kennington Road

The general location of this junction is shown in Figure 3, and a more detailed junction drawing can be found in Appendix C.

Figure 3 Kennington Park Road / Kennington Road site

- The junction is a three-arm T-Junction located in the London Borough of Lambeth. Kennington Park Road (A3) is part of the TLRN and runs on a south-west to north east alignment. Cycle Superhighway 7 runs along its length as a stepped track on both sides of the carriageway.
- In the north east-bound direction, Kennington Park Road has three general traffic lanes on the approach to the junction, with a cycle track on the nearside, divided between left-turning and ahead cycle movement. The cycle movements are separately signalled. Two general traffic lanes are for turning left, with one for ahead movement. Both movements are separately signalled.
- In the south west-bound direction, Kennington Park Road has three general traffic lanes, all proceeding ahead, and a nearside bus lane. An ASL is provided ahead of the nearside bus lane.
- Kennington Road (A23), south east-bound, has two general traffic lanes, both turning right onto Kennington Park Road, and a nearside bus lane. An ASL is provided ahead of the nearside bus lane.

1.1.4 Brixton Road / Camberwell New Road

The general location of this junction is shown in Figure 4, and a more detailed junction drawing can be found in Appendix D.

Figure 4 Brixton Road / Camberwell Road

The Junction is a skewed four-arm junction in the London Borough of Lambeth. All four arms form part of the TLRN.

Brixton Road

- Brixton Road (A23) runs south to north and has two lanes in both directions. The right turn is prohibited in both directions and there is no facility provided for cyclists to turn right either.
- The southern approach has a segregated cycle facility with its own signal control and the left and ahead movements are also separately controlled. Cyclists proceeding northbound enter a stepped track that leads them towards Cycle Superhighway 7.
- The northern approach has two lanes of traffic and the cyclists receive an early release from the 7.5m ASL positioned ahead of the nearside lane.

Camberwell New Road

- Camberwell New Road (A202) runs south-east to north-west towards Oval where Cycle Superhighway 5 starts.
- The south-east approach consists of a nearside bus lane and an offside general traffic lane, both ahead only. An ASL is provided ahead of the nearside bus lane. Cyclists are permitted to turn right using the two stage turn facility.
- The north-west approach consists of a single general traffic lane, with the left turn being banned. An ASL is provided ahead of the general traffic lane. Cyclists can turn right using the two-stage turn facility.

2 Hold the Left (HTL)

At a signal-controlled junction, Hold the Left (HTL) provides a cycle lane (or fully segregated track) with its own traffic signals, typically separated from adjacent general traffic lanes by an island. The traffic signal stage is set up such that the green aspect for the ahead movement from the cycle lane and the green aspect for left-turning vehicle movements do not occur simultaneously. This reduces the risk of collisions between left-turning motor vehicles and cycles by separating these movements in time.

Where there is sufficient space, the cycle movements can be also be separated allowing non-conflicting cycle movement(s) to run in parallel with one or more traffic movement.

Three research questions were identified for Hold the Left facilities:

Cyclists:

- RQ4 – How do cyclists use the facility?
- RQ6 – Do cyclists receive enough green time?

Pedestrians

- RQ5 – How do pedestrians use the facility? (The pedestrian questionnaire is dealt with in section 2.3).

Table 1 HTL locations

	Location	Junction	Surveyed arms with Hold the Left Facility
1	CS7 (Oval) Kennington Park Road / Oval	Brixton Road / Camberwell New Road	Brixton Road
		Kennington Park Road / Kennington Road	Kennington Park Road
2	CS2 Mile End Road / Burdett Road	Mile End Road / Burdett Road / Grove Road	Mile End Road / Eastbound
			Mile End Road / Westbound

2.1 Operation of the Hold the Left at each location

2.1.1 Brixton Road (4-arm crossroads)

- The cycle movement runs together with the ahead general traffic movement, whilst the left-turning general traffic is held.
- The cycle movement is then held whilst the left-turn traffic receives a green signal. The ahead general traffic is also on green.
- The right turn for all traffic including cycles is prohibited.

2.1.2 Kennington Park Road (3-arm T-junction)

There are two separately controlled cycle movements, ahead and left:

- The ahead cycles run in parallel with the ahead general traffic. Both left-turning movements are held
- The left-turning movements (cycles and general traffic) run in parallel. Both ahead movements are held.

Note that if there is no pedestrian demand, then the left-turning cyclists will also receive a green signal at the same time as the ahead traffic movements.

2.1.3 Mile End Road / Burdett Road (4-arm crossroads)

Eastbound Approach

- All movements from the cycle track run in parallel with the ahead general traffic movement. The left turn is held for general traffic.

- Movement from the cycle track is held while the left turn for general traffic receives green. The ahead movement for general traffic is also on green.

The right turn for all traffic is prohibited, but cyclists can undertake this in two stages.

Westbound approach

- All movements from the cycle track run in parallel with the ahead and right turn movement for general traffic. The left turn for general traffic is held.
- Movement from the cycle track is held while the left turn for general traffic receives green. The ahead movement for general traffic is also on green.

Cyclists are not permitted to turn right from the cycle track, but can undertake this using the two-stage right turn.

2.2 HTL Research Question 4 – How do cyclists use the facility?

2.2.1 Description

To understand how cyclists use the facility the question was broken down into separate parts as follows:

At each arm of the junction with HTL, how many cyclists proceed into the junction:

- at cycle stop line, on cycle green?
- at cycle stop line, on cycle red?
- at general traffic stop line, on green?
- at general traffic stop line, on red ?

And additionally for the Burdett Road / Mile End Road / Grove Road junction, but not the Kennington Park Road sites:

- from the 2ST waiting area, having arrived from the adjacent arm?
- from the 2ST waiting area, having passed through either the cycle stop line or general traffic stop line on red?

At each cycle and general traffic signal aspect what is the breakdown (for all sites) of the above by:

- cyclists turning left?
- cyclists proceeding ahead?
- cyclists turning right in a single stage?
- cyclists turning right in two stages (Burdett Road / Mile End Road / Grove Road only)?

2.2.2 Methodology

This research question was investigated using video surveys of each Hold the Left arm at the relevant location and junction, capturing a week's worth of video recordings. Multiple video camera angles were used to ensure that the research question could be adequately answered, with a minimum of two video cameras per arm.

The sample size was obtained using the first 2 signal cycles of each hour for 14 hours each day (7am start), giving a sample of 196 signal cycles, split evenly across both arms. This was achieved through reviewing alternate hours' video output for each arm at each junction.

2.2.3 2.2.3 Findings

2.2.3.1 2.2.3.1 General overview

The sample of cyclist observations at each site is indicated in Table 2.

Table 2 Sample size

Site	Number of observations
Mile End Eastbound	375
Mile End Westbound	335
Brixton Road	424
Kennington Park Road	770

The higher number of cyclists at Kennington Park Road, in comparison with Mile End Road eastbound, Mile End Road westbound and Brixton Road should be taken into consideration when observing the results within section 2.2.3.

Not all cyclists used the HTL facility; some entered the junction from the general traffic stop line, i.e. in the adjacent traffic lane. The proportion of cyclists proceeding into the junction from the cycle stop line compared to the general traffic stop line is shown in Table 3, with the actual numbers of cyclists also indicated.

Table 3 Proportion of cyclists proceeding into the junction at HTL junctions

HTL junction	Cyclists using cycle track	Cyclists using general traffic lane	Percentage of cyclists using cycle track
CS2 Mile End e/b	323	52	86%
CS2 Mile End w/b	285	50	85%
CS7 Brixton Rd	355	69	84%
CS7 Kennington Park Rd	764	6	99%

The vast majority of cyclists proceeded from the cycle stop line at all sites, ranging from 84% at Brixton Road to 99% at Kennington Park Road. The reason for this is likely to be a

combination of cyclists being directed, by design, into the segregated cycle lane upstream of the junction, and the operation of the junction itself.

2.2.3.2 Proceeding on red vs green signals

Of those cyclists who proceeded from the cycle stop line, the lowest proportion proceeding on green was observed on Mile End Road travelling eastbound (77%) with slightly more proceeding on green travelling westbound (83%). Kennington Park Road had the highest compliance with the traffic signals at 92% followed by Brixton Road (88%). Further details can be seen in Table 4.

The direction of cyclists passing through red at the cycle stop line was predominately straight ahead (64%) and then left (33%) with the very few turning right or using the two stage right turn. Although actual numbers are small (29 in the total sample), the direction of cyclists passing through red at the general traffic lane was 86% straight ahead, 14% left, with no observations for right turn or turning via the two stage turn. The data does not provide information regarding the duration of time after the signal has changed to red that a cyclist passed through.

Table 4 Cyclist compliance with green signals from the cycle track and carriageway

HTL junction	Compliant with green via cycle track	Proportion of cycle track cyclists	Compliant with green via carriageway	Proportion of carriageway cyclists
CS2 Mile End e/b	248	77%	48	92%
CS2 Mile End w/b	236	83%	41	82%
CS7 Brixton Rd	312	88%	54	78%
CS7 Kennington Park Rd	702	92%	5	83%

Of those cyclists who proceeded into the junction from the general traffic stop line, compliance with the signals ranged from 78% at Brixton Road to 92% at Kennington Park Road, the latter also being the site with the highest percentage utilising the cycle track. Compliance with the signals by those using the cycle track was higher than compliance by those using the general traffic stop line at three of the four sites. Mile End Road eastbound however has a higher compliance for cyclists using the road than those using the cycle track (92% to 77%).

2.2.3.3 How cyclists are using the facility

The site with the highest figures for use of the facility and compliance is at Kennington Park Road. At this location the method of control is such that the cycle movement operates in parallel with its corresponding vehicle movement. Together with the segregation starting well in advance of the junction, the cyclists receive the same benefit from being in the cycle track in terms of traffic signal timings, but also the additional benefit from being physically segregated from motor vehicles.

At the other locations the segregation starts much closer to the junction, which means that cyclists can make the choice of whether to use the segregated facility and the Hold the Left much closer to the junction, based upon which movement is receiving a green signal.

Summary:

- Use of the segregated track ranged from 84% to 99% across the four sites.
- Compliance of cyclists using the segregated track with traffic signals is higher at 3 of the 4 locations than that of cyclists using the main carriageway.
- The highest level of use of the cycle track is at the location where cyclists are directed by design into the segregated track in advance of the junction and signal timings through the junction are the same as for those using the general traffic lane.

2.2.3.4 Variations in direction of travel

At each site the predominant movement that cyclists undertake from both the cycle lane and traffic lane is ahead. CS2 at Mile End Road is on an east-west alignment and hence caters for this dominant movement.

However, at Kennington Park Road, CS7 continues ahead to the City of London, but the left turn is also popular for cyclists wishing to proceed toward the City of Westminster, and the junction layout has been designed to cater for this fairly even split in cycle flows.

Brixton Road is upstream from Kennington Park Road and the ahead cyclists continue on the cycle route towards Kennington Park Road. The left-turning cyclists continue towards the start of CS5.

The direction of travel from the general traffic lane mirrors the movements from the cycle lane, although reflecting the lower numbers of cyclists using the general traffic lane, with the exception of the right-turning movement at Mile End Road (see) Figure 6. It is also notable that no cyclists turned left at Mile End Road (westbound) from the general traffic lane.

The very low numbers of cyclists using the general traffic lane at Kennington Park Road is because the cycle movement runs in parallel with the corresponding traffic movement so there is no benefit of moving into the traffic lane.

The right turn behaviour at Mile End Road is covered in more detail in section 3.4.

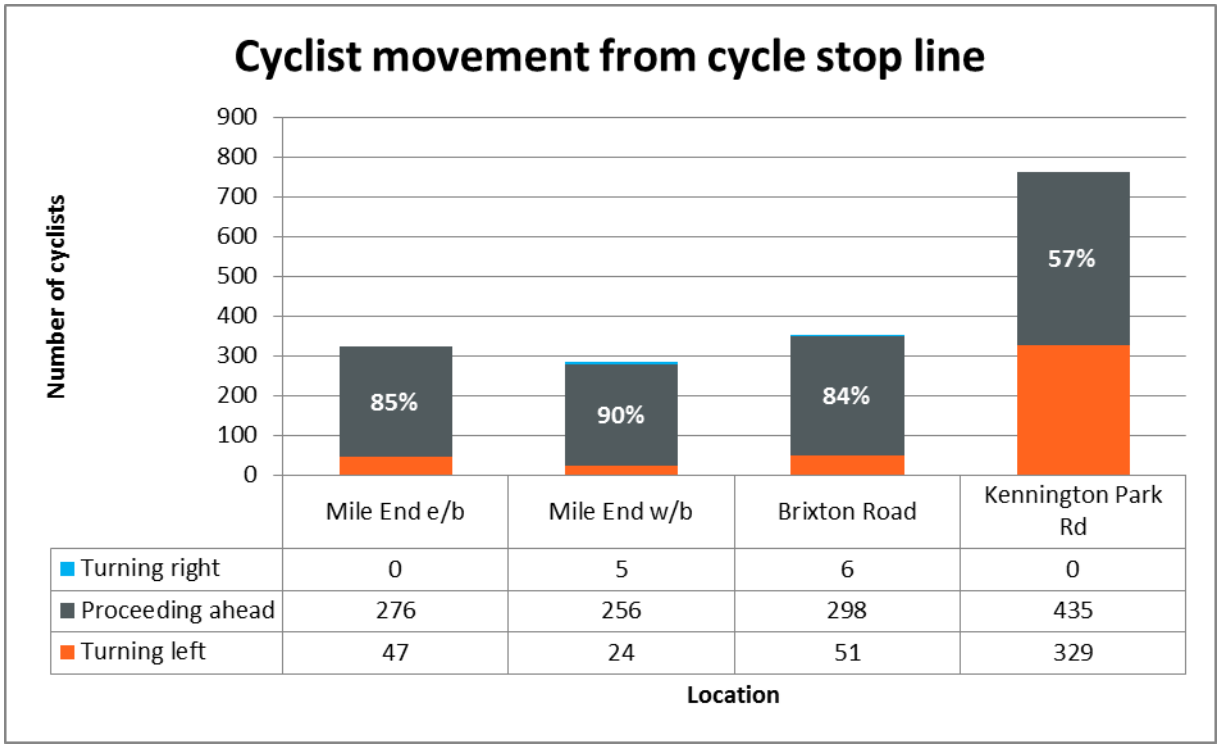


Figure 5 Directional movement of cycles from the cycle stop line

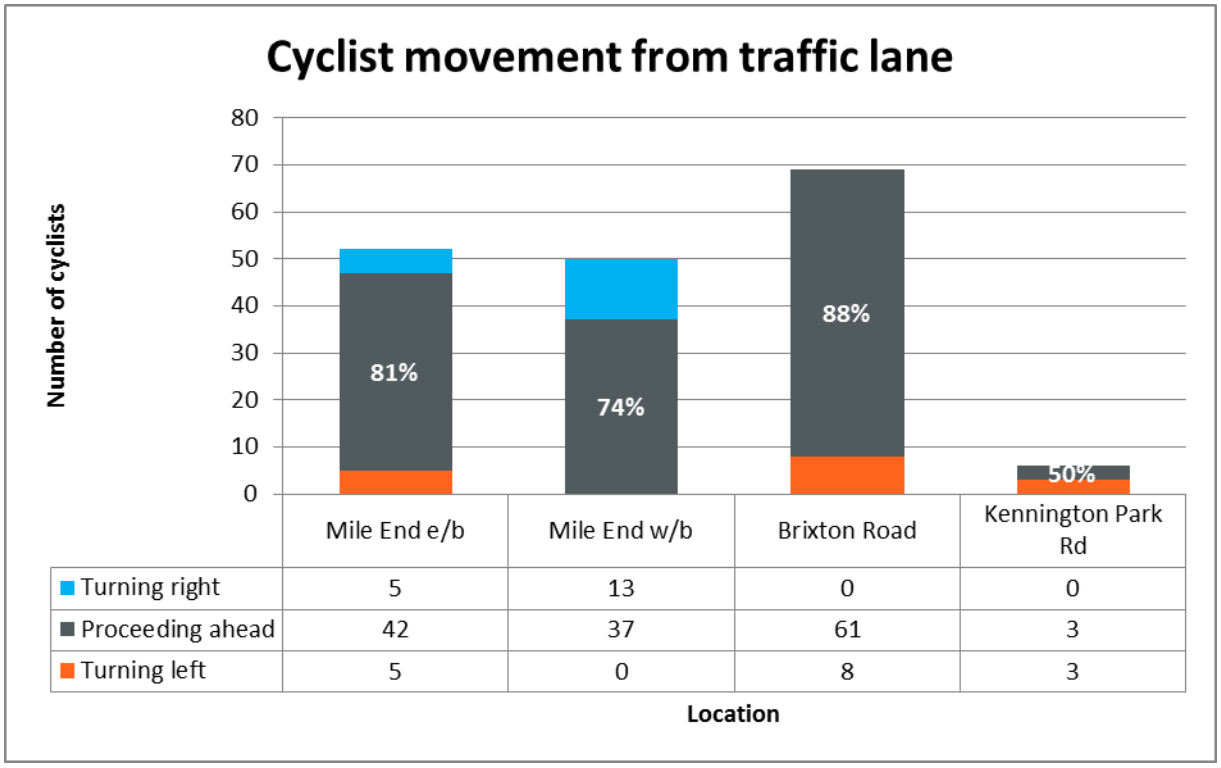


Figure 6 Directional movement of cyclists from the general traffic lanes

2.3 HTL Research Question 5 - How do pedestrians behave with the HTL layout?

2.3.1 Methodology

A pedestrian-only survey with 100 pedestrian participants was carried out for the Burdett Road/Mile End Road/Grove Road site, to address the following questions about the impact of cycle signal infrastructure on pedestrian crossing behaviour:

- Which crossing(s) did pedestrians use / where did they cross informally?
- How comfortable did pedestrians find it to cross?
- What information did pedestrians use when crossing? (i.e. what signal were they looking at?)
- How frequently did these pedestrians use the junction?

A map of the Burdett Road/Mile End Road/Grove Road site can be seen in Figure 7 below:

- Survey point HTL1 was on the western arm of the junction, on the northern footway of Mile End Road, capturing people using the pedestrian crossing next to the eastbound hold-the-left facility.
- HTL2 and HTL3 were both on the eastern arm of the junction, capturing pedestrians using the crossing next to the westbound hold-the-left facility. HTL2 was on the pedestrian refuge between the two parts of the staggered pedestrian crossing, and HTL3 was on the southern footway, at the other end of the same crossing.

Note that a wider area map is shown in Figure 1.

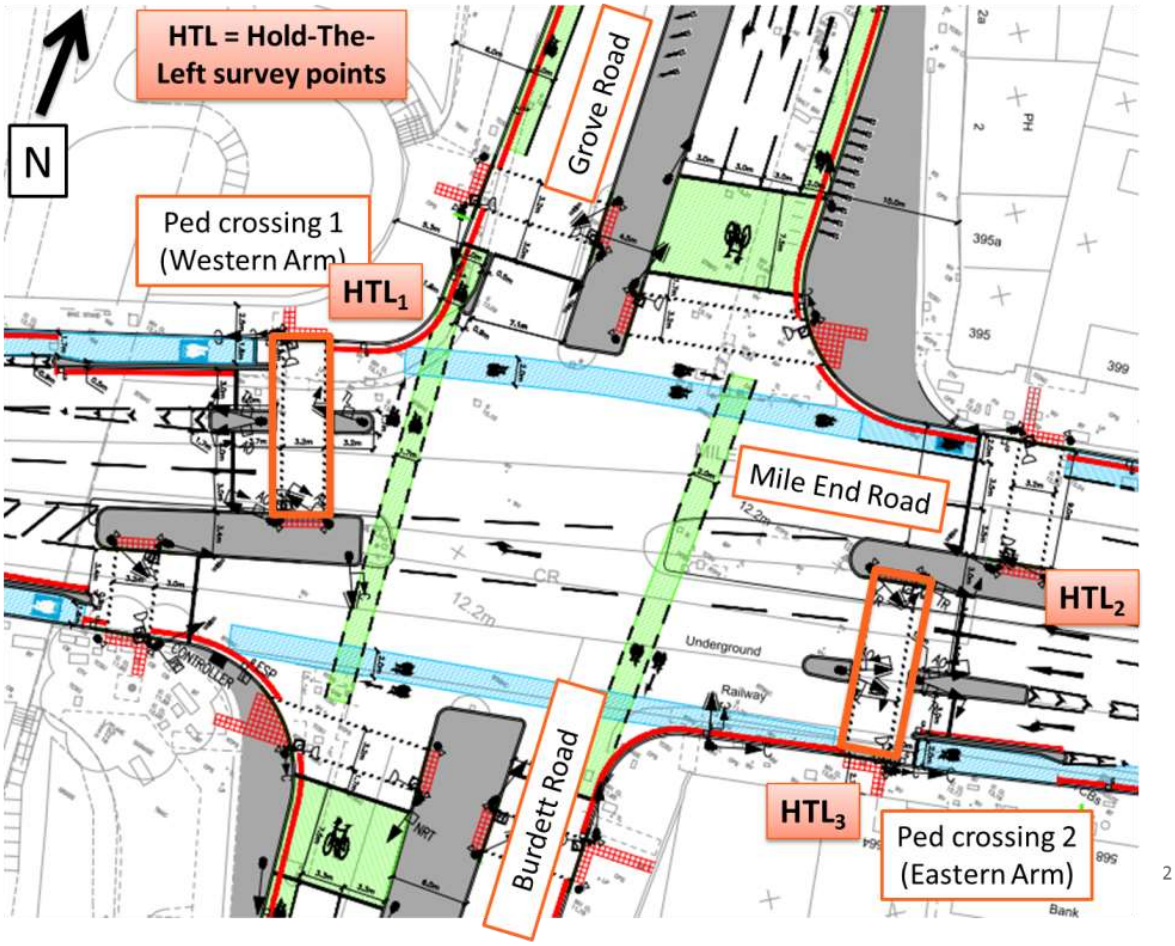


Figure 7 Burdett Road/Mile End Road/Grove Road survey locations

2.3.2 Which crossing(s) did pedestrians use?

Questionnaires were split across pedestrians using the crossings in each direction. At the 'HTL1' and 'HTL3' survey points, a total of 75 pedestrians were surveyed after they had crossed the road from the central island to the main footway. At the 'HTL2' survey point, a total of 25 pedestrians were surveyed after they had crossed from the main footway to the central island. This is indicated in Table 5.

Table 5 Number of pedestrians surveyed at each HTL survey point

Survey point		Sample size
Eastern Arm	Footway to island	25
Eastern Arm	Island to footway	25
Western Arm	Island to footway	50

2.3.3 How comfortable did pedestrians find it to cross?

Respondents were asked how confident or uncertain they felt about crossing here as a proxy for comfort (see Figure 8). Overall only 54% of respondents were either confident or very confident, whilst 29% indicated that they were uncertain or very uncertain. Uncertainty

was higher at the HTL2 and HTL3 sites (36% and 40% respectively). Participants at these HTL sites showed higher levels of uncertainty when crossing than those who were crossing at ER sites (where overall confidence was 77%).

Two key perceptions can be picked out from comments by respondents who indicated they were uncertain or very uncertain about this junction layout:

- It is dangerous/unsafe; and
- There is a lot going on which makes it confusing.

Some examples of comments relating to these perceptions are:

> *"Since new lights, terribly confusing for pedestrians, lots of local people say the same. Much less safe than before. ~Dangerous. Timings in other parts of the junction are rubbish."*
>
> *"Dangerous, especially when traffic stopped, don't know what's going on. You think it's safe but it's not."*
>
> *"Dangerous, people don't check cycle lane, only pay attention to cars."*
>
> *"Since light, traffic is red and pedestrian is also red, this results in crossing on red. The pedestrian lights take too long to turn green, people take risks."*
>
> *"Bit scary, too many lights."*
>
> *"Very confusing when 1st light is red for traffic and it looks safe to cross. This is first and last time I'll use this crossing."*
>
> *"Confusing- different lanes go at different times, don't know when to cross, confusing as a driver too."*
>
> *"Over complicated, 3 mins waiting to cross road to get to Co-op, frustrated. Can't be bothered to go because it takes so long with all the crossings at the junction."*
>
> *"Takes forever to cross. People I know from work(University) will go to Stepney Green to avoid using this junction."*

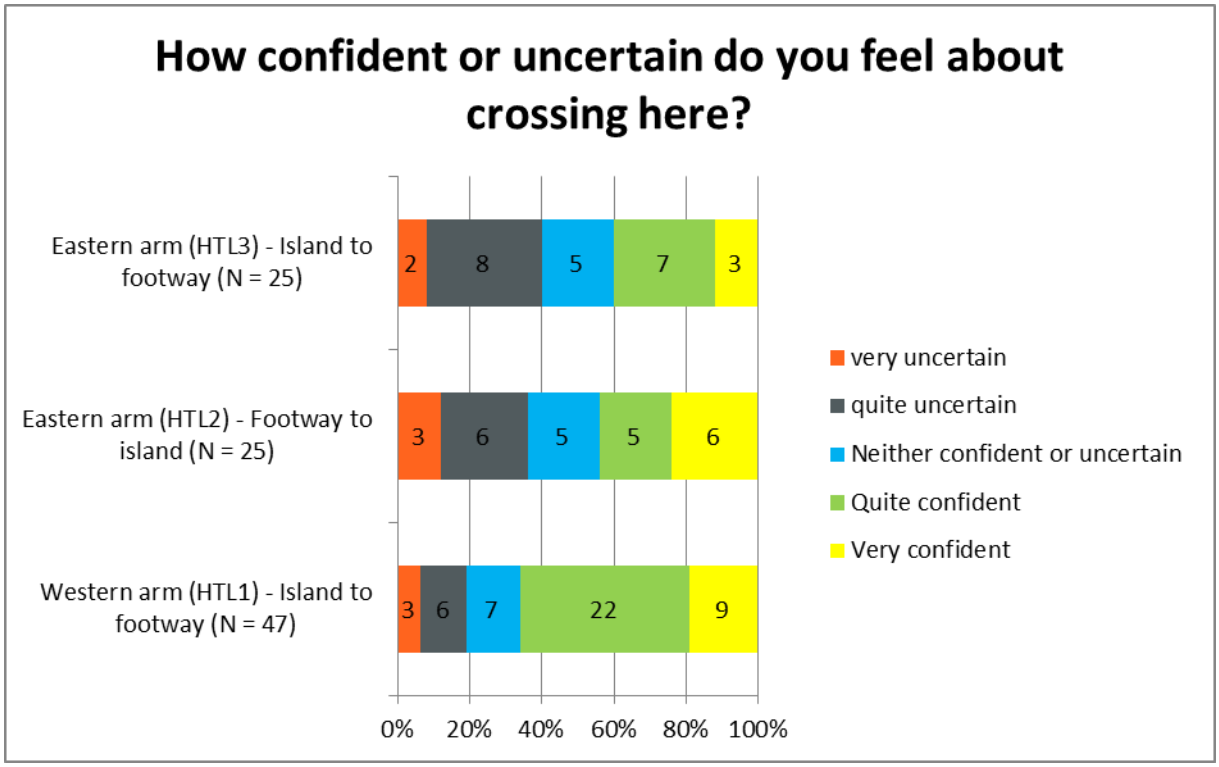


Figure 8 Pedestrian confidence when crossing at HTL crossings (N=97)

Pedestrians were asked to think about the last time they had crossed the road at the survey site, and indicate whether they crossed to/from the central island in a single movement. Three responses were removed, of these two pedestrians indicated that they didn't know and one pedestrian did not provide a response. The proportion of responses given by the remaining 97 pedestrians is shown in Table 6. As shown in this table, about 70% of pedestrians who had just crossed from the island to the footway reported that they had done so in a single movement, and about 30% reported that they stopped between the left-turning and straight-on traffic lanes. However, a chi-square test of independence showed that these differences were not statistically significant, that is, the reported crossing behaviour of pedestrians was not influenced by the direction of crossing.

Table 6 Proportion of responses from 97 pedestrians to question "Did you cross to/from the central island in one movement?"

	Crossing from Footway	Crossing from island
Yes	58%	71%
No, stopped on splitter island	42%	29%

2.3.4 What information did pedestrians use when crossing?

Pedestrians were asked a series of questions to ascertain the extent to which they looked at traffic signals in the junction and other road users behaviour to inform them when to cross the road.

The questions related to traffic signals were:

- "Did you look at the pedestrian traffic lights before crossing?"
- "Did you look at the vehicle traffic lights before crossing?"
- "Did you look at the cycle traffic lights before crossing?"

Responses were multiple-choice; the proportion of responses to each of these questions is shown in Figure 9 below.

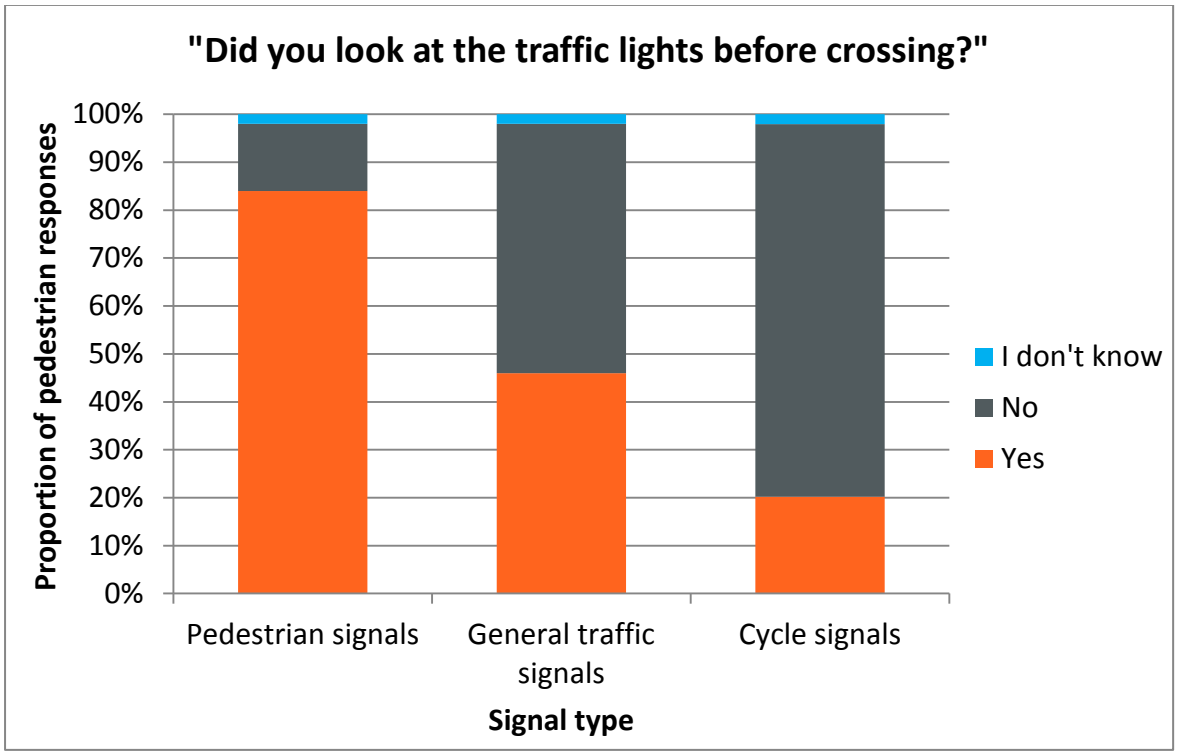


Figure 9 Pedestrians' stated observation of signals when deciding to cross at HTL junctions

The question relating to observation other road users' behaviour was: "Did you look at traffic in the road before crossing?". The available multiple choice answers were:

- Yes, I checked that all motor vehicles and cyclists were stopped before crossing
- Yes, I checked that motor vehicles were stopped before crossing
- Yes, I checked there was a sufficient gap between moving vehicles / cyclists before crossing
- Yes, but I am not sure what the cyclists were doing
- No, I just looked at the traffic lights

The results of this question are shown in Table 7

Table 7 Did you look at traffic in the road before crossing?

Q5: Did you look at traffic in the road before crossing?	Number of respondents
Yes, I checked that all motor vehicles and cyclists were stopped before crossing	52
Yes, I checked that motor vehicles were stopped before crossing	8
Yes, I checked there was a sufficient gap between moving vehicles / cyclists before crossing	34
Yes, but I am not sure what the cyclists were doing	1
No, I just looked at the traffic lights	5

The majority of pedestrians (86%) indicated that they either checked that all vehicles and cyclists were stopped (52%) or that they checked that there was a sufficient gap in moving vehicle / cyclists to allow safe crossing (34%). About 8% of pedestrians indicated that they checked motor vehicles were stopped.

This suggests that the most important piece of information that the pedestrians rely on when making the decision to cross the road is the pedestrian signals. The pedestrians do however take in other information, such as what the other signals are displaying, and what the traffic/cyclists are doing.

2.3.5 Does HTL encourage pedestrians to cross when they see cyclists held at a red signal (but general traffic is allowed to turn left)?

As a result of the signal set-up at the HTL facility, there is potential for pedestrians using the crossing to observe a red LLCS signal (for cyclists) and incorrectly perceive that ALL traffic is stopped at red when in fact vehicles in the left-turn lane have a green light to proceed.

The pedestrian survey results provide insight into the propensity that this perceptual error may occur. As shown in Figure 9, 20% of pedestrians who were surveyed indicated that they looked at the cycle lights; this sample therefore represents the proportion of people who might be at risk of making the perceptual error.

These pedestrians would be at risk of making the error if they:

a) Did not look at the vehicle traffic lights, and;

b) Did not look at the pedestrian traffic lights, or crossed on the red man.

It is important to note that pedestrians that have made this perceptual error would not necessarily act on it if they also checked the traffic before starting to cross.

Only two pedestrians met these criteria; one of these respondents indicated that they checked all motor vehicles and cyclists were stopped before crossing, and the other indicated that they checked there was a sufficient gap between moving vehicles / cyclists before crossing. As such, they were unlikely to have crossed the road in response to the red LLCS signal; it may therefore be concluded that none of 100 pedestrians who were surveyed at the HTL facility showed evidence for making the perceptual error.

Summary:

- Pedestrians rely most on the pedestrian signals
- Other information is taken to make a judgement to cross the road
- The pedestrians surveyed did not show evidence of making a perceptual error of assuming that all traffic will stop when straight ahead vehicles are signalled red.

2.3.6 How frequently did these pedestrians use the junction?

As can be seen in Table 8, most users of the crossings are frequent users, however a fair proportion of them use the crossing infrequently which suggests that the crossing should be designed to be intuitive to all users.

Table 8 How frequently pedestrians use the junction in a week

Pedestrian response	Number of respondents
5 or more times per week	51
3 or 4 times per week	8
Once or twice per week	17
Less than once per week	4
Less than once per month	10
This is the first time	10

2.3.7 Hold the Left Pedestrian Survey Conclusions

The objective of the pedestrian-only survey carried out for the Burdett Road/Mile End Road/Grove Road site, was to address a number of questions about the impact of cycle signal infrastructure on pedestrian crossing behaviour. In summary, each of these questions is addressed below.

- How comfortable did pedestrians find it to cross? - The majority of the sample, 71% (with 95% confidence level that the percentage of the population who would select this answer lies within the confidence interval 62.1% -- 80.2%.), reported that they did not feel unconfident using the crossing at the junction.
- **Which crossing(s) did pedestrians use / where did they cross informally?** - 60 to 70% of pedestrians who had just crossed between the island and the footway reported that they had done so in a single movement.

The responses to the question “What information did pedestrians use when crossing? (i.e. what signal were they looking at?)” are given below:

- 100% looked at either that the traffic is stopped, sufficient gaps in the traffic, or the traffic lights before crossing.
- 86% of pedestrians looked at the green/red figures before crossing.
- 57% of pedestrians reported that they crossed when the ‘green man’ was shown
- 46% looked at the vehicle traffic lights.

- Only 20% of pedestrians reported that they looked at the cycle traffic lights before crossing.

Research Question 5 also asked 'does HTL encourage pedestrians to cross when they see cyclists held at a red signal (but general traffic is allowed to turn left)? Based on the analysis of the questionnaire response, it may be concluded that none of 100 pedestrians who were surveyed at the HTL facility showed evidence for making the perceptual error.

2.4 HTL Research Question 6 – Do cyclists receive enough green time?

2.4.1 Description

The research question asks, on what proportion of signal cycles does the cycle lane/track fail to clear of cyclists who were wheel-stopped before it turned green? The purpose of this is to understand if there is always enough green time to allow all queuing cyclists through. In this instance, a cyclist is considered to have proceeded into the junction if they have passed the first set of pedestrian stud markings at the crossing.

2.4.2 Methodology

This research question was investigated using video survey of each Hold the Left arm at the relevant location and junction, capturing a week's worth of video. Multiple video camera angles were used to ensure that the research question could be adequately answered, with a minimum of two video cameras per arm.

For video extraction and analysis purposes, the question was broken down into separate cycle and motor vehicle components.

The sample size was obtained using the first 3 signal cycles of each hour for 14 hours each day (7am start), giving a sample of 294 signal cycles. This was achieved through reviewing alternate hours' video output for each arm at each junction.

The same junctions and approaches were used as per the Hold the Left Questions.

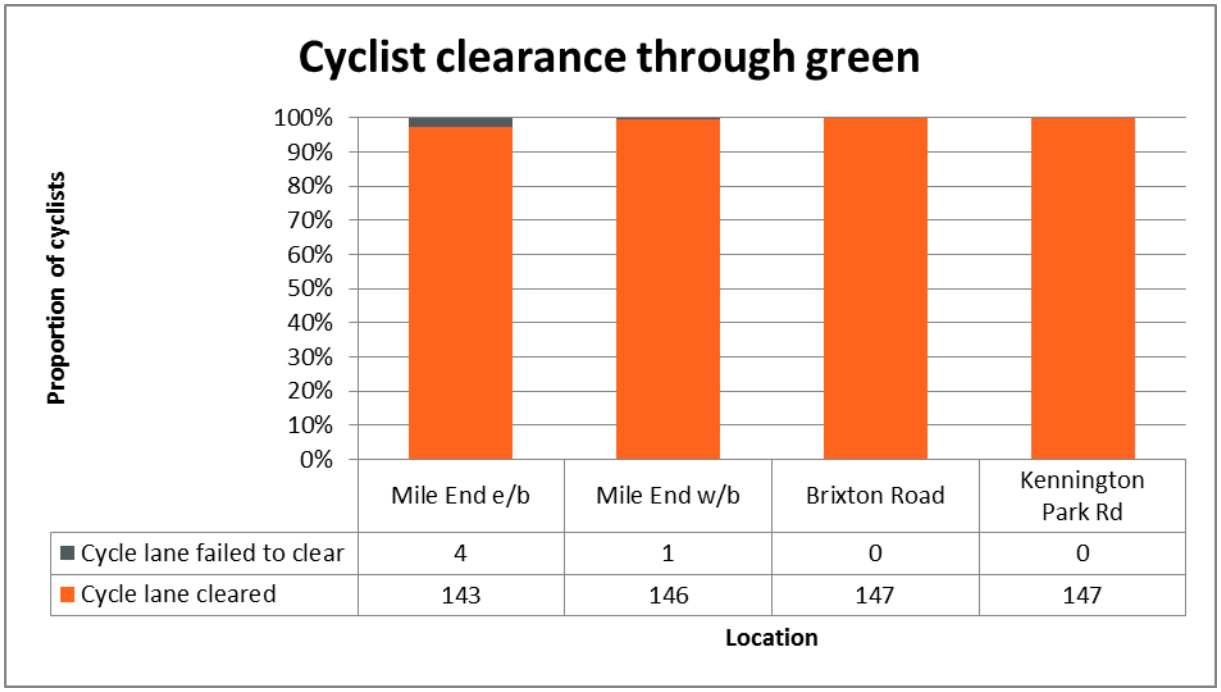


Figure 10 Proportion of cyclists clearing through the green timing length

As shown in Figure 10 during the period of observation, all cyclists got through the signal cycles at Brixton Road and Kennington Park Road. This was also the case for almost all cyclists at Mile End Road eastbound (in 3% of signal cycles, the cycle lane/track failed to clear) and at Mile End Road westbound (in 1% of cycles, the cycle lane/track failed to clear).

In the small number of cases where the cycle lane/track failed to clear at Mile End Road, the observations showed that this was due to cyclists using the cycle lane as a stopping place rather than there being insufficient capacity in the cycle lane, for example cyclists stopped because they were on their phone, or waiting for a friend to return from the shops. In one case, where one cyclist stopped and caused a queue, other cyclists behind were observed to form a second lane in order to overtake.

2.4.3 Conclusions/Summary

At all the sites, the cycle lanes remained clear, even with the large numbers of cyclists at Kennington Road and therefore the cycle signal phases are sufficiently long for the observed cycle flows.

Any observations of cyclists stopping were related to behaviour rather than the signals or capacity of the cycle lane.

3 Early Release (ER)

3.1 About Early Release

Early release (ER) provides a separate set of traffic signals for cyclists along with an Advanced Cycle Stop-line (ASL) and lead-in cycle lane. The cycle signals display a green aspect a number of seconds in advance of the green aspect signal for vehicles. This allows cyclists to proceed into a junction in advance of other waiting vehicles, and for the cyclists to clear the left turn conflict point. The locations of the trial sites are shown in **Table 9** below.

Table 9 Early Release trial site locations

	Location	Junction	Surveyed arms with Early Release Facility
1	CS6 – Blackfriars Road / Webber Street (QW1)	Webber Street / Blackfriars Road	Webber Street eastbound
			Webber Street westbound
2	CS2 Mile End Road / Burdett Road	Mile End Road / Burdett Road / Grove Road	Mile End Road / eastbound
			Mile End Road / westbound

Operation of the early release.

- At all four approaches the cyclists receive an early release of four seconds before the general traffic signal receives a green. At both locations, the early release is indicated using a low level cycle signal mounted at the cyclists' eye-height, underneath the general traffic signal.
- At all approaches apart from Webber Street westbound, there is also a single aspect cycle filter mounted on the far-sided secondary signal, which also indicates the four second early release.

3.2 ER Research Question 1 – Movement of cyclists through the Early Release junction

3.2.1 Research question description

For RQ1, the following questions were investigated:

[a] When the early release cycle signal shows, how many of the cyclists waiting at the stop line:

- are able to proceed ahead of general traffic?
- are not able to make use of the early release because they are queuing behind other cyclists?
- wait for the green for general traffic / appear not to notice the early release?

What is the breakdown of the above by signal cycles in which:

- the first waiting motor vehicle had encroached into the ASL waiting area by 2.5 metres or more?
- the ASL waiting area was entirely or mostly clear (i.e. at least 5.0 metres' depth is available)?

[b] On what proportion of the signal cycles does the first motor vehicle waiting at the stop line proceed:

- on the cycle early release, when a cyclist is also present?
- on the cycle early release, when there is no cyclist present?
- on the starting amber for general traffic?
- on the green for general traffic

This used a similar methodology as the off-street trials of Early Release that TRL has previously conducted for TfL[1].

3.2.2 Methodology

This research question was investigated using video observations of each early release arm at the relevant location and junction, capturing a week's worth of video. Multiple video camera angles were used to ensure that the research question could be adequately answered, with a minimum of two video cameras per arm.

For video extraction and analysis purposes, the question was broken down in to cycle [a] and motor vehicle [b] components.

The sample size was obtained using the first 2 signal cycles of each hour for 14 hours each day (7am start), giving a sample of 196, split evenly across both arms. This was achieved through reviewing alternate hours' video output for each arm at each junction. During a small number of signal cycles, 'no vehicle in lane' was recorded. These signal cycles have been excluded from the results.

3.2.3 Findings

3.2.3.1 Q1[a] cyclist behaviour

The cyclist response to early release is indicated in Table 10. Note that the sample size for each site is 196 signal cycles.

[1] Ball et al, 2015. PPR733 - Low level cycle signals with an early release - track trial report. TRL

Table 10 Cyclist action upon amber and green signal changes

Location	Cyclists able to proceed ahead of general traffic	Cyclists not able to use early release due to queuing behind other cyclists	Cyclists waited for traffic green or did not notice the early release	Total observed
Burdett Rd	155 (97%)	1 (0.6%)	4 (2.5%)	160
Grove Rd	132 (81%)	0 (0%)	31 (19%)	163
Webber St e/b	139 (85%)	0 (0%)	24 (15%)	163
Webber St w/b	121 (90%)	4 (3%)	9 (7%)	134

The majority of cyclists were able to proceed ahead of general traffic when the early release (ER) signal changed to amber or green (shown in Table 10). Burdett Road had the highest proportion at 97% (155 of 160) whilst Grove Road had the lowest at 81% (132 of 163).

No cyclists at Grove Road or Webber Street eastbound were unable to make use of the early release as a result of queuing behind other cyclists and only 0.6% (1 of 160) of cyclists at Burdett Road and 3% (4 of 134) of cyclists at Webber Street westbound experienced this. The one instance on Burdett Road was because the front cyclist noticed the ER late, holding up the cyclists behind.

At Grove Road and Webber Street eastbound there were higher proportions of cyclists who did not take advantage of the ER (i.e. they waited for the green signal for general traffic or did not appear to notice the ER). This was the case for 19% (31 of 163) of cyclists at Grove Road and 15% (24 of 163) of cyclists at Webber Street eastbound. At Burdett Road only 2.5% (4 of 140) of cyclists showed this behaviour and at Webber Street westbound 7% (9 of 134) of cyclists were observed to do this.

It is also noted that the LLCS are only mounted on the nearside primary signal, so cyclists waiting to turn right do not have this signal in their line of sight, and rely on the cycle filter mounted on the secondary signal. This is not fitted with a starting amber and so it may be the case that the reaction time to this signal is slower than with the LLCS.

3.2.3.2 Q1[a] driver behaviour (encroachment)

Observations of whether the first waiting vehicle encroached into the ASL at each junction are shown in Table 11. At Burdett Road, 9% of signals cycles included the first waiting vehicle encroaching into the ASL. The same proportion was recorded at Webber Street eastbound, with a similar 10% of signal cycles having this at Grove Road (although in the right hand lane, there were a higher proportion of signal cycles with encroachment, at 14%). At Webber Street westbound the proportion was higher at 26%.

Table 11 First vehicle encroachment of the ASL

Location		Number of signal cycles in which:			Total observed	Sample used
		The first waiting vehicle has encroached into the ASL waiting area by 2.5 m or more	*The ASL waiting area was entirely or mostly clear (5 m or more available)*	*There was no vehicle present (excluded from sample)*		
Burdett Rd	LH lane	8 (8%)	90 (92%)	0	98	98
	RH lane	9 (9%)	89 (91%)	0	98	98
	Total	17 (9%)	179 (91%)	0	196	196
Grove Rd	LH lane	8 (9%)	85 (91%)	5	98	93
	Middle lane	6 (6%)	90 (94%)	2	98	96
	RH lane	14 (16%)	76 (84%)	8	98	90
	Total	28 (10%)	251 (90%)	15	294	279
Webber St e/b	Total	9 (9%)	89 (91%)	0	98	98
Webber St w/b	Total	25 (26%)	73 (74%)	0	98	98

When looking for evidence of encroachment by the first waiting vehicles affecting how cyclists proceeded through the junctions at each site, it was found that, in general, there was very little effect. The majority of cyclists across all sites were observed to proceed ahead of general traffic regardless of whether the first waiting vehicle was encroaching into the ASL.

There were only two observations (of signal cycles) in which a cyclist was not able to make use of the early release because they were queuing behind other cyclists: one at Webber Street westbound with no front vehicle encroachment and the other at Burdett Road with front vehicle encroachment.

When looking at cyclists who waited for the green of the general traffic signals (or did not appear to notice the early release), this was also found not to be related to front vehicle encroachment specifically. At Burdett Road, there were four signal cycles in which four cyclists waited for the general traffic signal green and in each case the front waiting vehicle was not encroaching. Webber Street westbound had a similar record, with six cyclists across five signal cycles in which there were no encroaching front vehicles. At Grove Road, there were nine cyclists over nine signal cycles with only one of these having encroachment in both the middle and right hand lane. At Webber Street eastbound, there were more cyclists observed waiting for the general traffic signal to turn green. There were 18 signal cycles

where no encroachment was observed and 21 cyclists waited for the general traffic signal, while there were three signal cycles in which encroachment was observed where three cyclists waited for the general signal.

These results suggest that encroachment of the front waiting vehicle did not have a detrimental effect on cyclists using the early release. However, this study does not look at positioning of queuing traffic behind the front vehicle which could impact on whether cyclists are able to reach the ASL in order to make use of the early release.

3.2.3.3 Q1[b] driver behaviour (response to signals)

Table 12 provides a summary of the proportion of signal cycles in which the front waiting vehicle proceeded into the junction having followed the different cycle and general traffic signals.

Table 12 Driver response to signals for all lanes

Location		Number of signal cycles in which the first motor vehicle waiting at the stop line proceed:				Excluded as data missing	Sample used
		on the cycle ER, when a cyclist is also present	*on the cycle ER, when there is no cyclist present*	*on the starting amber for general traffic*	*on the green for general traffic*		
Burdett Rd	LH lane	1 (1%)	0 (0%)	2 (2%)	93 (97%)	2	96
	RH lane	0 (0%)	0 (0%)	0 (0%)	96 (100%)	2	96
	Total	1 (1%)	0 (0%)	2 (1%)	189 (98%)	4	192
Grove Rd	LH lane	1 (1%)	0 (0%)	0 (0%)	92 (99%)	5	93
	Middle lane	0 (0%)	0 (0%)	0 (0%)	96 (100%)	2	96
	RH lane	0 (0%)	0 (0%)	0 (0%)	89 (100%)	9	89
	Total	1 (0.4%)	0 (0%)	0 (0%)	277 (99.6%)	16	278
Webber St e/b	Total	3 (3%)	5 (5%)	33 (34%)	57 (58%)	0	98
Webber St w/b	Total	7 (7%)	4 (4%)	23 (23%)	64 (65%)	0	98

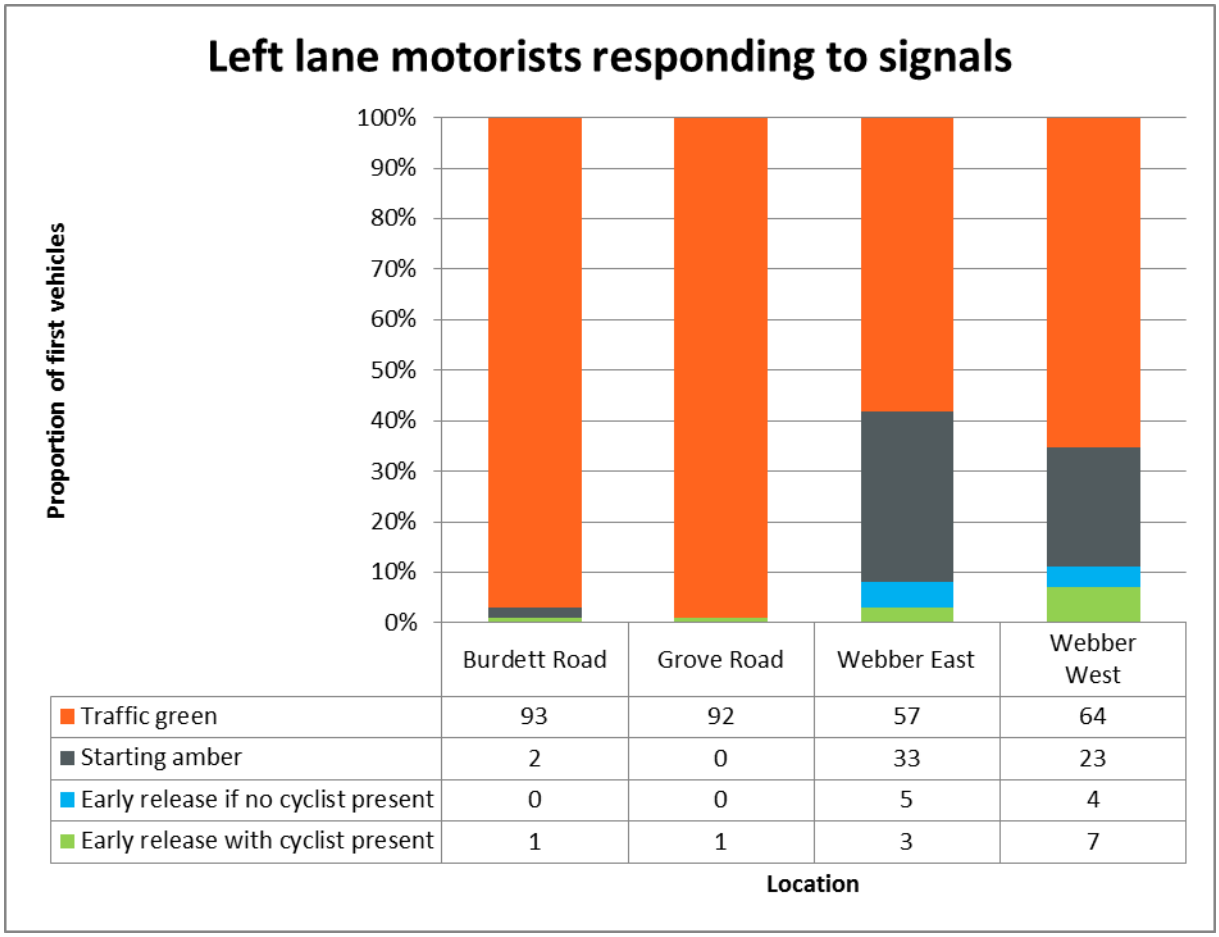
Results from observations of when the first car in the left-hand general traffic lane at the stop line proceeded into the junction (Figure 11), found that at Burdett Road and Grove Road, in almost all signal cycles, the first vehicles started moving forward in response to a green general traffic signal (97% and just under 100% respectively).

It should be noted that at these two sites, there were additional lanes in which first cars proceeded at a green for general traffic in 100% of signal cycles.

At Webber Street westbound, first waiting vehicles proceeded on a green for general traffic in 65% of signal cycles whilst at Webber Street eastbound, first waiting vehicles waited until

the green for general traffic to proceed in only 58% of signal cycles. In most of the signal cycles in which first waiting vehicles did not wait for the green for general traffic, they moved instead on a starting amber for general traffic (this was the case for 23% of cycles at Webber Street westbound and 34% at Webber Street eastbound).

There were a small proportion of signal cycles at each site in which first waiting vehicles appeared to follow the cycle early release (ER). This was observed in one signal cycle at each of Burdett Road and Grove Road, where the front waiting vehicle proceeded on the cycle ER when a cyclist was present. At Burdett Road, this was a motorcyclist who waited in the cycle box and followed the cycle signal. At Webber Street eastbound, there were three signal cycles in which the front waiting vehicle was observed proceeding on a cycle ER when there was a cyclist present and five signal cycles in which the front waiting vehicle proceeded when there was no cyclist present.



	Burdett Road	Grove Road	Webber East	Webber West
Traffic green	93	92	57	64
Starting amber	2	0	33	23
Early release if no cyclist present	0	0	5	4
Early release with cyclist present	1	1	3	7

Figure 11 Departure timing of first vehicle in left-hand general traffic lane

Most drivers were observed to proceed on a green traffic signal at each of the sites, and those who did not, generally proceeded on a starting amber. This was particularly prevalent at Webber Street, in both directions.

A number of motorcyclists were observed waiting in the cycle boxes ahead of other motor traffic, one of whom proceeded on the early release.

Summary

- 90% of motor vehicles did not respond to the cycle early release.
- At least 81% of cyclists proceeded into the junction ahead of general traffic.
- Less than 3% of cyclists were unable to use the early release due to queuing behind other cyclists.
- In about 10% of signal cycles, the front waiting vehicles encroached into the cycle boxes at Burdett Road, Grove Road and Webber Street eastbound.
- Webber Street westbound had front waiting vehicles encroaching into the ASL in 26% of signal cycles, and also had a similar percentage (23% of signal cycles) in which vehicles proceeded on a starting amber.

3.3 ER Research Question 5 – Proportion of cyclists arriving on green phase

3.3.1 Description

For RQ5, the following question was investigated: Of all cyclists proceeding into the junction, what proportion arrive on green (and therefore do not benefit from the early release)?

3.3.2 Methodology

This research question uses the same video as for early release RQ1, using video survey of each early release arm at the relevant location and junction, capturing a week's worth of video. Multiple video camera angles were used to ensure that the research question could be adequately answered, with a minimum of two video cameras per arm.

The sample size was obtained using the first 2 signal cycles of each hour for 14 hours each day (7am start), giving a sample of 196 signal cycles, split evenly across both arms. This was achieved through reviewing alternate hours' video output for each arm at each junction.

For the analysis of this question, 'proceeding in to the junction' was defined as crossing the first set of stud markings at the pedestrian crossing and 'arriving on green' was defined as a green signal showing at the moment when the cyclists crosses the advanced stop line.

3.3.3 Findings

As shown in Figure 12, two-thirds of cyclists at Webber Street westbound arrived on a red signal and hence benefitted from the early release, with those arriving on a red signal at Burdett Road and Grove Road being 83% (145 of 174) and 79% (147 of 187) respectively.

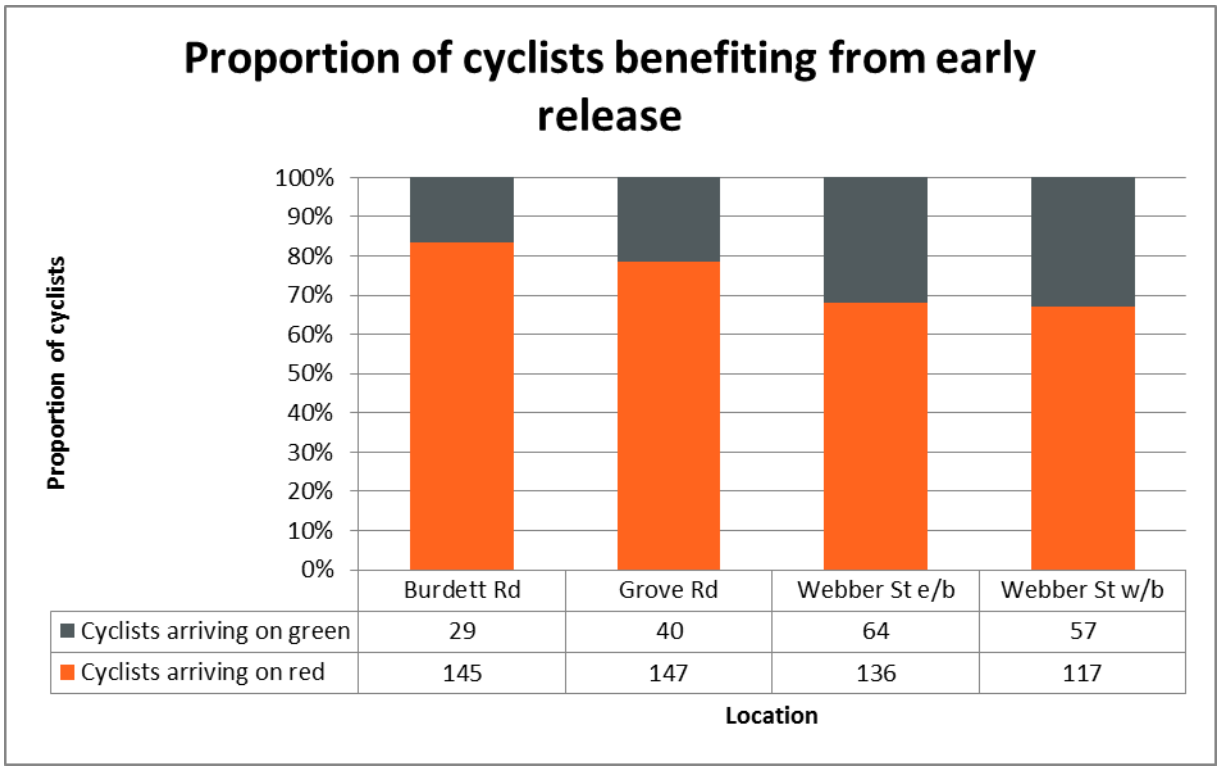


Figure 12 Cyclists arriving and benefitting from the early release

These observations are consistent with the proportion of green time available at each site. The junction at Burdett Road runs a longer cycle time (112-120 seconds), while Webber Street has shorter cycle times (88-104 seconds), hence as a percentage has a higher probability of cyclists arriving on green.

3.3.4 Conclusions

- Over two-thirds of cyclists using the junctions benefit from the early release.
- This is increased at Mile End Road / Burdett Road / Grove Road where the cycle time is longer and proportion of green time lower.

3.4 ER Research Question 6 – How do cyclists turn right?

3.4.1 Description

For RQ6, the following questions were investigated: Of the cyclists turning right from arms with early release, what proportion:

- use the early release signal to turn right in one movement?
- wait in the middle of the junction for a gap in opposing traffic in order to turn right?
- turn right in two stages (i.e. progress to the nearside 2ST waiting area)?

3.4.2 Methodology

This research question was investigated using video survey of each early release arm at the relevant location and junction, capturing a week's worth of video. Multiple video camera angles were used to ensure that the research question could be adequately answered, with a minimum of two video cameras per arm.

The sample size was obtained using the first 3 signal cycles seen from each start of 14 hours each day (7am start) with cyclists making this manoeuvre, giving a sample of 294 signal cycles, split evenly across both arms. This was achieved through reviewing alternate hours' video output for each arm at each junction.

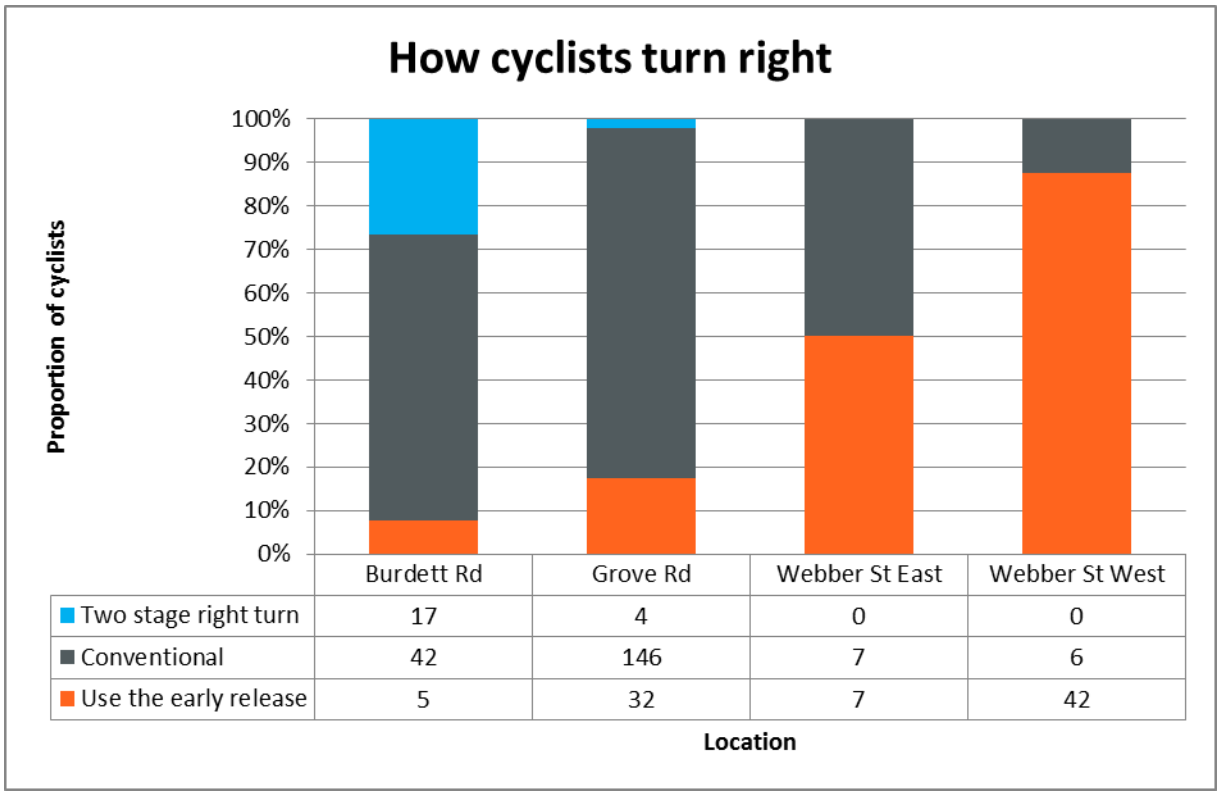
At the junction of Blackfriars Road / Webber Street there were insufficient right turning cyclists during some time periods for adequate samples of these movements to be achieved. Those time periods were excluded from the analysis.

The analysis split the cyclist movements into three different manoeuvres:

- Two stage right turn: Turning right in two stages (progressing to nearside 2ST waiting area)
- Conventional right turn: Waiting in the middle of the junction for a gap in opposing traffic (no matter what signal they passed through)
- Using the early release signal: specifically the green signal to turn right in one movement.

3.4.3 Findings

The findings of these observations can be seen in Figure 13, which includes sample sizes.



	Burdett Rd	Grove Rd	Webber St East	Webber St West
Two stage right turn	17	4	0	0
Conventional	42	146	7	6
Use the early release	5	32	7	42

Figure 13 How cyclists turn right at early release sites

As can be seen in Figure 13, regardless of the method of turning right, the total number of right turning cyclists observed is small for statistical purposes, in particular at Webber Street eastbound where only 14 cyclists were observed to turn right.

At Webber Street there is no formal two-stage right facility provided for cyclists. With the bi-directional cycle track located on the west side of the junction, the proportion using the early release to enter the track in the westbound direction is 88%.

The eastbound approach is split evenly between those using the early release and those undertaking the conventional method. However the flows are very low for this movement.

At Burdett Road, over a quarter of the cyclists (27%) were observed using the two-stage turn facility, however only 2% of cyclists at Grove Road did. An important difference between the two arms of the junction is that the right turn is prohibited at Burdett Road (except for cycles in two stages), and hence the two-stage facility is potentially a more attractive facility at this location.

The majority of cyclists at these sites were recorded as waiting in the junction for a gap in opposing traffic (66% on Burdett Road and 80% on Grove Road) whilst only 8% at Burdett Road and 18% at Grove Road took advantage of the early release to enable them to turn right in one movement. This may be related to the busy nature and size of this junction making it difficult to turn right in one movement even with the early release.

3.4.4 Conclusions

At the junction where there is no two-stage turn facility (Webber Street/ Blackfriars Road) more cyclists used the early release to turn right in one movement than waited in the middle of the junction for a gap in the opposing traffic. At Webber Street eastbound and westbound there is no two-stage turn facility for cyclists to use, the junction is more lightly trafficked than Burdett Road / Grove Road, and there are fewer traffic lanes and movements. Accordingly it may be easier for cyclists to turn right in one movement from Webber Street eastbound or westbound without encountering conflict with vehicle movements than it is to undertake the same manoeuvre at Burdett Road or Grove Road without conflict.

At the junction with the two-stage turn facility (Burdett Road/ Mile End Road/ Grove Road), over a quarter of cyclists from Burdett Road made a two-stage right turn using the designated waiting area, whilst only 2% of cyclists on Grove Road did. Slightly more cyclists took advantage of the early release to turn right in one movement at Burdett Road than at Grove Road, suggesting that cyclists approach this junction very differently from the two opposing sides.

Summary

Where no two-stage turn facility is provided, cyclists are more likely to take advantage of the early release to turn right.

Where a two-stage turn facility is provided, this has a higher use if the conventional right turn is prohibited.

The size of junction (and distance a cyclists has to travel to clear the conflict) has a direct correlation to the numbers using the early release to help complete the turn.

3.5 ER Research Question 7 - Impact of cycle signal infrastructure on pedestrian crossing behaviour

3.5.1 Description

This research question required a pedestrian-only survey for Burdett Road/Mile End Road site only, to address the following questions about the impact of cycle signal infrastructure on pedestrian crossing behaviour.

- Which crossing(s) did pedestrians use?
- How comfortable did pedestrians find it to cross?
- What information did pedestrians use when crossing? (i.e. what signal were they looking at?)
- How frequently these pedestrians use the junction.

3.5.2 Methodology

Enumerators used a pre-prepared questionnaire (see Appendix E) to ask questions of pedestrians who had just used the crossing and this was later manually entered in to a database for analysis. The questionnaire was designed to generate suitable data to answer the research question.

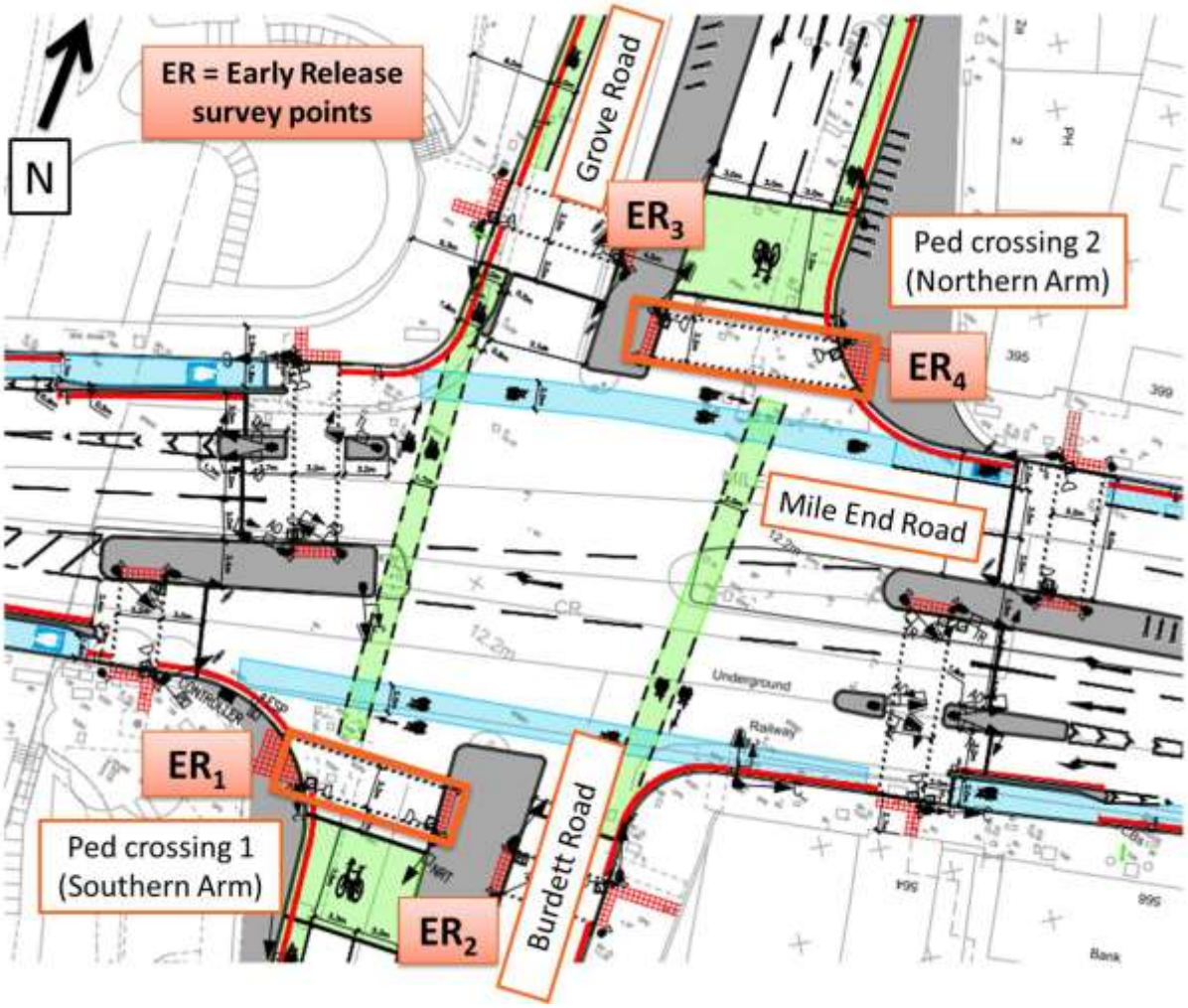
3.5.3 Which crossing(s) did pedestrians use?

This research question was investigated using questionnaire surveys with pedestrians at the Burdett Road / Mile End Road / Grove Road junction, using a sample target of 100 pedestrians with an approximate even spread of directions at each of the two examined crossings of the junction (which was broadly achieved, see Table 13).

Table 13 Pedestrian sample

Location	Pedestrian sample
Southern Arm (Footway)	25
Southern Arm (Island)	28
Northern Arm (Island)	24
Northern Arm (Footway)	26

At the ‘ER1’ and ‘ER4’ survey points, pedestrians were surveyed after they had crossed the road from the central island to the main footway. At the ‘ER2’ and ‘ER3’ survey points, pedestrians were surveyed after they had crossed from the footway to the central island.



3.5.4 How comfortable did pedestrians find it to cross?

Respondents were asked how confident or uncertain they felt about crossing here as a proxy for comfort (see Figure 14). The majority of respondents were either confident or very confident (77%), but a fair proportion (18%) also stated that they felt quite uncertain or very uncertain. This is a lower proportion compared to the HTL sites, where uncertainty was reported by 29% of respondents.

Three perceptions can be picked out from comments by respondents who indicated they were uncertain or very uncertain about this junction layout:

- there is a lot going on which makes it confusing;
- the traffic light timings are not suitable; and
- the junction is not safe.

Some examples of comments relating to these perceptions are:

> *"Never know where traffic is coming especially on other arms, not clear now it has changed."*

"Hazard, too many lights, too many lanes, too complex."

"Red man for long time: could cross in that time because no traffic coming. Too open, bus stop too close to lights, cars don't pay attention-crash into bus. Think cars should be able to turn right from southern arm because can from northern arm."

"Traffic lights are 47 seconds on red- way too long to wait for green man.(man timed it while I was talking to him- participants partner). Too many things happening- very distracting."

"Dangerous: not designed for pedestrians, have to wait for ages and have to go on red light. Not synchronised with 2nd half of crossing. Bus stop D up the road- when there is a bus obstructs view of road."

"People not looking at lights, not a safe junction."

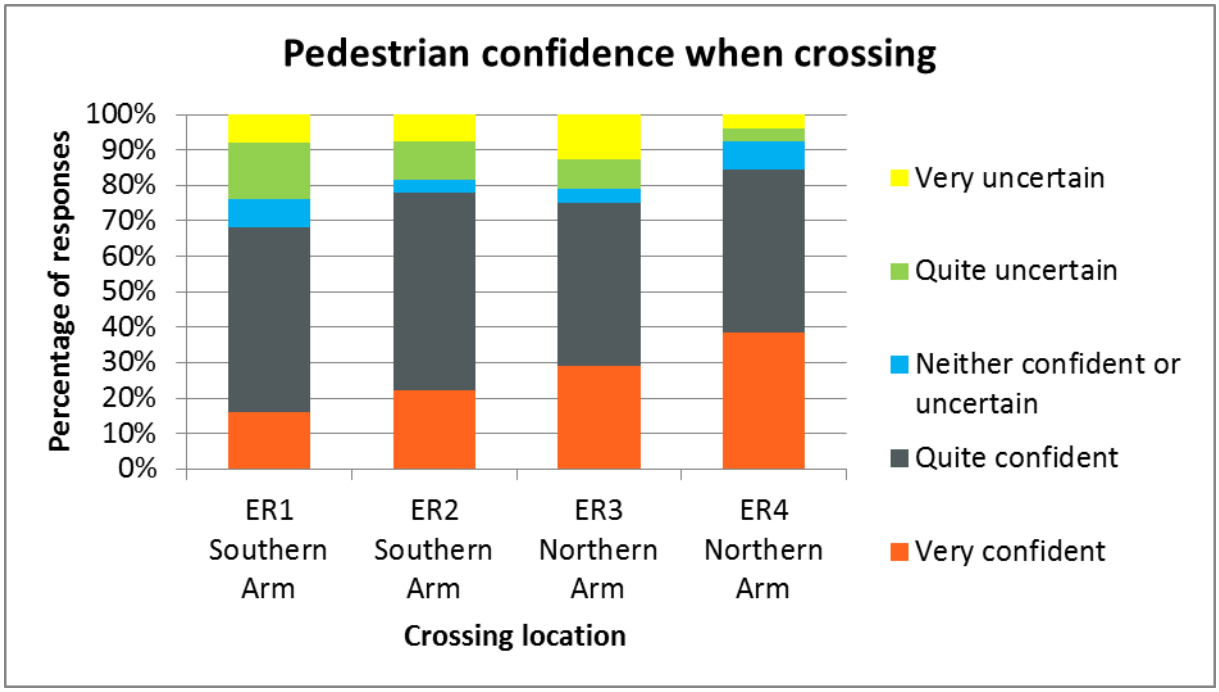


Figure 14 Pedestrian confidence when crossing at Early Release sites

3.5.5 *What information did pedestrians use when crossing? (i.e. what signal were they looking at?)*

As seen in Figure 15, the majority of pedestrians (65%) reported that they crossed when the 'green man' was shown on the pedestrian signal; the next most common response was that they crossed on the 'red man' (17.5%). Nearly 6% of pedestrians reported crossing during the countdown phase of the pedestrian signal.

Around 12% of the sample indicated that they either did not look at the pedestrian signals, or they did not know whether they had looked at them.

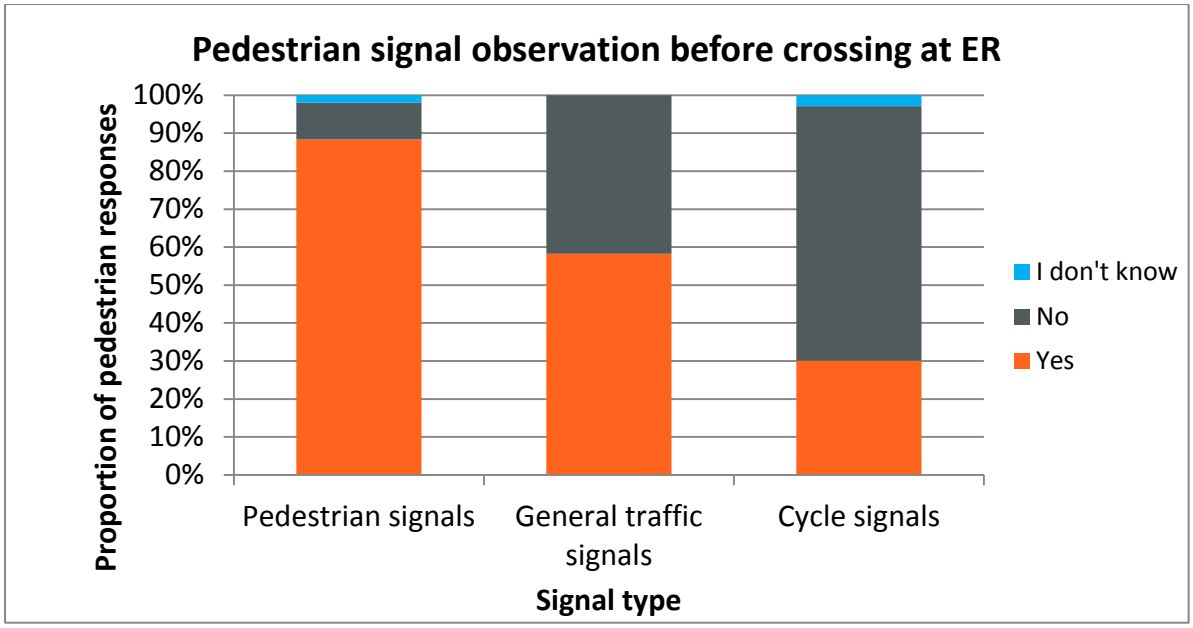


Figure 15 Pedestrians' stated observation of signals when deciding to cross at ER junctions (N = 103)

There is the potential for pedestrians using the crossing to incorrectly perceive the cycle early release signal as a 'green light' for pedestrians; this could therefore lead to conflict between pedestrians, cyclists and (eventually) other general traffic.

The early release pedestrian survey results provide some insight into the propensity that this perceptual error may occur. As shown in Figure 15, 30% of pedestrians who were surveyed indicated that they looked at the cycle lights; this sample therefore represents the proportion of people who might be at risk of making the perceptual error. These pedestrians would be at risk of performing the error if they looked at the cycle signal and:

- did not look at the pedestrian traffic lights or crossed on the red man, and;
- did not look at what the cyclists were doing.

Only 1 pedestrian met these criteria; this respondent indicated that they looked at the cycle lights, looked at the pedestrian lights but crossed on the red man, and was not sure what the cyclists or vehicles were doing. This case therefore represents a scenario in which the perceptual error described above may have taken place; although the precise timing of this individual's crossing relative to the early release cycle signal is not known. In any case, this example was unique in the sample of 103 pedestrians surveyed.

3.5.6 How frequently these pedestrians use the junction

Respondents were generally frequent users of this crossing (see Table 14), which suggests a potentially high level of familiarity with the crossing.

Table 14 Self-reported frequency of crossing use

Pedestrian response	Number of respondents
5 or more	58
3 or 4 times	9
1 or 2 times	14
Less than once a week	8
Less than once month	10
First time	4

3.5.7 Early Release Pedestrian Survey Conclusions

The objective of the pedestrian-only survey carried out for the Burdett Road/Mile End Road/Grove Road site, was to address a number of questions about the impact of cycle signal infrastructure on pedestrian crossing behaviour. In summary, each of these questions is addressed below.

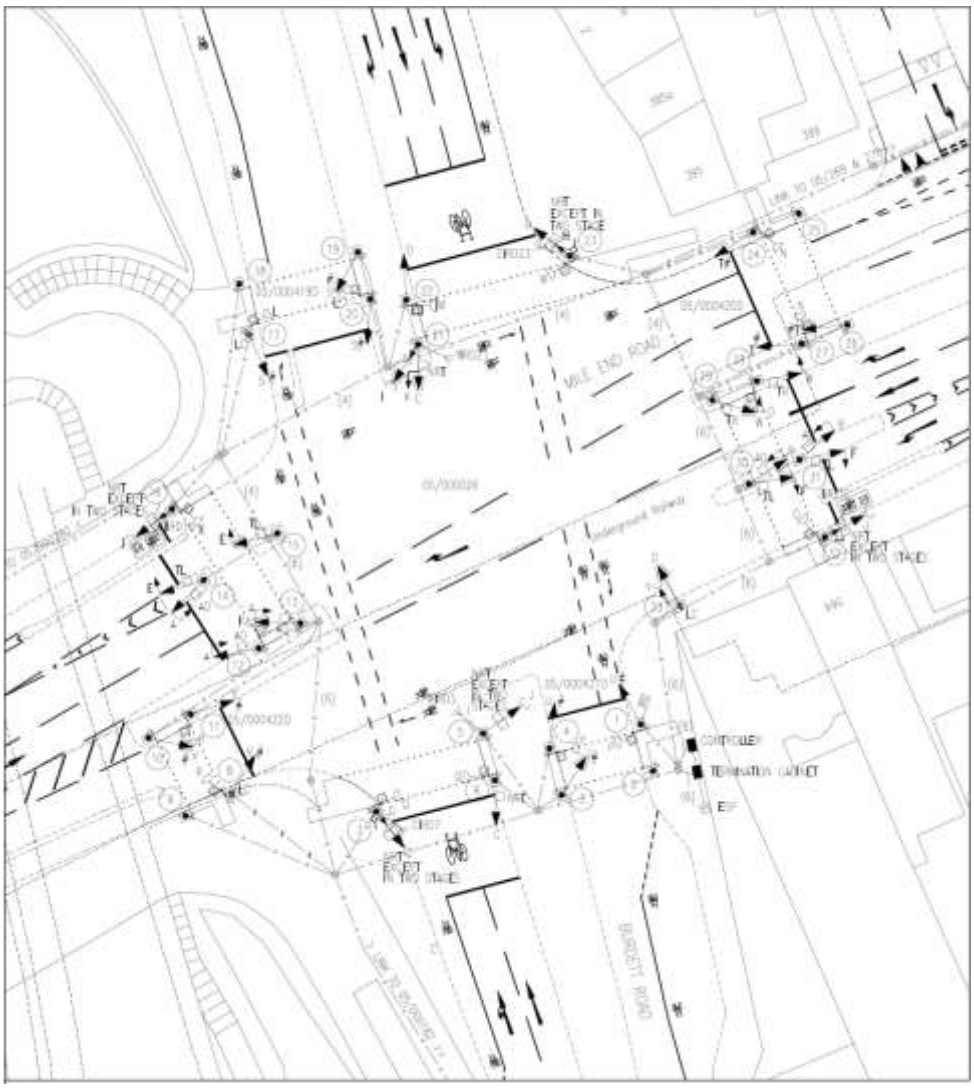
- **How comfortable did pedestrians find it to cross?** - The majority of the sample (82%) reported that they felt confident or neutral when using the crossing at the junction.
- **What information did pedestrians use when crossing?** (i.e. what signal were they looking at?):
    - 100% looked at either whether the traffic was stopped, whether there were sufficient gaps in the traffic, or at the traffic lights before crossing
    - 88% of pedestrians looked at the pedestrian lights before crossing.
    - 65% of pedestrians reported that they crossed when the 'green man' was shown
    - 58% looked at the general traffic signal,
    - Only 30% of pedestrians reported that they looked at the cycle traffic lights before crossing.

Conclusion:

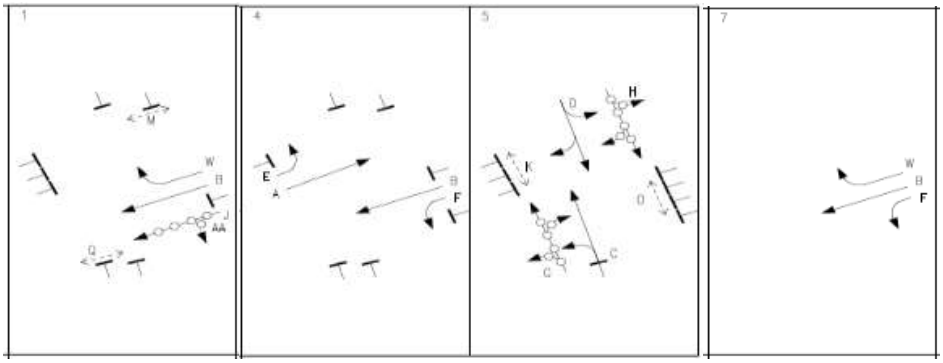
The introduction of Early Release cycle arrangements do not confuse pedestrians waiting to cross the road.

Appendix A Mile End Road / Burdett Road / Grove Road

Detailed drawing of the junction layout.

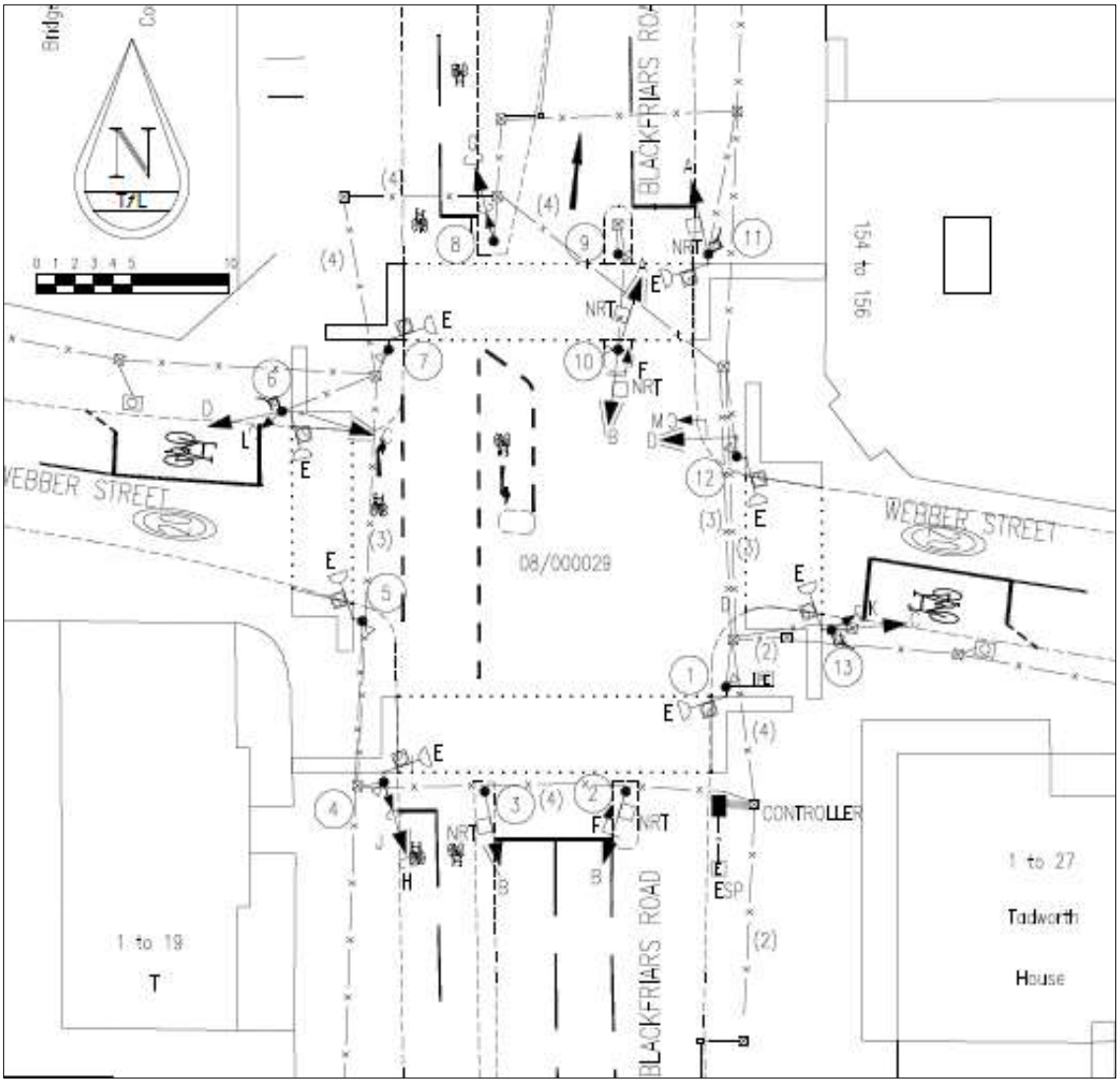


Method of Control

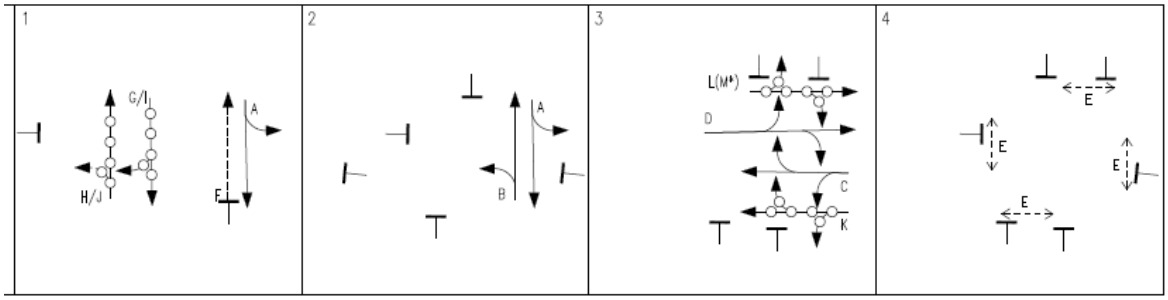


Appendix B Blackfriars Bridge Road / Webber Street

Detailed drawing of the junction layout.



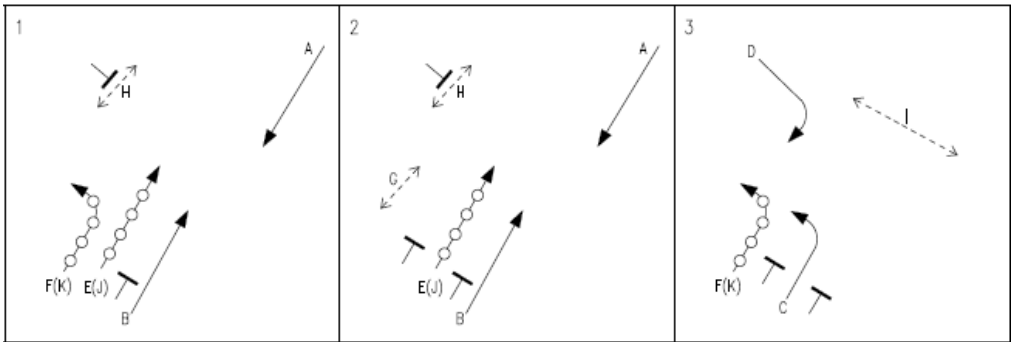
Method of control



Appendix C Kennington Park Road / Kennington Park Road

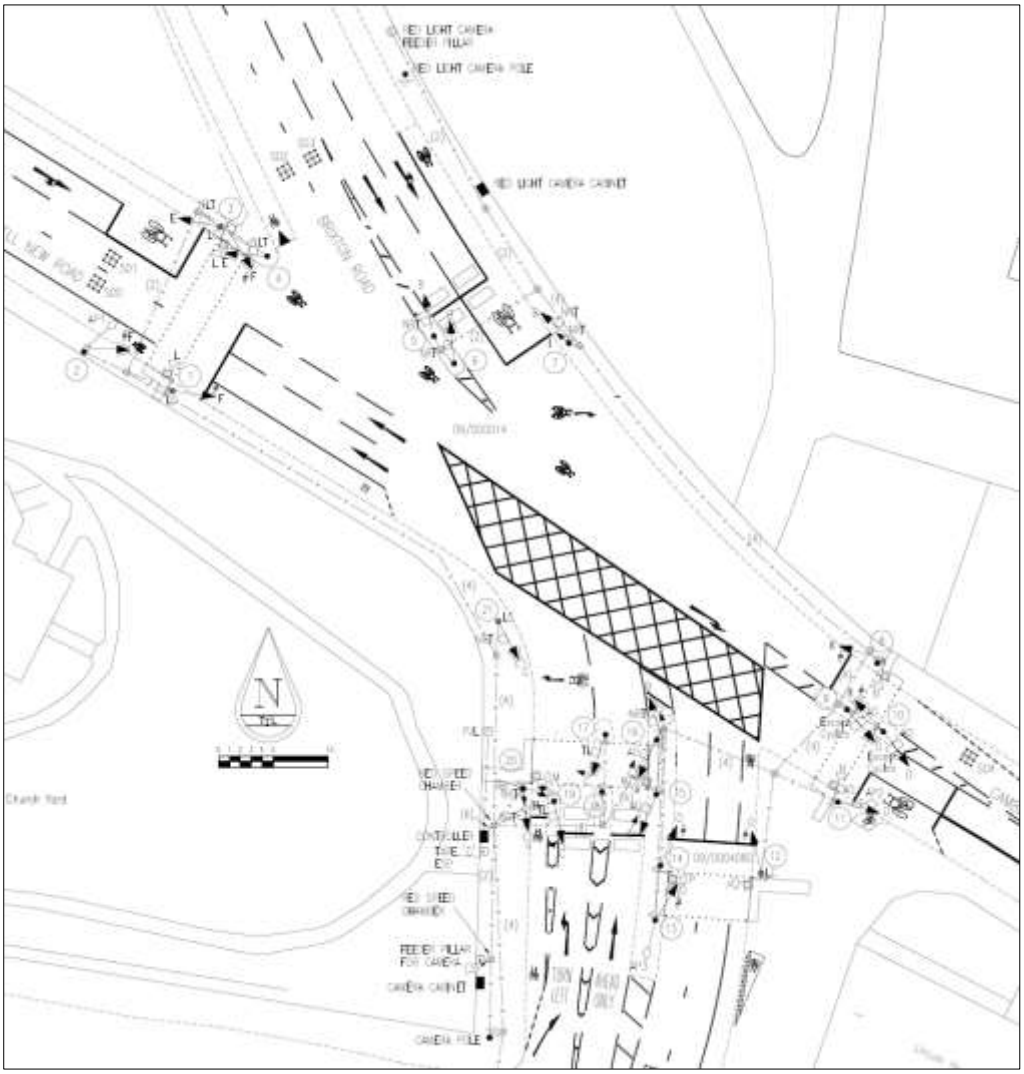
Detailed drawing of the junction layout.

Method of control

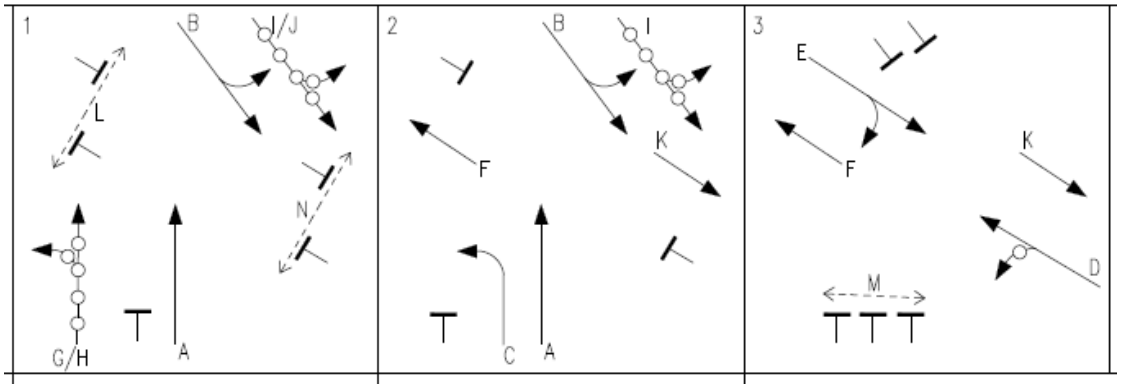


Appendix D Brixton Road / Camberwell New Road

Detailed drawing of the junction layout.



Method of control



Appendix E Hold the Left pedestrian questionnaire

Instructions for staff:

- Ensure that the correct form is used, with images which match the site.
- Target sample is pedestrians who are:
    - Crossing Mile End Road on the Eastern arm of the junction, and:
    - Crossing Mile End Road on the Western arm of the junction.
- Please complete a minimum of 50 pedestrian surveys at each of the Westbound and Eastbound locations (see diagram overleaf)
    - On the Western arm of the junction, due to limited survey space on the island, it is only possible to survey pedestrians crossing from the island to the footway (using the Northern footway as the survey location – **HTL_1**)
    - On the Eastern arm of the junction, aim for an approximate 50/50 split between pedestrians crossing from the footway to the central island (using the island as the survey location – **HTL_2**) and vice-versa (using the footway as the survey location – **HTL_3**)
- To complete a survey, approach pedestrians immediately after they have crossed the road.
- Before completing a survey, ensure that participants are aged 18 or over, and that they give full informed consent to participate.
- Complete one form for each participant.
- Read out the questions to the participant, writing the answers they give in the space provided.
- Use the pictures on the form and/or point to relevant parts of the junction area to explain specific features of the junction which are in question.
- Remember to thank the respondent after the survey.

Information for participant (to be read by surveyor):

The survey shouldn't take more than 5 minutes. There are 7 short multiple choice questions and 1 open question to answer. There will then be some questions about you to answer at the end. To start with, I will read out the question; please then indicate your answer, thinking about this junction and your experience using it as a pedestrian.

If you would like me to repeat the question or if you have any questions at any time, please just ask.

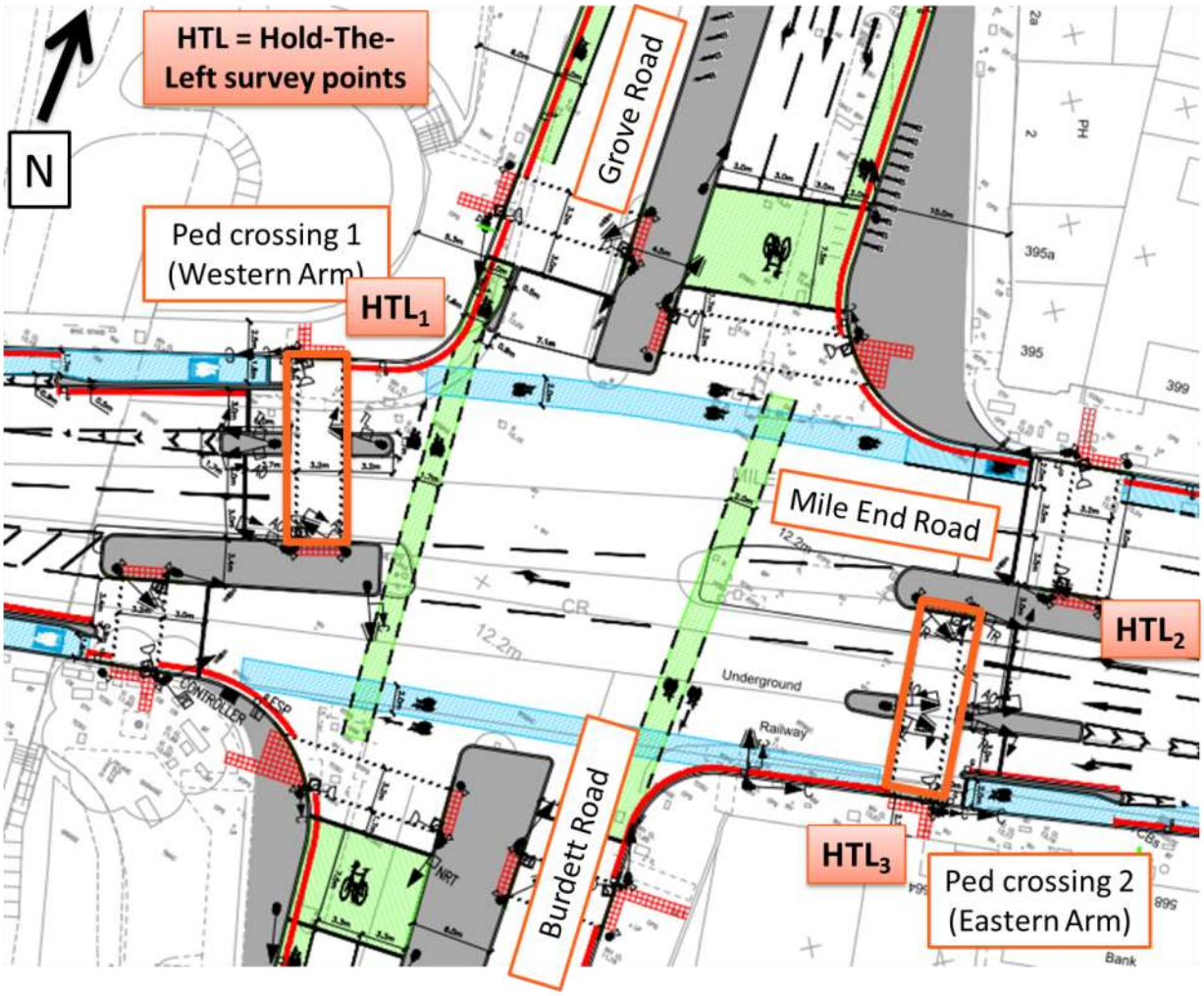
The survey will take a few minutes to complete. The information you provide will be completely anonymous, and will be used to provide feedback to Transport for London on the design of junctions like this.

You are free to stop taking part in the survey at any time. Before we begin, can I ask you to please confirm that you are:

a) Over the age of 18?

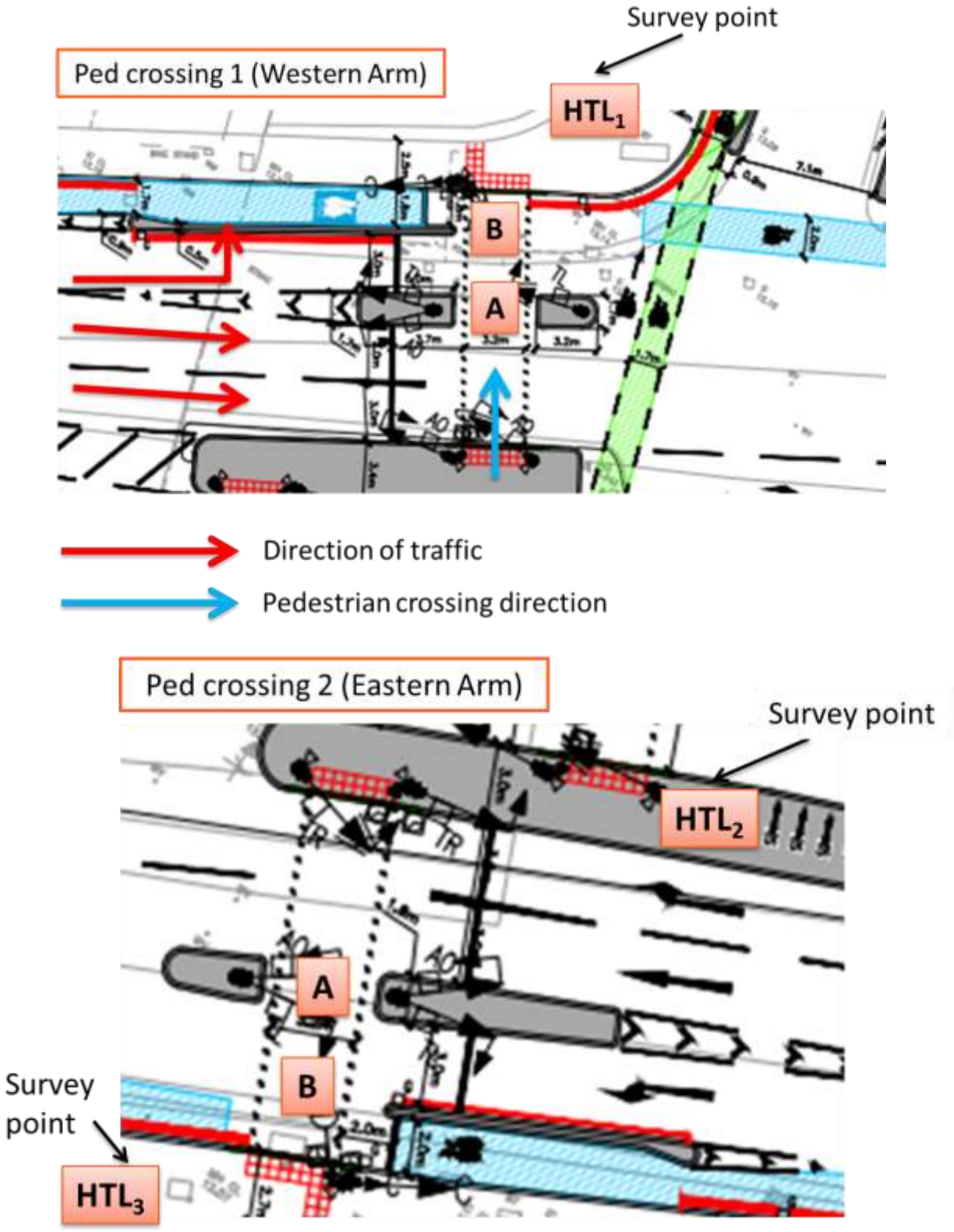
b) Happy to proceed with this survey?

Junction layout diagrams



2

Reference diagrams for Question 1



Pedestrians surveyed at HTL_2 will be crossing South-to-North

Pedestrians surveyed at HTL_3 will be crossing North-to-South

Hold-The-Left Pedestrian Survey

Survey location:

☐ **Western arm (HTL_1)** *(50 pedestrians)*

☐ **Eastern arm (HTL_2)** *(25 pedestrians)*

☐ **Eastern arm (HTL_3)** *(25 pedestrians)*

This survey is being conducted on behalf of Transport for London and is about the junction facility at this site.

Please confirm:

☐ **Participant is over 18**

☐ **Participant consents to proceed**

Q1: Thinking about the last time you crossed the road at this junction, did you cross to/from the central island in one movement? (Use reference diagrams as prompts)

Tick all that apply:

☐ Yes
☐ No, I stopped at location A (i.e. between the left-turning traffic lane and other traffic lanes)
☐ No, I stopped at location B (i.e. between the cycle lane and the traffic lane)
☐ I don't know

Q2: Did you look at the pedestrian traffic lights before crossing? (Point to signals)

☐ Yes, I crossed on the green man
☐ Yes, I crossed on the red man
☐ Yes, I crossed during the countdown
☐ No, I did not look at the pedestrian traffic lights
☐ No, I did not look at the pedestrian traffic lights, but I followed other pedestrians
☐ I don't know

Q3: Did you look at the vehicle traffic lights before crossing? (Point to signals)

☐ Yes, I looked at the vehicle traffic lights before crossing
☐ No, I did not look at the vehicle traffic lights
☐ I don't know

Q4: Did you look at the cycle traffic lights before crossing? (Point to signals)

☐ Yes, I looked at the cycle traffic lights before crossing
☐ No, I did not look at the cycle traffic lights
☐ I don't know

Q5: Did you look at traffic in the road before crossing?

☐ No, I just looked at the traffic lights
☐ Yes, I checked that all motor vehicles and cyclists were stopped before crossing
☐ Yes, I checked that motor vehicles were stopped before crossing
☐ Yes, I checked there was a sufficient gap between moving vehicles / cyclists before crossing
☐ Yes, but I am not sure what the vehicles were doing
☐ Yes, but I am not sure what the cyclists were doing

☐ I don't know
☐ Other (please describe):

Q6: How frequently do you cross the road at this junction?

☐ This is the first time
☐ Less than once per month
☐ Less than once per week
☐ Once or twice per week
☐ 3 or 4 times per week
☐ 5 or more times per week

Q7: In general, how confident or uncertain do you feel about crossing here?

☐ Very confident
☐ Quite confident
☐ Neither confident or uncertain
☐ Quite uncertain
☐ Very uncertain
☐ Don't know / Don't have an opinion

Q8: Do you have any other comments about the pedestrian crossing at this location?

Self-completion demographic questions

THE FOLLOWING QUESTIONS SHOULD BE SELF-COMPLETED BY PARTICIPANTS.

Q9. Please state your age:

☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ 75 or over
☐ Prefer not to say

Q10. Please state your gender:

☐ Male ☐ Female ☐ Prefer not to say

Q11. To which of these ethnic groups do you consider you belong?

☐ White
☐ Mixed
☐ Asian or Asian British
☐ Black or Black British
☐ Any other ethnic group
☐ Prefer not to say
☐ Don't know

A disabled person is defined under the Equality Act 2010 as someone with a 'physical or mental impairment which has a substantial and long term adverse effect on that person's ability to carry out normal day-to-day activities.'

Q12. Do you consider yourself to be disabled under the Equality Act 2010?

☐ Yes
☐ No
☐ Don't know
☐ Prefer not to say

Q12a. If you answered YES, please mark all that apply below:

☐ Hearing impairment
☐ Visual impairment
☐ Speech impairment
☐ Mobility impairment
☐ Physical co-ordination difficulties
☐ Reduced physical capacity
☐ Severe disfigurement
☐ Learning difficulties (e.g. dyslexic)
☐ Mental ill health
☐ Progressive conditions
☐ Other (please specify)

Q12b. If you answered YES, do you ever use a wheelchair when travelling around London?

☐ Yes
☐ No

Researcher observations

Q13. Was the respondent using any of the following?

☐ Walking frame
☐ One walking stick
☐ Two walking sticks
☐ Wheelchair
☐ Mobility scooter
☐ Guide dog
☐ White stick/cane
☐ Crutches
☐ Pram/pushchair
☐ None

Q14. Was the respondent encumbered with/using any of the following?

☐ Shopping bag
☐ Shopping trolley
☐ Small child/ baby
☐ Suitcase/ heavy luggage
☐ Large or awkward item
☐ Baby pushchair/ pram
☐ Looking at mobile phone or other device
☐ None

Q15. Was the respondent accompanied by any of the following

☐ Baby
☐ Toddler/ pre-school
☐ Children 5-11 years
☐ Children 12-16 years
☐ Elderly person
☐ Person with mental/ physical impairment
☐ None
☐ Other adult (Specify number of other adults and write in box below)

Appendix F Early Release Pedestrian Survey

Instructions for staff:

- Ensure that the correct form is used, with images which match the site.
- Target sample is pedestrians crossing:
    - The Burdett Road (Northbound) portion of the Southern arm of the junction, and:
    - The Grove Road (Southbound) portion of the Northern arm of the junction.
- Complete a minimum of 50 pedestrian surveys at each of the Northbound and Southbound locations (see diagram overleaf)
    - Aim for an approximate 50/50 split between pedestrians crossing from the footway to the central island (using the island as the survey location – **ER_2/ER_3**) and vice-versa (using the footway as the survey location – **ER_1/ER_4**)
- To complete a survey, approach pedestrians immediately after they have crossed the road
- Before completing a survey, ensure that participants are aged 18 or over, and that they give full informed consent to participate.
- Complete one form for each participant.
- Read out the questions to the participant, writing the answers they give in the space provided.
- Use the pictures on the form and/or point to relevant parts of the junction area to explain specific features of the junction which are in question.
- Remember to thank the respondent after the survey.

Information for participant (to be read by surveyor):

The survey shouldn't take more than 5 minutes. There are 6 short multiple choice questions and 1 open question to answer. There will then be some questions about you to answer at the end. To start with, I will read out the question; please then indicate your answer, thinking about this junction and your experience using it as a pedestrian.

If you would like me to repeat the question or if you have any questions at any time, please just ask.

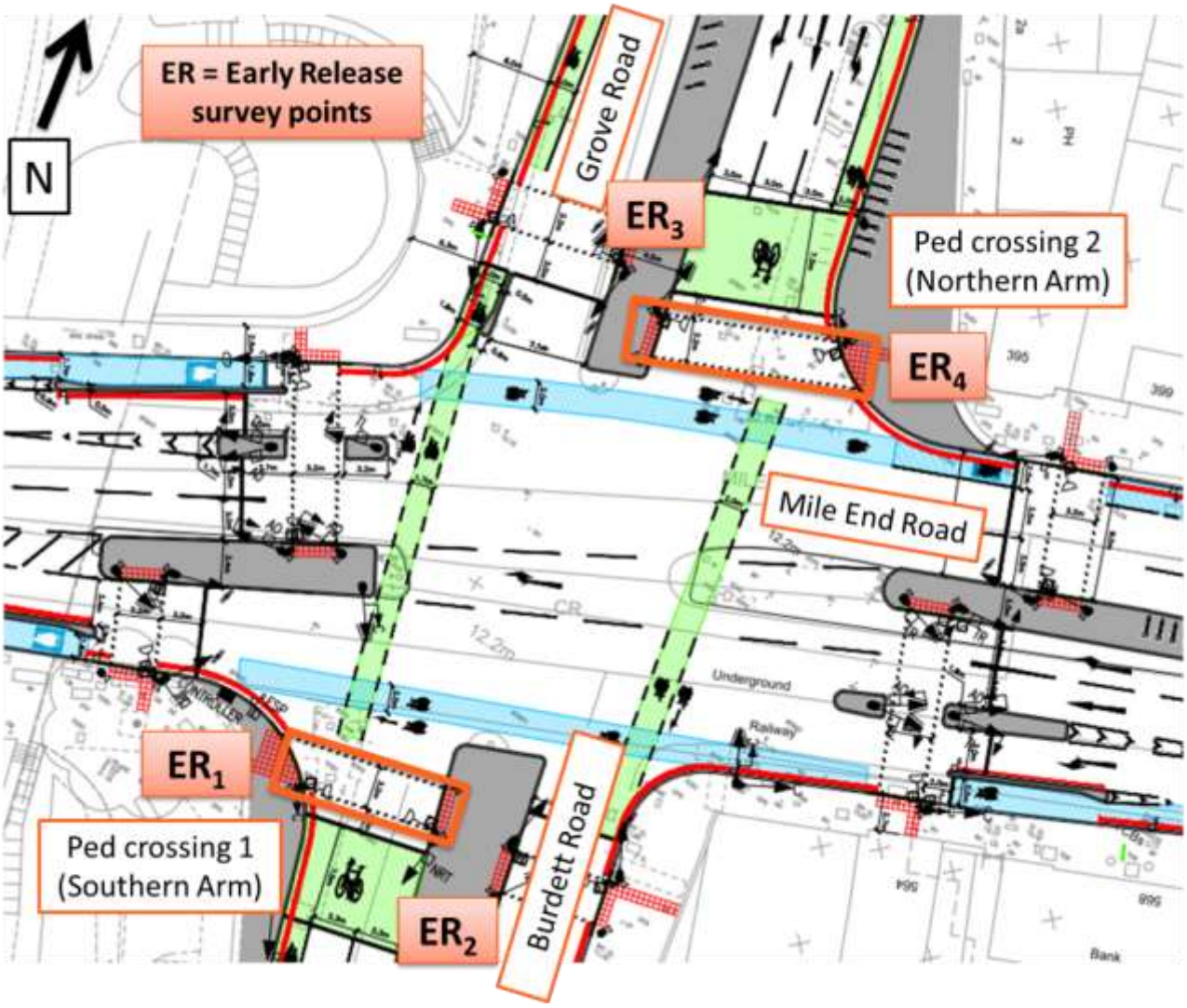
The survey will take a few minutes to complete. The information you provide will be completely anonymous, and will be used to provide feedback to Transport for London on the design of junctions like this.

You are free to stop taking part in the survey at any time. Before we begin, can I ask you to please confirm that you are:

c) Over the age of 18?

d) Happy to proceed with this survey?

Junction layout diagram



6

Early Release Pedestrian Survey

Survey location:

Collect 25 samples per arm.

- ☐ **Southern arm (ER_1)**
- ☐ **Southern arm (ER_2)**
- ☐ **Northern arm (ER_3)**
- ☐ **Northern arm (ER_4)**

This survey is being conducted on behalf of Transport for London and is about the junction facility at this site.

Please confirm:

- ☐ **Participant is over 18**
- ☐ **Participant consent to proceed**

Q1: Thinking about the last time you crossed the road at this junction, did you look at the pedestrian traffic lights before crossing? *(point to ensure participant considers the correct lights).*

- ☐ Yes, I crossed on the green man
- ☐ Yes, I crossed on the red man
- ☐ Yes, I crossed during the countdown
- ☐ No, I did not look at the pedestrian traffic lights
- ☐ No, I did not look at the pedestrian traffic lights, but I followed other pedestrians
- ☐ I don't know

Q2: Did you look at the vehicle traffic lights before crossing? (point to ensure participant considers the correct lights)

- ☐ Yes, I looked at the vehicle traffic lights before crossing
- ☐ No, I did not look at the vehicle traffic lights
- ☐ I don't know

Q3: Did you look at the cycle traffic lights before crossing?
(point to ensure participant considers the correct lights)

- ☐ Yes, I looked at the cycle traffic lights before crossing
- ☐ No, I did not look at the cycle traffic lights
- ☐ I don't know

Q4: Did you look at traffic in the road before crossing?

- ☐ No, I just looked at the traffic lights
- ☐ Yes, I checked that all motor vehicles and cyclists were stopped before crossing
- ☐ Yes, I checked that motor vehicles were stopped before crossing
- ☐ Yes, I checked there was a sufficient gap between moving vehicles / cyclists before crossing
- ☐ Yes, but I am not sure what the vehicles were doing

☐ Yes, but I am not sure what the cyclists were doing
☐ I don't know
☐ Other (please describe):

Q5: How frequently do you cross the road at this junction?

☐ This is the first time
☐ Less than once per month
☐ Less than once per week
☐ Once or twice per week
☐ 3 or 4 times per week
☐ 5 or more times per week

Q6: In general, how confident or uncertain do you feel about crossing here?

☐ Very confident
☐ Quite confident
☐ Neither confident or uncertain
☐ Quite uncertain
☐ Very uncertain
☐ Don't know / Don't have an opinion

Q7: Do you have any other comments about the pedestrian crossing at this location?

Self-completion demographic questions

THE FOLLOWING QUESTIONS SHOULD BE SELF-COMPLETED BY PARTICIPANTS.

Q8. Please state your age:

☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ 75 or over ☐ Prefer not to say

Q9. Please state your gender:

☐ Male ☐ Female ☐ Prefer not to say

Q10. To which of these ethnic groups do you consider you belong?

☐ White
☐ Mixed
☐ Asian or Asian British
☐ Black or Black British
☐ Any other ethnic group
☐ Prefer not to say
☐ Don't know

A disabled person is defined under the Equality Act 2010 as someone with a 'physical or mental impairment which has a substantial and long term adverse effect on that person's ability to carry out normal day-to-day activities.'

Q11. Do you consider yourself to be disabled under the Equality Act 2010?

☐ Yes
☐ No
☐ Don't know
☐ Prefer not to say

Q11a. If you answered YES, please mark all that apply below:

☐ Hearing impairment
☐ Visual impairment
☐ Speech impairment
☐ Mobility impairment
☐ Physical co-ordination difficulties
☐ Reduced physical capacity
☐ Severe disfigurement
☐ Learning difficulties (e.g. dyslexic)
☐ Mental ill health
☐ Progressive conditions
☐ Other (please specify)

Q11b. If you answered YES, do you ever use a wheelchair when travelling around London?

☐ Yes
☐ No

Researcher observations

Q12. Was the respondent using any of the following?

☐ Walking frame
☐ One walking stick
☐ Two walking sticks
☐ Wheelchair
☐ Mobility scooter
☐ Guide dog
☐ White stick/cane
☐ Crutches
☐ Pram/pushchair
☐ None

Q13. Was the respondent encumbered with/using any of the following?

☐ Shopping bag
☐ Shopping trolley
☐ Small child/ baby
☐ Suitcase/ heavy luggage
☐ Large or awkward item
☐ Baby pushchair/ pram
☐ Looking at mobile phone or other device
☐ None

Q14. Was the respondent accompanied by any of the following

☐ Baby
☐ Toddler/ pre-school
☐ Children 5-11 years
☐ Children 12-16 years
☐ Elderly person
☐ Person with mental/ physical impairment
☐ None
☐ Other adult (Specify number of other adults and write in box below)

Low-Level Cycle Signals

TfL is introducing innovative infrastructure for cyclists across the capital to improve safety and increase levels of cycling among all types of people in London.

This report presents the findings of research on two relatively new infrastructure innovations for cyclists: 'Hold the Left' (HTL) and 'Early Release' (ER) that have been implemented at some signalised junctions. The work has also generated data on the use of two-stage turn facilities (2ST).

Research questions were agreed for each innovation. These used video surveys, to record natural human behaviour, complemented by questionnaires to better understand how users perceive these facilities.

Overall findings are that: Over two-thirds of cyclists using the junctions installed with Early Release benefitted from Early Release, increasing at sites where cycle times were longer and the proportion of green time lower. At junctions installed with Hold the Left, the cycle lanes remained clear even with large numbers of cyclists at particular junctions and therefore the cycle signal phases appear sufficiently long for the observed cycle flows. For right-turning cyclists: where no two-stage turn facility is provided, cyclists are more likely to take advantage of an Early Release to turn right; where a two-stage turn facility is provided, this has a higher use if the conventional right turn is prohibited; and the size of junction (and distance a cyclists has to travel to clear the conflict) has a direct correlation to the numbers using Early Release to help complete the turn.

TRL
Crowthorne House, Nine Mile Ride,
Wokingham, Berkshire, RG40 3GA,
United Kingdom
T: +44 (0) 1344 773131
F: +44 (0) 1344 770356
E: enquiries@trl.co.uk
W: www.trl.co.uk

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