Low Level Cycle Signals on a separate pole to the main traffic signals – Appendices

Track trial report

This document contains the appendices to accompany the report from the third sub-trial of a larger track trial investigating the reactions of road users to Low Level Cycle Signals (LLCS) on a separate pole to the main traffic signals (Trial code: M19).

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Appendix A Table of findings against each research question

Table A-1 lists the findings against the research questions and are re-produced from the end of each sub-section in the main report.

Table A-1 – Summary of findings against each of the research questions

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
RQ1 / RQ9 - Did people understand the LLCS and new layout?	[F1.a.] - Almost all participants (over 95% of cyclists and pedestrians, 100% of car drivers and motorcyclists, and 93% of HGV drivers) said they understood the LLCS to be traffic signals for cyclists or normal traffic signals. [F1.b.] - As in the previous trial, a small percentage (less than 5%) of pedestrians, cyclists and car drivers misinterpreted the LLCS as indicating when cyclists should cross the road, so they could have incorrectly judged that they had priority. [F1.c.] - All cyclists and all car drivers, 92% of motorcyclists and 87% of HGV drivers understood the meaning of the cycle reservoirs; these were similar proportions to the previous trial. The minority of motorcyclists, HGV drivers and pedestrians who misunderstood the purpose of the cycle reservoirs either thought that motorcycles could also use them or that they were a cyclist crossing.	[F9.a.] - All cyclists and car drivers made a safe interpretation of the LLCS with an early release, saying they were either traffic signals for cyclists or normal traffic signals. [F9.b.] - Two cyclists, who said they did not currently cycle frequently, were confused by the purpose of the cycle reservoir and therefore did not use it. [F9.c.] - About 10% of cyclists were initially confused by the layout and the early release, commenting that they were not sure whether they could go through the main red signal. However, almost all participants indicated that they understood the signals and layout after a few passes through the junction.
RQ2 – What did people think about the location of the signals?	[F2.a.] - Most participants (about 80% of cyclists, about 70% of car drivers and HGV drivers, and about 60% of motorcyclists and pedestrians) thought the location of the LLCS signal poles was about right but over 20% of car drivers and motorcyclists and just under 30% of pedestrians felt that the LLCS would have been better located on the same pole as the main signals.	

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	[F2.b.] - Drivers who preferred the LLCS to be on the same pole as the main signals thought it would make them more aware of cyclists and what they were doing, than if they were on separate poles.	
RQ10 – Did people notice the early release and what did they think of it along with the new layout?		[F10.a.] - Similar to the previous trial (M18), 96% of cyclists and 98% of car drivers noticed the early release. [F10.b.] - Over 80% in each road user group were positive about the early release with the most common reasons being 'enabled cyclists to get up to speed first' and 'enabled cyclists to clear the junction'. [F10.c.] - About 15% of cyclists and 5% of car drivers were negative about the early release with the most common reasons being 'Concern that motorists may go on the signal' and 'Found the junction to be confusing'. However results from the M18 Trial (same pole) suggest that motorists would not go on an early release. [F10.d.] - There was a statistically significant increase in the proportion of cyclists who said they noticed the difference between the shorter and longer early releases (37% compared with 25% in the trial where the signals were on the same pole). [F10.e.] - About 20% of cyclists said that the difference affected the way they went through the junction, with those who commented feeling safer and more at ease with a longer early release. Both cyclists and car drivers said that having the signals on separate poles made the early release more obvious.

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
		[F10.f.] - Similar to the trial with no early release, 68% of cyclists and 80% of car drivers thought that the layout of the LLCS was 'about right'.
RQ3 / RQ11 – What attitudes did people have towards the LLCS and new layout?	[F3.a.] - 90% of all participants thought cyclists on the road would benefit from the LLCS and 30% of motorcyclists felt that scooter riders and motorcyclists would also benefit as the LLCS are easier for them to see when waiting at the junction. [F3.b.] - Improved visibility and a clearer direction for cyclists were perceived to be the key benefits. The LLCS were perceived to be useful to other road users, because they helped them better understand cyclists' actions. [F3.c.] - The majority of cyclists (89%), car drivers (68%) and motorcyclists (54%) were positive in their comments about the signals. Most HGV drivers were either positive (42%) or neutral (42%). [F3.d.] - Over 65% of participants in each road user group thought the height of the signals (1.4 metres) was about right and over 55% thought the angle of the LLCS (15 degrees) was about right. [F3.e.] - Almost all of the cyclists (97%) and over 70% of car drivers, motorcyclists, HGV drivers and pedestrians thought the size of the cycle reservoir was about right. [F3.f.] - The most common suggestions for improvements were to make the signals brighter and provide an early release for cyclists, and to provide more information on the LLCS for all users. This was particularly mentioned by	[F11.a.] - 80% of cyclists and car drivers felt the LLCS were at about the right height whilst 65% of cyclists and 90% of car drivers thought the angle was 'about right'. This was similar to the separate poles trial with no early release.

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	pedestrians.	
RQ4 / RQ12 – Did the LLCS and new layout affect what people looked at?	[F4.a.] - LLCS were the most important piece of information for cyclists entering the junction. [F4.b.] - Significantly more cyclists, car drivers and motorcyclists said they looked at the LLCS in the trial where the signals were located on separate poles than did the participants in the trial where the signals were on the same poles. [F4.c.] - Significantly more car drivers said they looked at the secondary signals when waiting to go straight on or turn right (83% and 79% compared with 61% and 63% in the same pole trial). Some suggested that they looked at the secondary signal instead of the main signals, because the main signals were obscured from their view. [F4.d.] - Compared with the M14 Trial, significantly fewer motorcyclists in the M19a Trial reported looking at the near-side main signals when turning left (62% compared with 87%) and turning right (26% compared with 47%). One motorcyclist suggested that it was difficult to see the near-side main signal from the first stop line. [F4.e.] - When compared with the M14 Trial, fewer car drivers in the M19a Trial reported that the main signals were the most important piece of information when waiting at the junction. Between 20% and 30% of car drivers thought that the near-side main signals were most important when turning left compared with around 60% in the previous trial.	[F12.a.] - The LLCS were the most important piece of information for between 50% and 85% of cyclists (depending on the manoeuvre). This was a result of the early release, although having the LLCS on a separate pole to the main signals also had an additional effect but to a lesser extent. [F12.b.] - Car drivers said they looked more at the near-side LLCS and less at the near-side main signals during the trials where an early release was experienced. They said they looked at the secondary signals more when the LLCS were on separate poles. [F12.c.] - The main and secondary signals were the most important piece of information to car drivers, with less than 25% saying the LLCS were the most important when the LLCS were located on separate poles.

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	[F4.f.] - Pedestrians said they looked at the pedestrian signals and the main traffic signals more than the LLCS, which overall were not considered to be as important. [F4.g.] - Two pedestrians said they could not see the LLCS from the pavement. This led to a concern that they might try to cross when the main signal was red but the LLCS was green.	
RQ5 / RQ13 – Did the LLCS and new layout affect compliance: i) whether cyclists stopped at a red light; ii) where people waited?	[F5.a.] - There was no difference in the compliance of cyclists with the red signal between the same pole trial and the separate poles trial. [F5.b.] - In all trials the observed compliance with the cycle reservoir was substantially higher than values that have been observed on-street in other studies; the absolute values of compliance would not be expected to be reproduced in the real world, but it is likely the direction of the change would. [F5.c.] - The trials with the separate poles were associated with an improvement in compliance of motorists stopping before the stop line. Specifically in the scenarios with no controlled cyclists in front, the proportion stopping within the reservoir decreased from: 5.6% to 1.8% in the car trial; 4.7% to 0.7% in the motorcycle trial; and 10.1% to 0% in the HGV trial, all of which were statistically significant decreases. [F5.d.] - There was a small statistically significant decrease in the proportion of cars that stopped with their bumper more than 1.25m into the reservoir; this was from 1.5% to	[F13.a.] - There were no consistent trends in the proportion of cyclists who went through the junction on a red signal in the different early release scenarios between the same pole trial and the separate poles trial. [F13.b.] - Excluding the first session, there was an increase in the proportion of observations where the cyclist stopped before the cycle reservoir in the separate poles trial (M19b), compared against the same pole trial (M18); this was from 0.1% to 4.7% in the scenario with no car and from 0% to 3.9% in the scenario with the car behind. This was likely due to the sample rather than an effect of the early release: two cyclists said they didn't understand the reservoir and so didn't stop inside it. [F13.c.] - There was a very high level of compliance (98.5%) with the reservoir by car drivers, which was a similar level of compliance to previous trials.

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	0% in the trial with no cyclist and from 1.1% to 0% in the trial with a cyclist in front. Although only a small change, this was an indicative effect that suggests the location of the main signals deterred the car drivers from stopping far into the reservoir. [F5.e.] - In the questionnaires and focus groups, some cyclists explained that they didn't notice the reservoir on their first few passes through the junction and stopped before the reservoir, but once they realised it was there they all stopped in it. [F5.f.] - In the separate poles trial in the scenario with no car, there was a significant reduction in the proportion of cyclists waiting with their front wheel beyond the second stop line, from 8.4% to 3.1%, excluding the first session. [F5.g.] - On some approaches, the separate pole was associated with a shift to the left in cyclists' stopping position when they were turning left or going straight on, bringing them closer to the LLCS.	
RQ6 / RQ14 – Did the LLCS and new layout affect how people moved off as the signals changed to	[F6.a.] - There was a small statistically significant increase in the average Reaction Time of the cyclists; this was from 1.3 seconds in the same pole trial to 2.0 seconds in the separate poles trial in both the scenario with and without a controlled car behind them. This may suggest that the cyclists were less rushed in the trial with the signals mounted on the separate poles. [F6.b.] - There was also a statistically significant increase in the average Entry Time of the cyclist; this was from 2.8 seconds in the same pole trial to 3.4 seconds in the	[F14.a.] - The separate poles resulted in a statistically significant decrease in cars moving before the starting amber, from 3.1% (same pole trials) to 0.3%, pooled across all early releases. [F14.b.] - Similar to the same pole trial with early release, in the separate poles trial with an early release, 8% of car drivers said that on normal roads they would go on an early release and 14% responded 'it depends' (compared with less than 5% and 10% respectively).

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
green?	separate poles trial in the scenario with no car and from 2.9 seconds to 3.4 seconds in the scenario with a controlled car behind. [F6.c.] - There were no significant differences in the average Reaction Time of the car drivers between the same pole and separate poles trials. [F6.d.] - There was a statistically significant increase in the average Entry Time of the cars; this was from 5.1 seconds in the same pole trial to 6.0 seconds in the separate poles trial in the scenario with no cyclist and from 6.4 seconds to 6.8 seconds in the scenario with a controlled cyclist in front. This was likely explained by some car drivers stopping further back from the stop line in order to be able to see the main signals. [F6.e.] - In the trials with no early release, both with signals on the same pole and separate poles, there were no observations where the cyclist turned right in front of the oncoming car.	[F14.c.] - The average Reaction Times for the car drivers were around half a second slower in the separate poles trial compared to the same pole trial. [F14.d.] - Moving the main signals to the first stop line gave the cyclist an additional one-second time advantage on average to enter the junction ahead of the car. This was similar for the different durations of the early release. [F14.e.] - Positioning the LLCS on a separate pole from the main signals did not affect the proportion of observations where the cyclist turned right in front of the oncoming car, compared to the 'same poles' trial. [F14.f.] - Similar to the findings in the trial with the LLCS on the same pole as the main signals, in the 'separate poles' trial a longer early release resulted in a larger proportion of observations where the cyclist turned right in front of the oncoming car; this was 24%, 52%, 46% and 71% for the 2, 3, 4 and 5 second early release scenarios, respectively.
RQ7 – Did the LLCS and new layout affect how pedestrians crossed the road?	[F7.a.] - For the separate poles trial compared against the same pole trial, there were statistically significant increases in the proportion of observations where the pedestrian crossed before they reached the crossing. This was the case at all four arms of the junction: Arm A: 3% to 21% (Controlled – one way road) Arm B: 15% to 26% (Controlled with island) Arm D: 2% to 19% (controlled – no island) Arm C: 4% to 21% (uncontrolled crossing). [F7.b.] - The findings for the location where pedestrians	

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	started to cross were similar whether a cyclist was present or not. [F7.c.] - Of those pedestrians who crossed through the cycle reservoir, most understood the purpose of the cycle reservoir, although a small minority (8% of all participants) said they did not notice them when crossing and mistakenly crossed in the reservoir and said the junction layout and 'road construction' contributed to this. [F7.d.] - The focus group participants indicated that the LLCS had little effect on their decision when to cross (compliance with the Red Man).	
RQ8 / RQ15 – Did the LLCS and new layout affect perceived safety?	[F8.a.] - The majority of cyclists (about 93%) perceived the junction to be 'safer' or 'much safer' than an ordinary junction. [F8.b.] - The majority of car drivers (about 95%) perceived the junction to be either 'safer', 'much safer' or no different and 'easier, 'much easier', or no different from an ordinary junction; however only 10% specifically mentioned the LLCS in terms of safety. In the focus group it was agreed that it was the combination of the cycle reservoir and the LLCS that made it feel safer. [F8.c.] - The majority of motorcyclists (75% and 54%) and HGV drivers (60%) perceived there to be no difference between the safety and ease of using the trial junction and an ordinary junction. [F8.d.] - Compared with the trial where the LLCS and main signals were on the same pole, significantly more	[F15.a.] - The majority of cyclists (about 90%) felt that the trial junction was 'easier' or 'much easier' and 'safer' or 'much safer' to use than an ordinary junction. [F15.b.] - 3% of cyclists felt that the junction was more difficult to use. There was concern from two cyclists that cyclists would begin to rely more on the LLCS and less on road sense. [F15.c.] - Of those cyclists who mentioned the LLCS, 63% specified the early release as the reason for the junction feeling safer (similar to the M18 Trial). [F15.d.] - The majority of car drivers (between 60% and 70% of car drivers) felt that the trial junction was 'easier' or 'much easier' and 'safer' or 'much safer' to use than an ordinary junction. [F15.e.] - There were 10% of car drivers who said the junction felt more difficult to use and one car driver (2%)

Question	M19a Trial (separate poles with no early release)	M19b Trial (separate poles with early release)
	pedestrians (20%) felt the junction was 'more unsafe' or 'much more unsafe', because of concerns that the LLCS were not positioned well for pedestrians, making it unclear when it is safe to cross.	said the junction felt more unsafe. [F15.f.] - Of those car drivers who mentioned the LLCS, about 40% said it was the early release that made them feel safer. One car driver said they felt less safe as there was the potential for car drivers to be distracted by the LLCS and move into the junction early. [F15.g.] - When asked about the safety of the junction in the M19b trial, 3% of cyclists and 3% of car drivers specifically mentioned the separate poles; most of these comments were positive to say that the layout of signals was clear and helped to reinforce the cycle reservoir.

Appendix B Further details on methodology

B.1 Sample size

Table B-1 shows the sample size collected for the cycle trial and car trial. There was a target of 40 observations (for each manoeuvre) for cyclists and 25 observations for car drivers.

Table B-1 – Cycle trial and car trial: collected sample size

User group	Vehicles	Arm/Turn		No early release (M19a)	With early release (M19b)				
					2 secs	3 secs	4 secs	5 secs	All early release scenarios
Cyclist	Participant cyclist, no car	A	Left	37	45	42	42	44	173
			Right	32	43	40	41	41	165
		B	Left	34	43	42	40	42	167
			Straight	36	41	44	40	46	171
		C	Left	35	41	43	41	44	169
			Right	32	41	42	41	44	168
		D	Straight	31	41	46	39	47	173
			Right	31	43	40	38	41	162
			Total	268	338	339	322	349	1348
	Participant cyclist, car behind	A	Left	41	44	43	45	45	177
			Right	41	44	42	45	45	176
		B	Left	41	43	42	44	45	174
			Straight	42	45	44	45	45	179
		C	Left	42	46	42	44	45	177
			Right	41	44	44	47	44	179
		D	Straight	40	43	43	44	45	175
			Right	37	43	44	44	42	173
			Total	325	352	344	358	356	1410
Car driver	Participant car driver, no cyclist	A	Right	85	46	45	45	41	177
		B	Left	42	25	22	24	21	92
			Straight	44	23	24	24	21	92
		C	Left	42	24	23	24	20	91
			Right	43	24	23	24	22	93
		D	Straight	44	24	24	26	22	96
			Right	41	24	22	22	20	88
			Total	341	190	183	189	167	729
	Participant car driver, cyclist in-front	A	Right	72	48	42	44	44	178
		B	Left	35	23	21	23	22	89
			Straight	36	25	21	25	22	93
		C	Left	37	23	22	23	22	90
			Right	33	24	20	24	22	90
		D	Straight	35	24	21	24	22	91
			Right	36	24	21	24	22	91
			Total	284	191	168	187	176	722

Table B-2 shows the sample size collected for the motorcycle, HGV and pedestrian trials.

Table B-2 – Motorcycle, HGV and pedestrian trial: collected sample size

User group	Vehicles	Arm/Turn		No early release (M19a)
Motorcyclist	Participant motorcyclist, car behind, no cyclist	A	Left	19
			Right	19
		B	Left	19
			Straight	19
		C	Left	18
			Right	20
		D	Straight	20
			Right	18
			Total	152
	Participant motorcyclist, no car, cyclist in-front	A	Left	21
			Right	18
		B	Left	20
			Straight	20
		C	Left	16
			Right	16
		D	Straight	20
			Right	19
			Total	150
HGV driver	Participant HGV driver, no other vehicles	A	Straight	70
		B	Straight	70
		D	Straight	69
			Total	209
Pedestrian	Controlled crossing at junction	A		125
		B		125
		D		125
	Puffin crossing	LLCS side		125
		Pedestrian side		125
	Uncontrolled crossing at junction	C		125
		Total		750

Appendix C Further analysis of video data

This section presents more detailed results for the stopping behaviour of participants in the M19 trials; see Sections 3.5 and 4.5 of the main report for the summary analysis

C.1 Longitudinal stopping position

C.1.1 Cycle trial

Table C-1 shows the longitudinal stopping position of the cyclists for all the cycle trials, split by session.

Table C-1 - Cycle trial: longitudinal stopping position relative to the cycle reservoir, by location of signals, early release and session (video data)

Session	Participant group	Junction layout	Early release	Before reservoir	Within reservoir	0-1m after reservoir	More than 1m after reservoir	Sample size
1st session	Participant cyclist (no car)	Same pole	No early release (M14)	0.4%	93.9%	4.8%	0.9%	228
			With early release (M18)	1.6%	94.0%	4.2%	0.2%	432
		Separate poles	No early release (M19a)	4.7%	94.4%	0.9%	0.0%	107
			With early release (M19b)	14.1%	83.5%	1.5%	0.9%	468
	Participant cyclist (car behind)	Same pole	No early release (M14)	0.6%	96.0%	3.4%	0.0%	176
			With early release (M18)	1.0%	95.2%	3.8%	0.0%	520
		Separate poles	No early release (M19a)	5.7%	92.4%	1.0%	1.0%	105
			With early release (M19b)	11.1%	87.8%	1.1%	0.0%	451
2nd and 3rd sessions	Participant cyclist (no car)	Same pole	No early release (M14)	0.4%	91.2%	8.4%	0.0%	239
			With early release (M18)	0.1%	91.6%	7.9%	0.4%	844
		Separate poles	No early release (M19a)	0.0%	96.9%	3.1%	0.0%	161
			With early release (M19b)	4.7%	92.4%	3.0%	0.0%	880
	Participant cyclist (car behind)	Same pole	No early release (M14)	0.5%	94.6%	5.0%	0.0%	221
			With early release (M18)	0.0%	92.8%	7.0%	0.1%	853
		Separate poles	No early release (M19a)	0.0%	96.4%	3.2%	0.5%	220
			With early release (M19b)	3.9%	91.7%	4.4%	0.1%	959
All sessions	Participant cyclist (no car)	Same pole	No early release (M14)	0.4%	92.5%	6.6%	0.4%	467
			With early release (M18)	0.6%	92.4%	6.7%	0.3%	1276
		Separate poles	No early release (M19a)	1.9%	95.9%	2.2%	0.0%	268
			With early release (M19b)	7.9%	89.3%	2.4%	0.3%	1348
	Participant cyclist (car behind)	Same pole	No early release (M14)	0.5%	95.2%	4.3%	0.0%	397
			With early release (M18)	0.4%	93.7%	5.8%	0.1%	1373
		Separate poles	No early release (M19a)	1.8%	95.1%	2.5%	0.6%	325
			With early release (M19b)	6.2%	90.4%	3.3%	0.1%	1410

C.1.2 Car, Motorcycle and HGV trials

Table C-2 presents the full results of the longitudinal stopping position of motorists, classified into six zones: 'Before reservoir', '0 to 1.25m into reservoir', '1.25 to 2.5m into reservoir', '2.5 to 3.75m into reservoir', '3.75 to 5m into reservoir', 'After reservoir'.

Table C-2 - Car trial, motorcycle trial and HGV trial: longitudinal stopping position relative to the cycle reservoir, by location of signals (video data)

Participant group	Trial	Location of signals	Before reservoir	0 to 1.25m into reservoir	1.25 to 2.5m into reservoir	2.5 to 3.75m into reservoir	3.75 to 5m into reservoir	After reservoir	Sample size
Participant car driver (no cyclist)	M14	LLCS Covered	93.8%	4.6%	1.0%	0.0%	0.0%	0.5%	194
		Same pole	94.4%	4.1%	1.0%	0.5%	0.0%	0.0%	195
	M19a	Separate poles	98.2%	1.8%	0.0%	0.0%	0.0%	0.0%	341
Participant car driver (cyclist in front)	M14	LLCS Covered	97.8%	1.6%	0.0%	0.0%	0.5%	0.0%	183
		Same pole	98.4%	0.5%	0.0%	1.1%	0.0%	0.0%	186
	M19a	Separate poles	98.9%	1.1%	0.0%	0.0%	0.0%	0.0%	284
Motorcyclists (car behind)	M14	LLCS Covered	93.6%	3.5%	0.0%	0.0%	3.0%	0.0%	202
		Same pole	95.3%	3.0%	0.0%	0.0%	1.7%	0.0%	233
	M19a	Separate poles	99.3%	0.7%	0.0%	0.0%	0.0%	0.0%	152
Motorcyclists (cyclist in front)	M19a	Separate poles	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	160
HGV drivers (no other vehicles)	M14	LLCS Covered	96.9%	3.1%	0.0%	0.0%	0.0%	0.0%	130
		Same pole	89.9%	10.1%	0.0%	0.0%	0.0%	0.0%	129
	M19a	Separate poles	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	209

Figure C-1 shows the proportion of observations where the motorist stopped more than 1.25 metres past the reservoir entrance; i.e. this excludes those observations where there was only a minor encroachment.

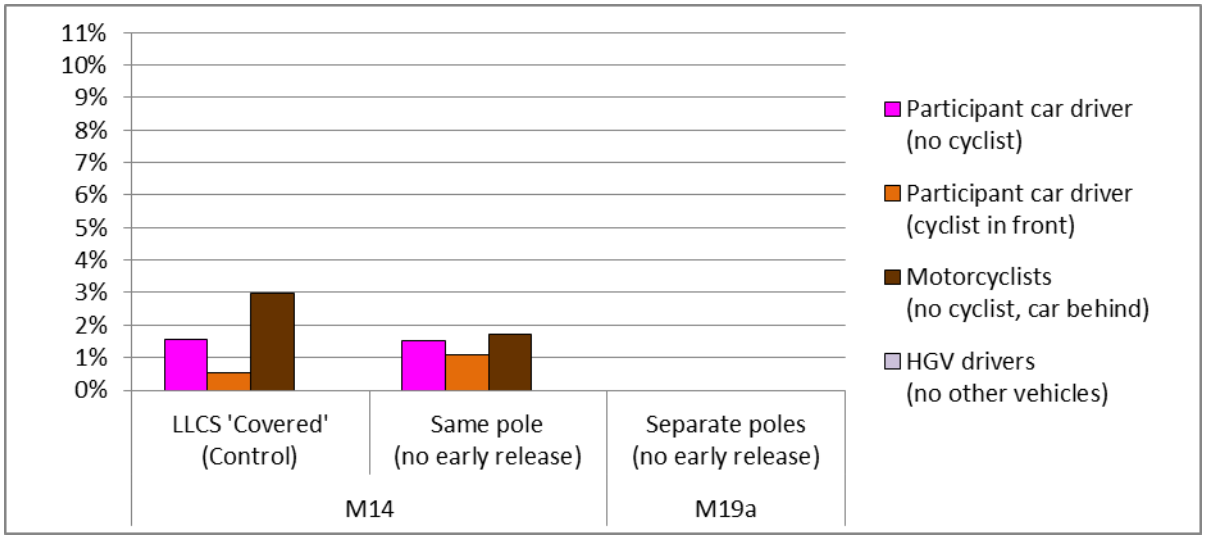

Figure C-1: Car trial, motorcycle trial and HGV trial: proportion of observations where the participant stopped more than 1.25m past the cycle reservoir entrance, by location of signals (video data)

Table C-3 presents the results of the longitudinal stopping position of car drivers in the trials with an early release.

Table C-3 – Car trial: longitudinal stopping position relative to the cycle reservoir, by location of signals and early release (video data)

Participant group	Location of signals	Early release	Before reservoir	0 to 1.25m into reservoir	1.25 to 2.5m into reservoir	2.5 to 3.75m into reservoir	3.75 to 5m into reservoir	After reservoir	Sample size
Participant car driver (no cyclist)	Same pole	No early release (M14)	94.4%	4.1%	1.0%	0.5%	0.0%	0.0%	195
		Early release (M18)	98.2%	1.8%	0.0%	0.0%	0.0%	0.0%	679
	Separate poles	No early release (M19a)	98.2%	1.8%	0.0%	0.0%	0.0%	0.0%	341
		Early release (M19b)	98.5%	1.5%	0.0%	0.0%	0.0%	0.0%	729
Participant car driver (cyclist in front)	Same pole	No early release (M14)	98.4%	0.5%	0.0%	1.1%	0.0%	0.0%	186
		Early release (M18)	99.6%	0.3%	0.1%	0.0%	0.0%	0.0%	671
	Separate poles	No early release (M19a)	98.9%	1.1%	0.0%	0.0%	0.0%	0.0%	284
		Early release (M19b)	98.5%	1.4%	0.0%	0.1%	0.0%	0.0%	722

C.2 Lateral stopping position

C.2.1 Cycle trial

Figure C-2 shows the lateral stopping position of the cyclists broken down by arm, turning movement and LLCS scenario.

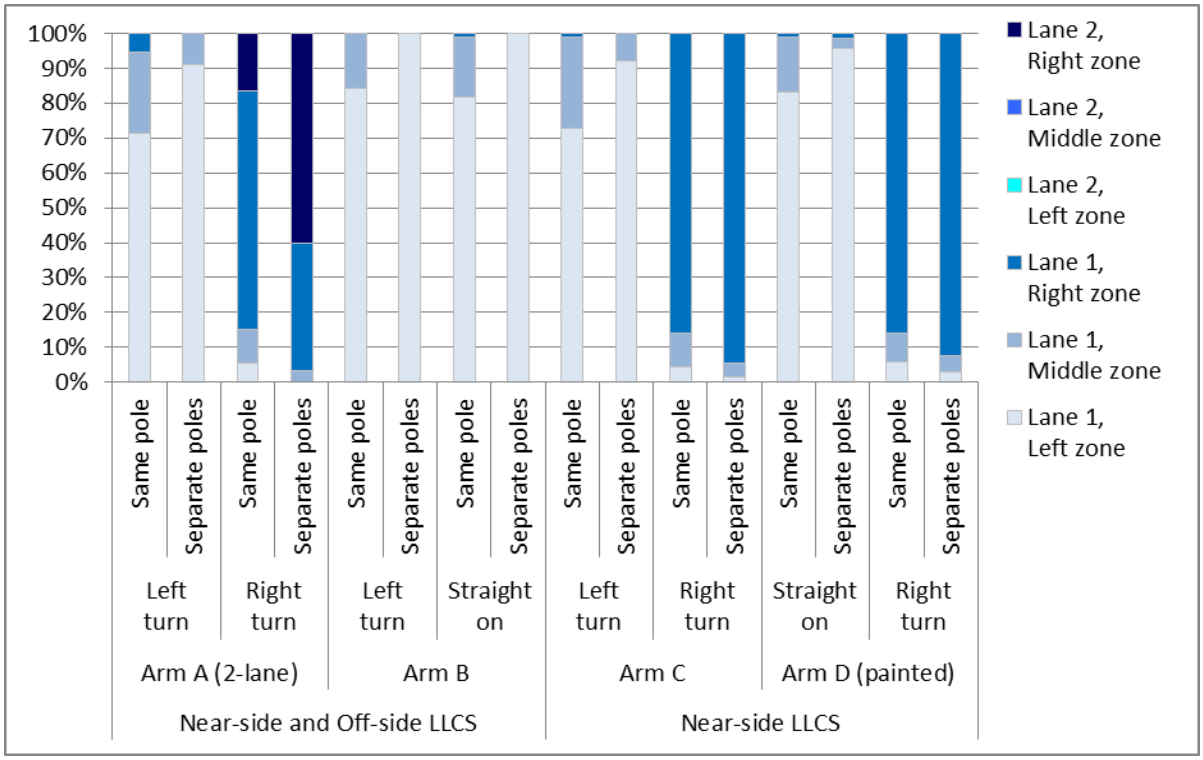

Figure C-2 – Cycle trial: lateral stopping position in lane, by location of signals, turning movement and junction layout (video data)

C.3 Red light compliance

C.3.1 Cycle trial

Table C-4 shows the proportion of observations where a participant cyclist went through the junction while the signal was still on red, split by the LLCS early release scenarios.

Table C-4 – Cycle trial: number of observations where the cyclist was non-compliant with a red signal (video data)

Trial	Junction layout scenario	Early release scenario	Non-compliant observations	Total observations	Percentage non-compliant
M18 (early release)	Same pole	2 secs	6	668	0.9%
		3 secs	14	717	2.0%
		4 secs	5	711	0.7%
		5 secs	16	686	2.3%
		All early release scenarios	**41**	**2782**	**1.5%**
M19b (early release)	Separate poles	2 secs	2	710	0.3%
		3 secs	7	698	1.0%
		4 secs	1	698	0.1%
		5 secs	1	710	0.1%
		All early release scenarios	**11**	**2816**	**0.4%**

C.4 Pedestrian trial

C.4.1 Where pedestrians started crossing

The analysis on where pedestrians started crossing was broken down by whether there was a cyclist present as the pedestrian passed 5m before the crossing, as shown in Figure C-3. This shows that the findings for the location where pedestrians started to cross were similar whether a cyclist was present or not.

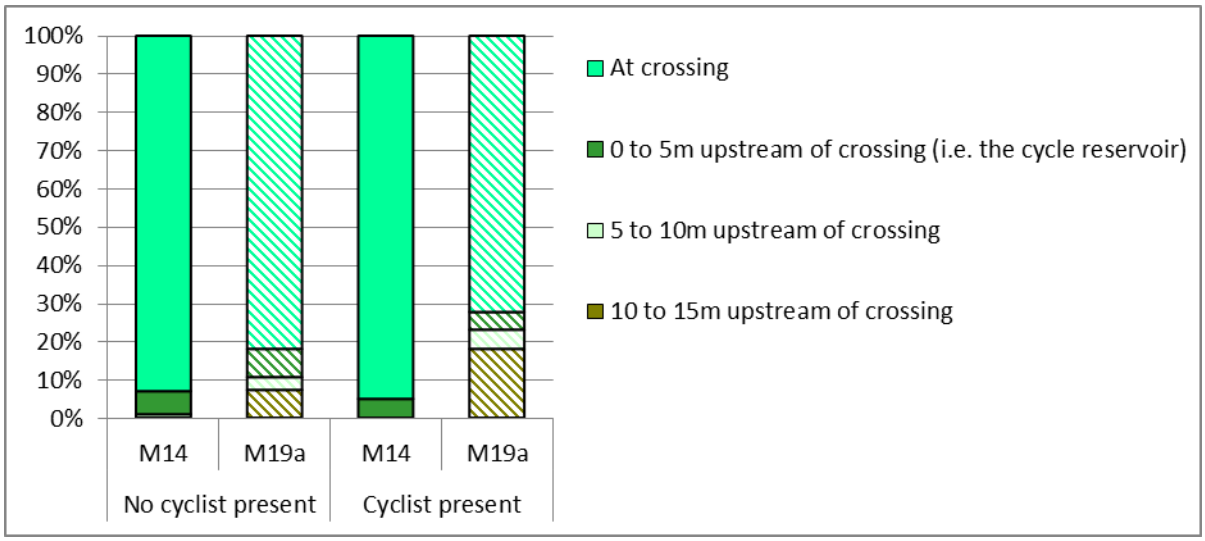

Figure C-3 – Pedestrian trial, pooled for all four crossings at the junction: zone where pedestrians started to cross, by location of signals and whether a cyclist was present (video data)

Figure C-4 shows where the pedestrians stepped into the road for the two approaches at the standalone Puffin crossing.

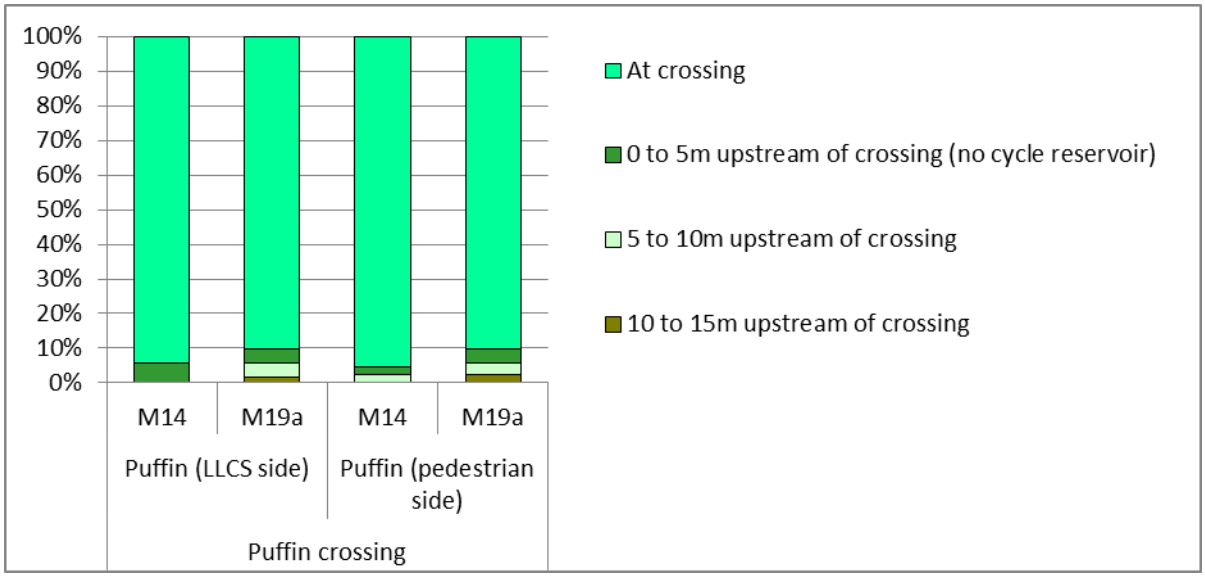

Figure C-4 - Pedestrian trial, Puffin crossing: zone where pedestrians started to cross, by location of signals and crossing type (video data)

C.4.2 When pedestrians started crossing

Data was captured on when participants arrived at the crossing and when they crossed. Figure C-5 illustrates which pedestrian signal was showing when participants started to cross, filtered for those who arrived on a Red Man.

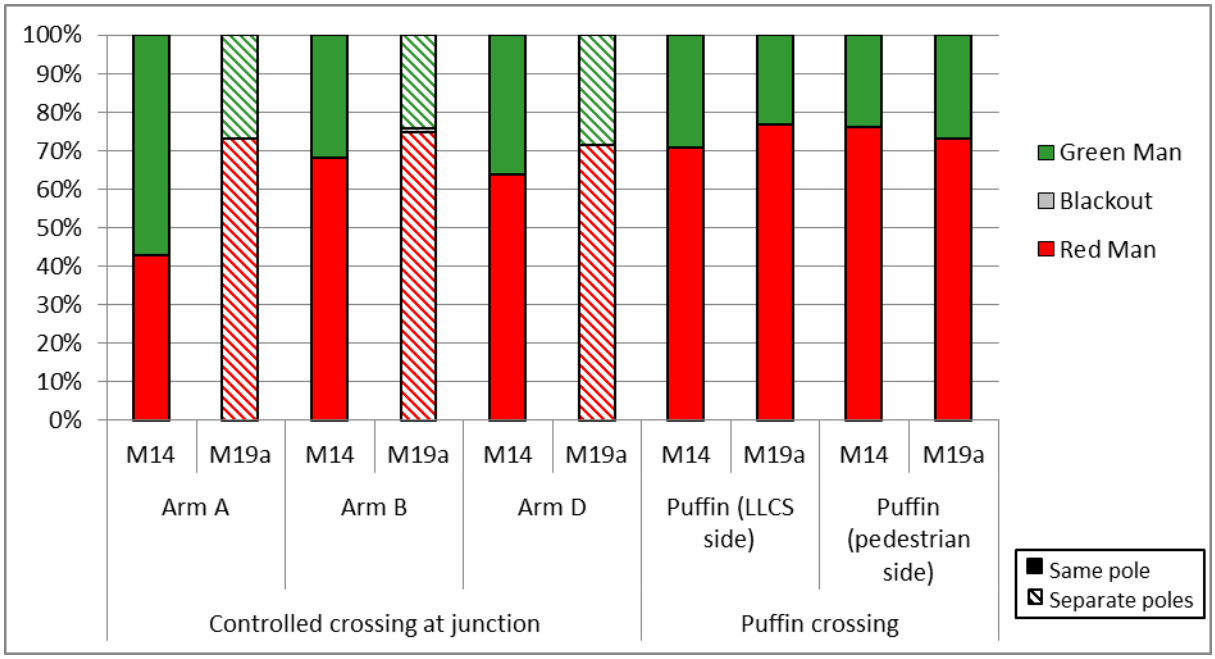

Figure C-5 - Pedestrian trial: signal showing when pedestrians started to cross (for those who arrived on a Red Man), by location of signals and crossing type (video data)

Appendix D Further analysis of questionnaire data (M19a Trial: no early release)

D.1 Introduction

Throughout this appendix, the following terminology has been used:

- 'M14 Trial' – Trials where the LLCS changed to green at the same time as the main signals; i.e. no 'early release'. Both signals were on the same pole, at the front of the cycle reservoir. Participants experienced the signals both covered and uncovered. In all graphs this trial is presented with a solid block.
- 'M19a Trial' – Trials where the LLCS changed to green at the same time as the main signals; i.e. no 'early release'. Participants experienced the LLCS at the front of the cycle reservoir and the main signals on a separate pole in line with the back of the cycle reservoir, which was set back 5 metres. In all graphs this trial is presented with diagonal lines.

D.2 The sample

D.2.1 Participant characteristics

D.2.1.1 Age

83% of participants were aged 25 to 74. The range of ages was similar between the two trials. Figure D-1 shows this.

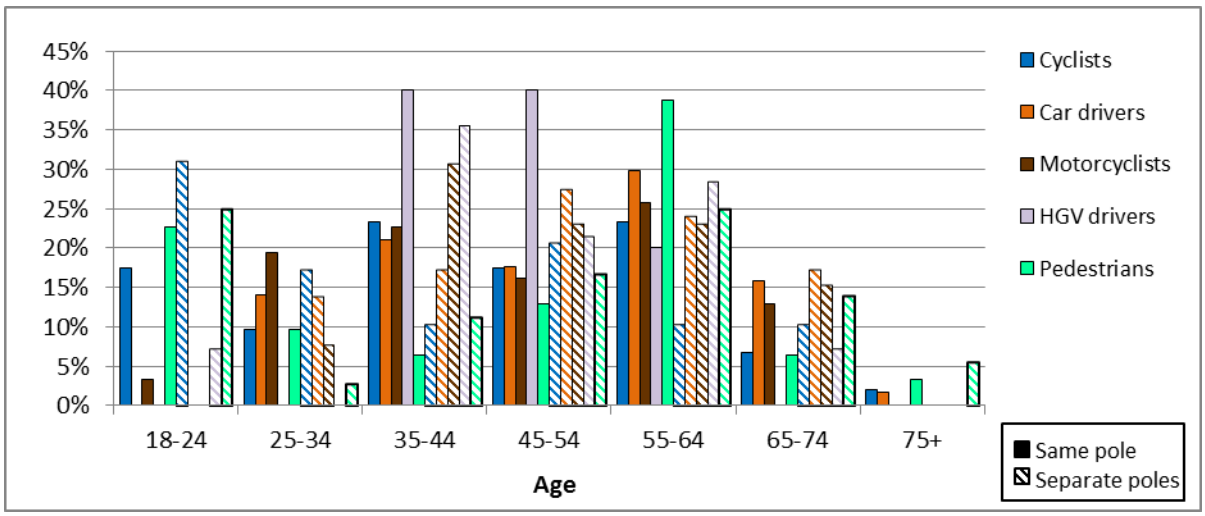

Figure D-1: Age characteristics

D.2.1.2 Gender

79% of the M19a cyclists were male, which was higher than in the M14 Trial. Females made up two thirds of the pedestrians, which was higher than in the M14 Trial. In both the M14 and M19a Trial the car drivers were fairly evenly split between men and women while motorcyclists and HGV drivers were all male. Figure D-2 shows this.

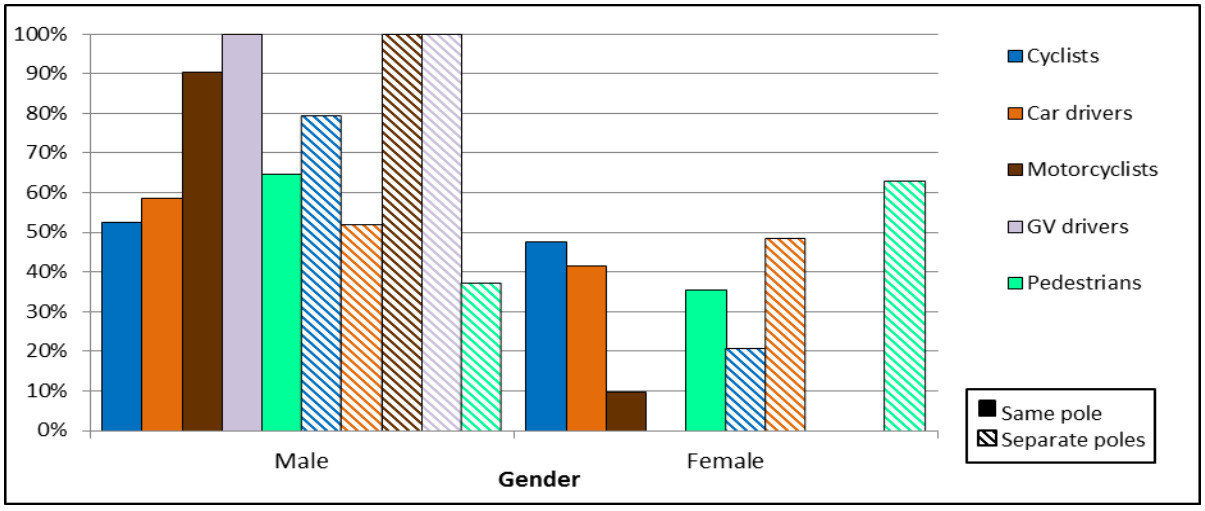

Figure D-2: Gender characteristics

D.2.1.3 Typical cycling journeys

Just over half of the M19a cyclist participants (53%) were not frequent cyclists, cycling less than once a week or not at all (see Figure D-3). This was higher than in the M14 Trial. Only a few of the car drivers (11%) and over 40% of the motorcyclists in the M19a Trial were frequent cyclists. A higher proportion of pedestrians were not frequent cyclists (over 80%) in the M19a Trial, compared to the M14 Trial.

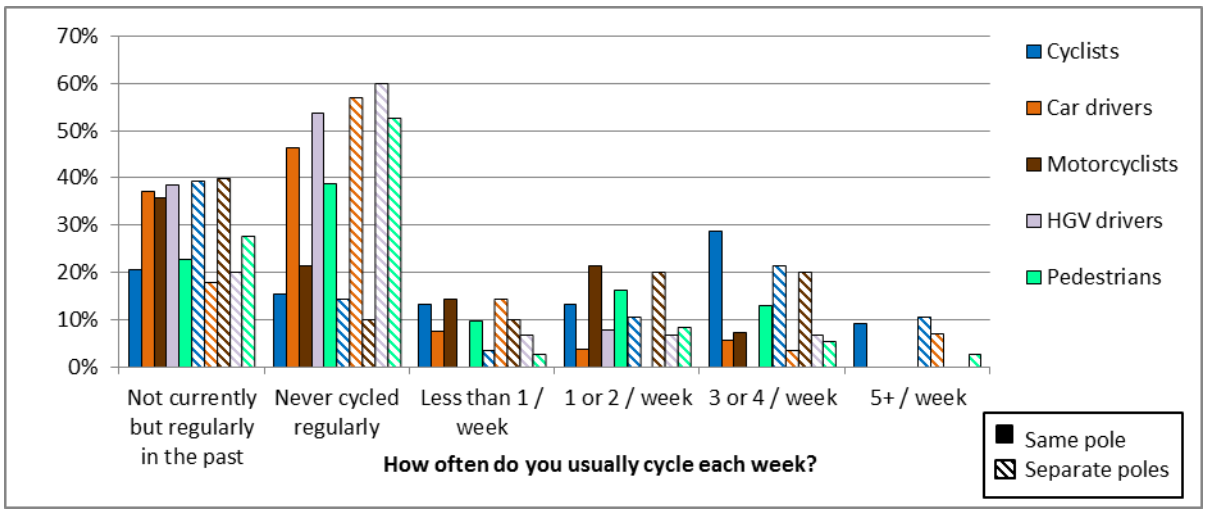

Figure D-3: Cycle frequency

When cycling, leisure journeys were the type of journey made most often by M19a participants, as was the case in the M14 Trial. The most common distance cycled by participant cyclists in the M19a Trial was 3 to 5 miles, compared with 5 miles or over in the M14 Trial. Fewer participant cyclists cycled over 5 miles compared with car drivers, motorcyclists and HGV drivers.

Compared with the M14 Trial, the types of journeys made by M19a cycling participants were similar in purpose and predominantly on road, but shorter in distance with only 23% cycling 5 miles or more (a decrease from 46% in the M14 Trial). About a third of M19a cyclists said they cycle in London at least once a month compared with only 7% in the M14 Trial.

The M14 and M19a participants drove a car about the same amount; they were generally frequent car drivers, driving at least once a week. 24% of cyclist participants said they never drive compared with 11% in the M14 Trial.

The M19a drivers' most common car journey purpose was for work (31%) followed by shopping and leisure. To work or education was the least common journey purpose in contrast with the M14 Trial when it was the most common journey purpose.

M19a drivers drove a similar mix of journey distances to M14 drivers, but fewer drove over 21 miles (7%, compared with 18%).

As in the M14 Trial, the M19a motorcyclists were mostly frequent motorcyclists riding at least once a week, with the most common journey purpose being for leisure. There was a slight increase in those riding motorcyclists for work or business.

Overall, the M14 and M19a participant characteristics were very similar. Where differences in the sample composition may have a bearing on results, further investigation has been conducted to ensure the results are related to the signals being set back and not due to the participant characteristics.

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. Results are shown in Figure D-4. In the M19a Trial, there was an increase in those cyclists who never use these types of junctions or use them less than once a week compared with the M14 Trial. This corresponds with the increase in infrequent cyclists in the M19a Trial.

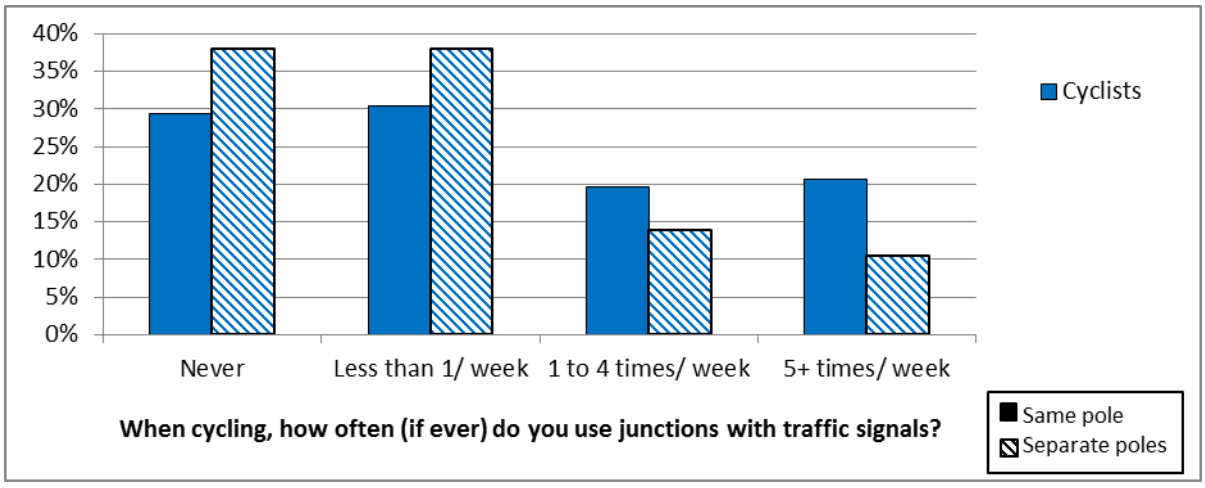

Figure D-4: Experience of junctions with traffic signals

The cyclists who said they used junctions with traffic signals (62%) were asked how often, if ever, they go through traffic signals when they are red. Over 80% said never, compared with less than 70% in the M14 Trial. 11% said 'some times' which was similar to the proportion in the M14 Trial. One M19a cyclist participant said they 'mostly' went through red lights compared with no M14 cyclist participants. The cyclists in the M19a Trial that said they went through red lights all cycled more than 5 times a week (however this sample was very small, only 3 people).

The most common reason for going through a red was when turning left. Other reasons given included going straight to get ahead of traffic; when there was no traffic; when the signals were about to change to green; in bad weather; and when there were no pedestrians at pedestrian crossings. The reasons for going through a red and amber signal were associated with turning left; bad weather; and when there were no pedestrians at pedestrian crossings.

D.2.2.2 LLCS

Participants were shown photographs of the LLCS. They were asked whether they had seen or heard of the signals before (see Figure D-5 for results). Generally, fewer M19a participants said that they have never seen the signals before, although there was a slight increase for car drivers compared with the M14 Trial. In the M19a Trial the proportion of car drivers who had never seen or heard about the signals was much higher than that for the other participants groups.

About a quarter of cyclists and a third of motorcyclists said they had seen them in another country as did a few car and HGV drivers. Compared with the M14 Trial, this is a decrease of 14% for car drivers, an increase of 18% for motorcyclists and similar for cyclists and HGV drivers.

The proportion of those who had seen them in the UK was higher compared with the M14 Trial, particularly for cyclists, up by 19%. These people may have been referring to media coverage about the trials or the signals on Toucan crossings.

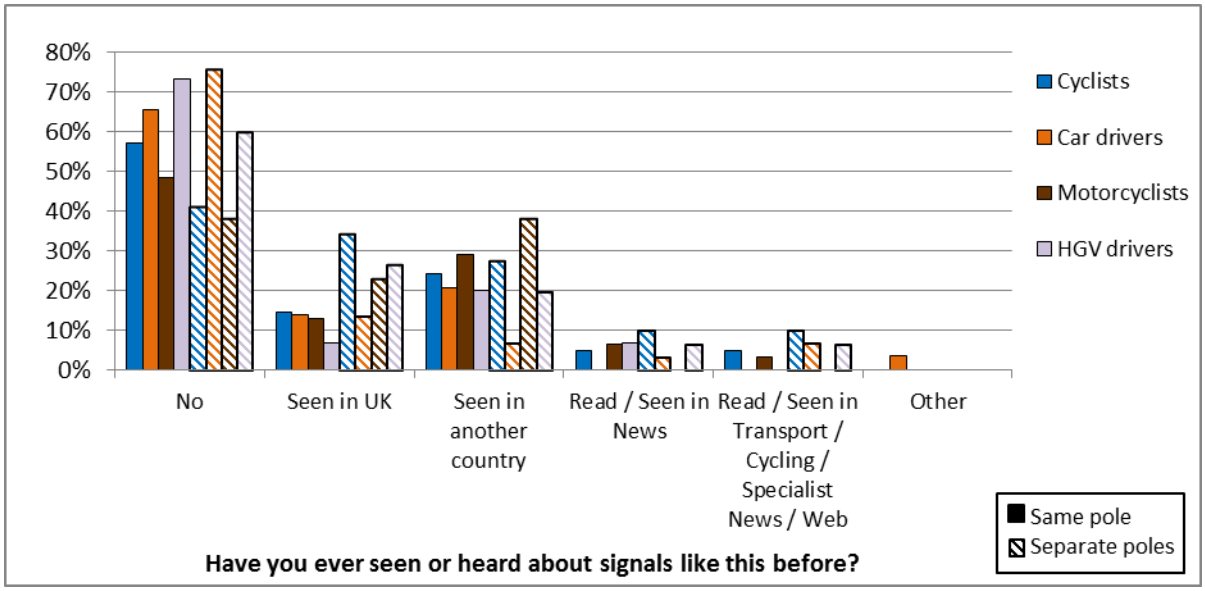

Figure D-5: Previous experience of LLCS

D.2.2.3 Cycle reservoirs

Participants were shown photographs of cycle reservoirs. They were asked whether they had seen such markings before and what the markings mean. As in the M14 Trial about 75% of cyclists and car drivers said they had seen them before and all motorcyclists had seen them before. Figure D-6 shows this.

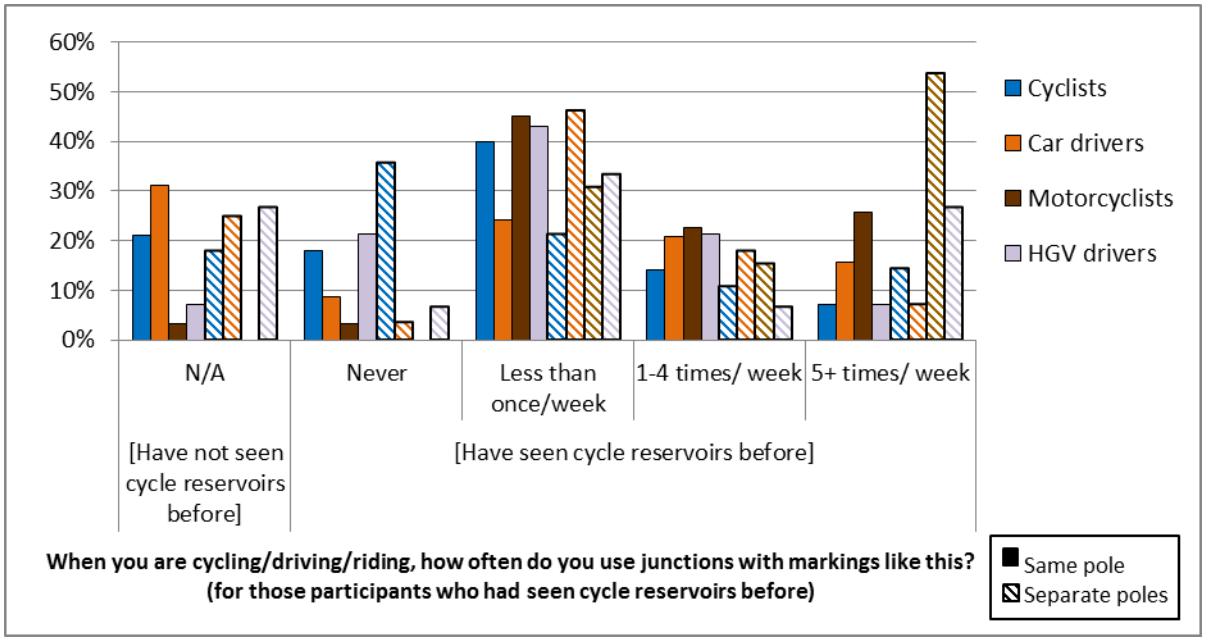

Figure D-6: How often participants use junctions with cycle reservoirs

Cyclists who said they use cycle reservoirs while cycling were then asked how often they enter the area with the cycle symbol while waiting for the signals to change. All cyclists said they waited in the cycle reservoir either 'every time' or 'most times' compared with 90% in the M14 Trial.

Car drivers and motorcyclists were asked the same question for situations with and without cyclists around, and the responses were similar in the M14 and M19a Trial, with slightly higher proportions of all modes in the M19a Trial saying they would 'never' stop inside the cycle reservoir area (see Figure D-7). However in the M19a Trial, motorcyclists said they 'often' or 'always' stop inside the cycle reservoir, more so when there are no cyclists around.

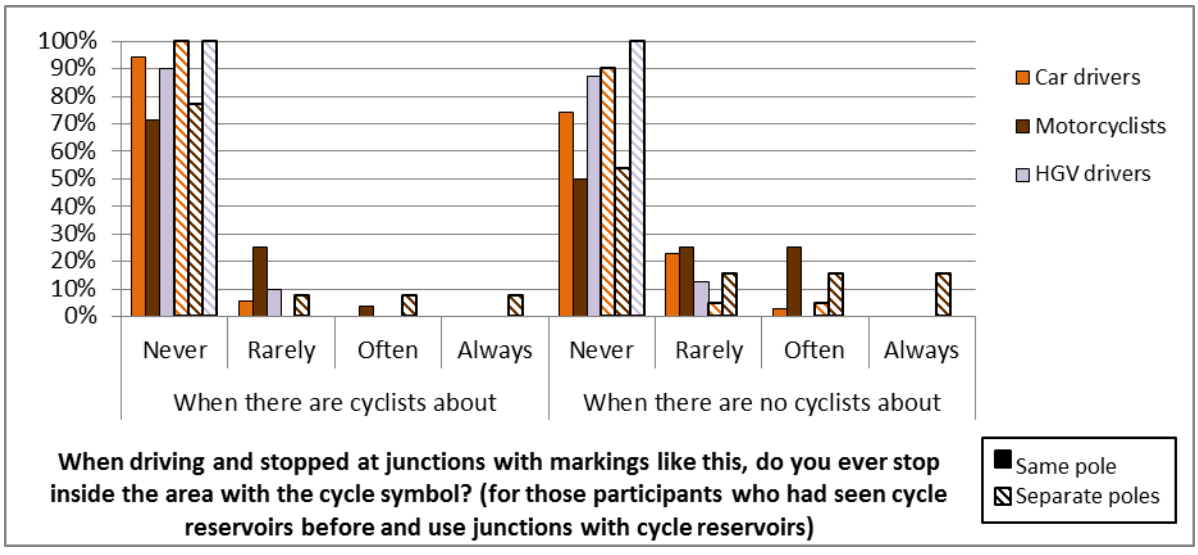

Figure D-7: Compliance of motorists with cycle reservoirs – normal driving

Several motorcyclists commented that it would depend on the number of cyclists present:

"I know the lane is for push cycles only but still use it as I am not in their way. If several cyclists present then I would stay out but if only one then I would probably join them."

"It would depend on the traffic at the time. If I could position the bike within and on the edge of the box with a cyclist about I probably would."

Motorcyclists and car drivers were also asked whether, if they saw a junction with signals and markings like those seen in the trial, they thought they would ever stop within the cycle reservoir. More M19a motorcyclists said they would not stop in the cycle reservoir than M14 motorcyclists; while responses by car drivers were similar in the M14 and M19a Trials. Figure D-8 shows this.

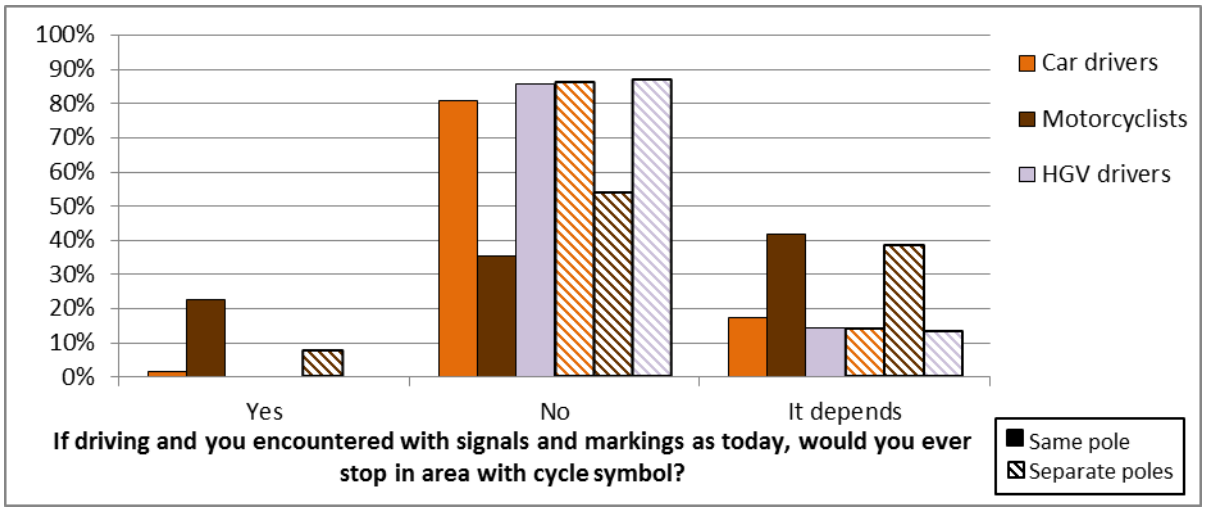

Figure D-8: Compliance of motorists with cycle reservoirs – with markings and signals as in the trial

The single M19a motorcyclist who said they would always stop in the cycle reservoir, acknowledged that it would depend on the number of cyclists present, avoiding the box if there were several cyclists already using it.

M19a motorcyclists who said stopping in the cycle reservoir would depend on the situation gave safety as a reason for doing so, i.e. to avoid an accident, but also said it would depend on the position of cyclists within the box. Similarly to M14 motorcyclists, filtering in heavy traffic was referred to.

"Filtering in London, use of ASL [cycle reservoir] can be safer dependent on position of cyclists, cars and road furniture."

The M19a drivers who said they might stop in the cycle reservoir also gave similar responses to M14 drivers, referring to queuing traffic. One M19a car driver said it would depend on the size of the box and how many cyclists were around.

D.2.3 Summary

The participant characteristics were fairly similar between the M14 and M19a Trials, with some variations. The main differences were that there were more male cyclists; fewer cyclists who cycled more than once a week; and fewer female pedestrians. Similarly to the M14 Trial, M19a car drivers, motorcyclists, HGV drivers and pedestrians generally cycled less frequently than the cyclists. Participants predominantly cycled on the road and fewer M19a participants cycled distances further than 5 miles. About a third of M19a

cyclists cycled in London at least once a month, slightly more than in the M14 Trial. When asked about cycling on normal roads, a minority of M14 and M19a cyclists admitted to sometimes going through a red signal. More cyclists in the M19a Trial had never used junctions with cycle reservoirs, 60% of these participants cycled less than once a week. More M19a car drivers used junctions with cycle reservoirs less than once a week and more M19a motorcyclists used them more than 5 times a week compared with the M14 Trial. Most participants indicated good levels of compliance with cycle reservoirs. A few motorcyclists said they often or always stop in cycle reservoirs; more so when there are no cyclists around.

D.3 Experiences from the trial

D.3.1 Understanding of the signals and the junction

D.3.1.1 Noticing the LLCS

Participants were asked how many runs through the junction they made before they noticed the LLCS. In the M14 Trial, most participants typically experienced one uncovered session and one covered session so a relative comparison could be made in the M14 report. In the M19 Trial, participants typically experienced three uncovered sessions. As such, it is not possible to make a fair comparison between the M14 Trial and M19 Trial in terms of how noticeable the LLCS were.

D.3.1.2 Understanding the LLCS

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

D.3.1.3 Views on the location of the LLCS on separate poles

Participants were asked to explain their answers. These are shown in Figure D-9.

Cyclists

One cyclist suggested that the LLCS allow cyclists to get a head start when the lights change. Although a different participant commented that it could be confusing with the LLCS just replicating the main traffic signals.

Two cyclists said it was uncomfortable looking so close when they are used to looking ahead or higher at main traffic signals. These participants suggested having the LLCS either nearer or on the same pole as the main traffic signals.

Statistical tests were carried out to understand whether participants who cycled more than once a week or cyclists who had used cycle reservoirs before affected these results. No effect was found.

Pedestrians

Two pedestrians stated that they could not see the traffic signals from the pavement:

> *"The cycle signal wasn't easy to spot and it was too low for pedestrians to see clearly."*

"The signal is not positioned to make it easy for pedestrians to see from the safe area of the pavement at the crossing."

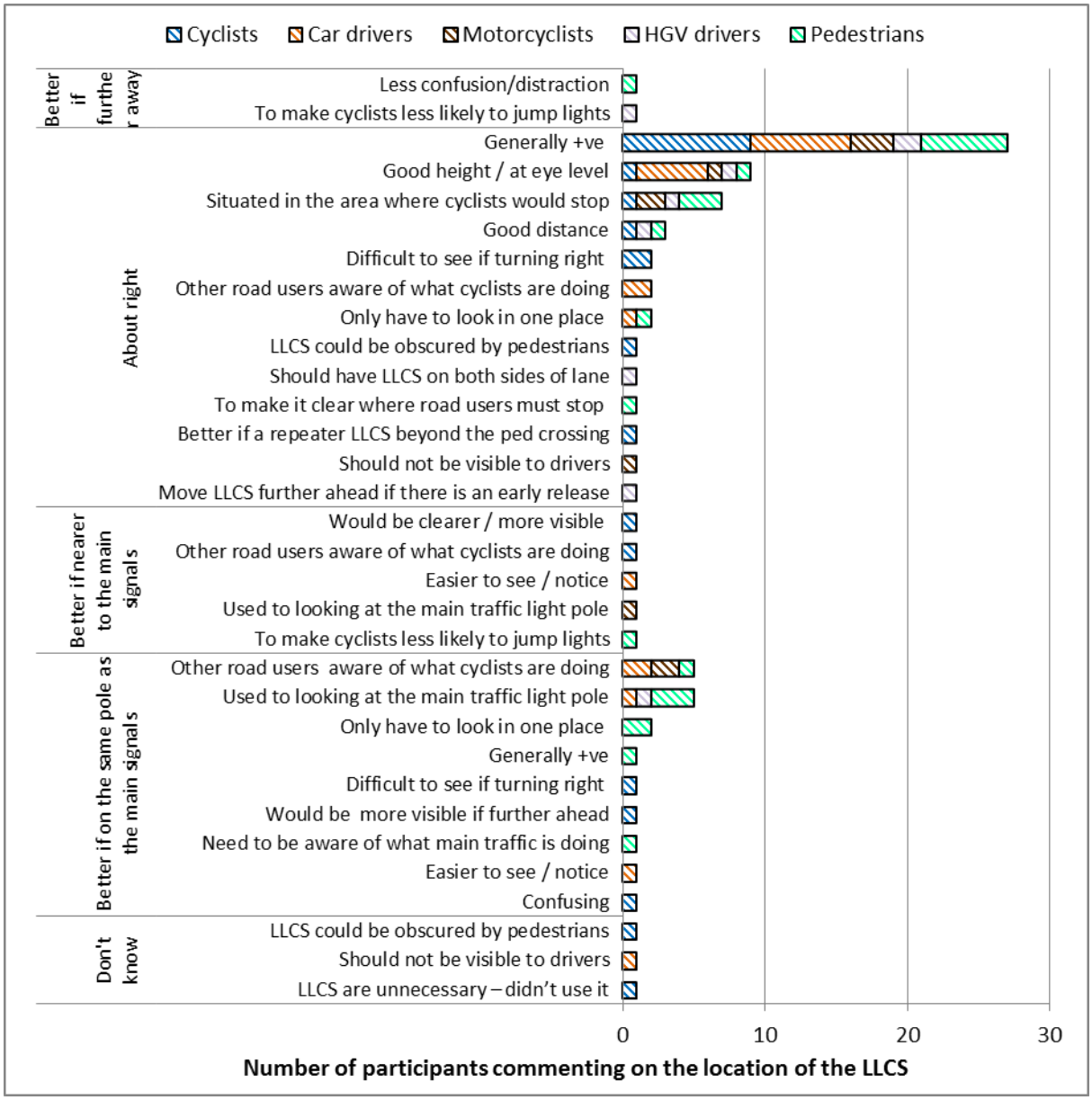

Figure D-9: Views on the separate poles

Views on the location of the LLCS are covered in greater detail in Section 3.2 in the main report.

D.3.2 Approaching the signals

D.3.2.1 Entering the cycle reservoir

Noticing the cycle reservoir

Noticing the cycle reservoir is covered in Section 3.5.2 in the main report

Understanding of the cycle reservoir

Understanding of the cycle reservoir is covered in Section 3.1.2 in the main report.

Effect of LLCS on stopping position

Participants were asked whether the LLCS affected their stopping position. The results for the M19a Trial were very similar to those for the M14 Trial, with the majority of participants saying they were never affected by the LLCS.

Participants were invited to comment on their answers and these cyclists gave similar responses to the participants in the M14 Trial, mostly about stopping in a position to see the signals, with some stating they could not see them when turning right:

> *"If turning right and in right side of box then really had to turn head to see lights as almost at 90 degree to me, so sometimes stopped bit further back from front of box so could see lights."*
>
> *"It is distracting to look to your left especially as angle of signals is away from you if you are on right side of the box. In everyday life I am used to looking at other signals ahead and higher so naturally look to those."*
>
> *"They were useful if turning left but if I was on the right side they were hard to see."*

Those car drivers that said the LLCS affected where they stopped explained that the LLCS reminded them of the presence of cyclists and that they stopped outside the cycle box. All motorcyclists and HGV drivers said the LLCS did not affect where they stopped as they were following the main traffic signals.

Results from the post-trial questionnaire suggest that one car driver stopped in the unpainted cycle reservoirs because they misunderstood their purpose. This participant understood that the green painted cycle reservoir was for cyclists only and therefore did not stop in this area. However, their comments suggest that they thought vehicles were permitted in the unpainted cycle reservoirs and therefore they did stop in these areas.

D.3.2.2 Compliance of other road users staying out of the cycle reservoir

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 car drivers, motorcyclists and HGV drivers in both the M14 and M19a Trials said they did not stop in the cycle reservoir; they generally explained this was because the area was for cyclists only. One motorcyclist said they did not stop in the cycle reservoir but would have normally done so:

> *"I knew I was being filmed so complied with [the] Highway Code otherwise I would have used them".*

One car driver and one motorcyclist said that they waited in the cycle reservoir 'every time'. The car driver commented:

"[I] noticed it first time and waited [in the box] every time waiting for lights to change." [Car driver][1]

Another car driver responded 'sometimes' saying that they did not stop in the green cycle reservoir.

Cyclists were asked whether having a car behind them ever affected their stopping position. 79% said 'never', 17% said 'sometimes' and 3% said 'every time'. This is very similar to the M14 responses. The majority said that they stopped in the cycle reservoir so the position of the car behind did not affect them. A couple of cyclists mentioned:

"It made me more wary when pulling away as the car pulled away at the same time."

"[I] would have stopped in the cycle area anyway but appreciated it more when a car was behind me."

Car drivers were asked whether having a cyclist in front of them affected their stopping position and the majority said 'never' (72%) as the cyclist stopped in the cycle reservoir and the car driver stopped at the line before it. Compared with the M14 Trial, the proportion of drivers saying that the cyclist sometimes affected their stopping position was 13% higher.

Reasons for this included:

"With the cyclist in front my actions were determined by his position or direction of travel."

"If [there were] cyclists about [I] would tend to stop nearer [the] centre of road."

"It sometimes made me stop further back."

Compliance of other road users staying out of the cycle reservoir is also covered in Section 3.5.2 in the main report.

D.3.2.3 Size of the cycle reservoir

Figure D-10 shows the views of participants regarding the size of the cycle reservoir.

[1] However, this car driver then reported that they never crossed the stop line before the signals changed to green which suggests they misunderstood the question.

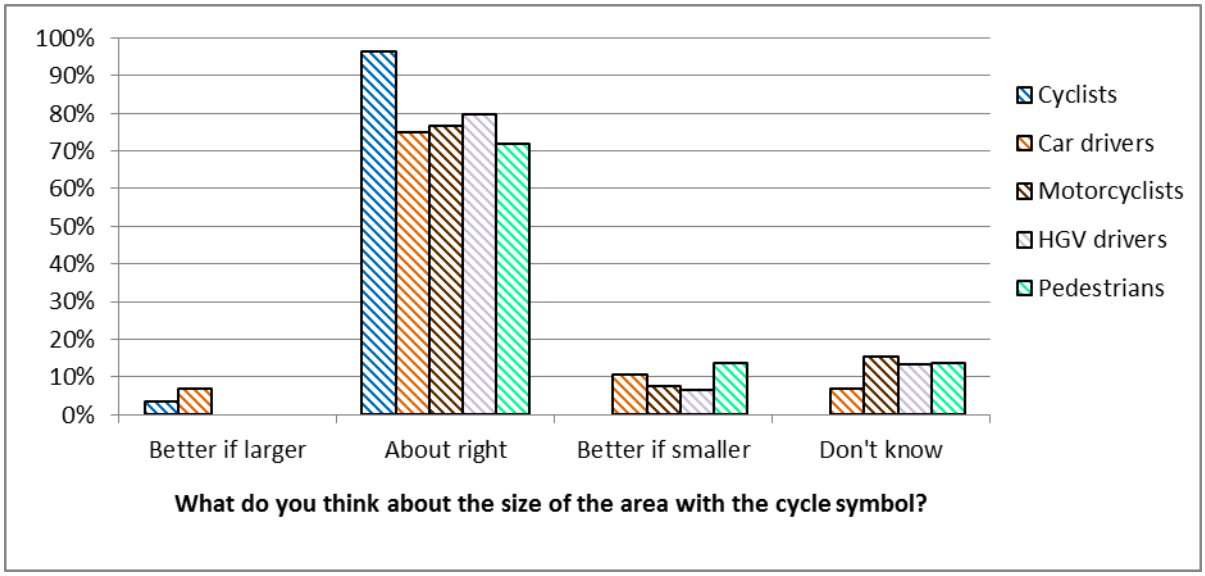

Figure D-10: Views on the size of the cycle reservoir

Comments from those who thought the cycle reservoir was about the right size include:

> *"It's about the right size, it gives enough room to feel comfortable when there is a car behind you."*

> *"Good size for a group of cyclists."*

About 15% of participants commented that it would depend on the number of cyclists present, possibly needing a larger cycle reservoir if there were more cyclists:

> *"Obviously it depends on the number of cyclists using them in any given area. Central cities/towns may benefit from larger ones."*

In contrast, one cyclist said that if it was any larger, there would be less room for other road users when the lights change to green as the cyclists would take longer to get going.

Of those that thought the cycle reservoir should be smaller, one said it should be 'about half the size' as there was lots of room for cyclists. A car driver and a motorcyclist also suggested that the cycle reservoir should be smaller as it would slow traffic:

> *"It seemed to allow 3 or 4 rows of cyclists in it. If it were full it would slow down following traffic a lot." [Car driver]*

Most pedestrians who said it was too large, cited a lack of cyclists as the main reason however one M19a pedestrian stated that they did not like the size of the reservoir because it put cars in a position where they are harder to see:

> *'Safer for pedestrians if they can see cars waiting at a junction, which is harder if they are further back' [Pedestrian]*

Those that responded 'don't know' generally commented that it would depend on the volume of cyclists.

Thoughts on the size of the cycle reservoir is also covered in Section 3.3.4 in the main report.

D.3.2.4 Stopping position within the cycle reservoir

Cyclists were asked whether having a car behind them affected where they stopped. Results from the M19a Trial were very similar to those from the M14 Trial with about 80% stating that they were never affected by the car behind them.

Those that were affected by the presence of a car said that they stopped in the cycle reservoir because they felt safe. One cyclist commented:

> *"I may have taken a more assertive position to prevent overtaking. [It was] not very pleasant to be followed by a car especially going ahead from Arm D."*

In terms of general positioning, one cyclist said they kept to the left of the box when turning left or going straight and waited to the right of the box when turning right.

D.3.2.5 Thoughts on the height and angle of the LLCS

Figure D-11 and Figure D-12 show participant views on the height and angle of the LLCS. Findings are broken down by road user.

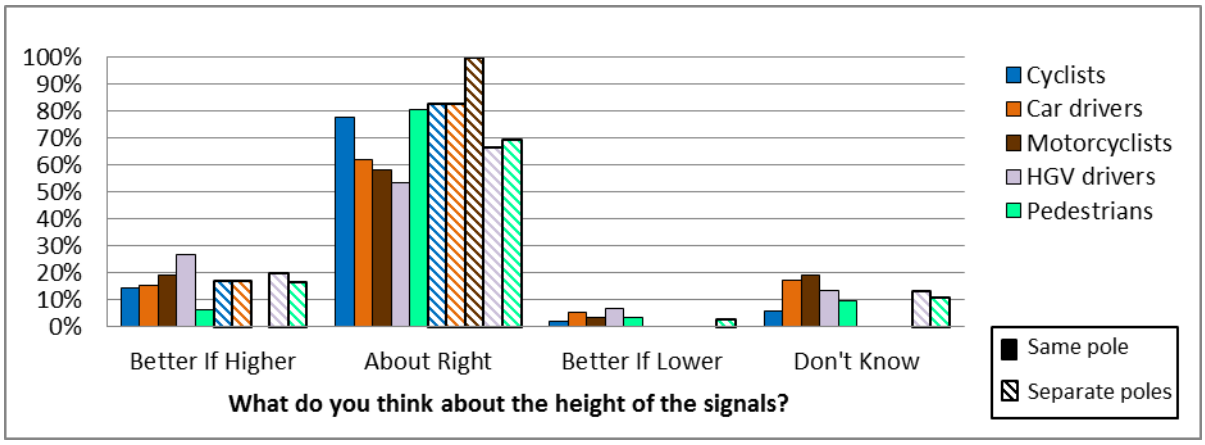

Figure D-11: Views on the height of the LLCS

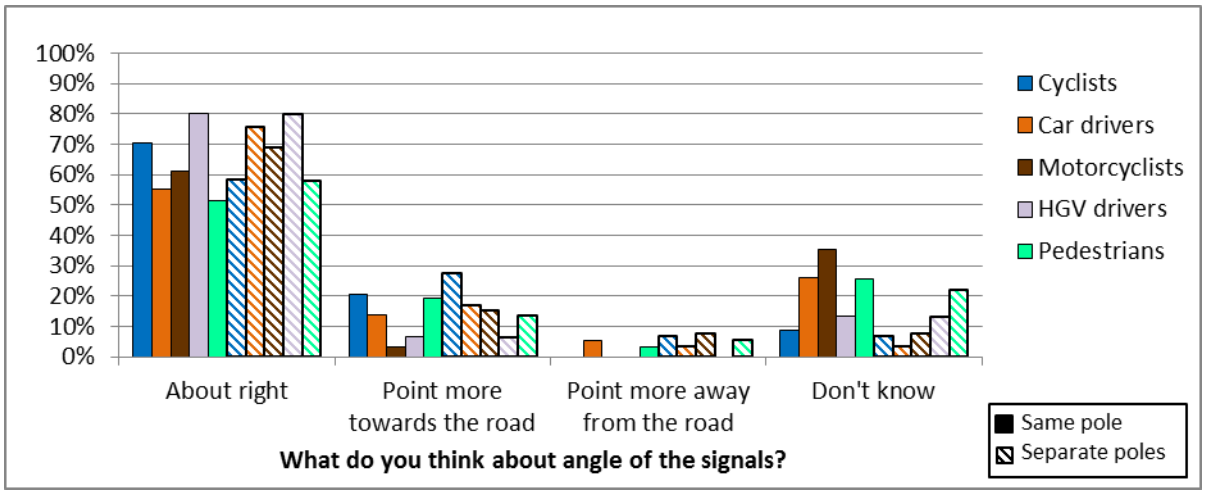

Figure D-12: Views on the angle of the LLCS

Cyclists

Responses to the question on height of the signals were similar in the M14 and M19a Trials for cyclists, with the majority reporting that the height was about right. Two M19a

cyclists provided further comments that, due to the height of the signals, the LLCS might be obscured by waiting pedestrians.

Slightly fewer M19a cyclists thought the angle of the signal was correct, with about 60% of M19a cyclist stating that they thought the angle was right compared to about 70% of the M14 cyclists.

Car drivers

When asked about the height of the LLCS, 17% of M14 car drivers provided the response 'don't know' and no M19a drivers put this response. Allowing for these participants, 80% of both M14 and M19a participants thought the height was about right. About 15% of car drivers in both trials thought that the height of the LLCS would be better if they were higher.

When asked about the angle of the LLCS, 26% of M14 car drivers provided the response 'don't know' and only 3% of M19a participants gave this response.

Motorcyclists

100% of M19a motorcyclists thought that the height of the signals was about right. This is a significant[2] increase from the M14 Trial when less than 60% of motorcyclists gave this response.

There was a 10% increase from the M14 Trial to the M19a Trial in the proportion of motorcyclists who thought the signals should point more to the road.

Two M19a motorcyclists commented that the position of the LLCS was good because they are aimed for cyclists within the cycle reservoir to see:

> *"Current position makes sense since these are aimed at cyclists in the ASL."*
>
> *"I think they are positioned in the right place for the cyclists at the front of a group to see."*

HGV drivers

Many of the HGV drivers thought that the height of the signals was about right in both the M14 (53%) and M19a (67%) Trials. Responses to the question on the angle of the LLCS were similar in the M14 and M19a Trials for HGV drivers with the majority reporting that the angle was about right.

Pedestrians

The majority of pedestrians (81% in M14, and 69% in M19a) thought that the height was about right. Responses to the question on the angle of the LLCS were similar in the M14 and M19a Trials for pedestrians with the majority reporting that the angle was about right.

Thoughts on the height and angle of the LLCS is also covered in Section 3.3.3 in the main report.

[2] $p<0.01$

D.3.3 Moving through the junction

D.3.3.1 Turning right across the path of oncoming traffic

At Arm D, where cyclists were turning right across the path of other road users, cyclists were asked whether they considered turning in front of the oncoming car. Results are shown in Figure D-13. In the M19a Trial there was a significant decrease in cyclists stating that they did not consider turning in front of the car[3] and a significant increase in those stating that they turned in front of the car[4]. There was also an increase in those who considered, but did not turn, however this was not significant.

These results should be treated with caution as the video data shows that none of the participants in the M19a Trial turned in front of a car. These results therefore only provide an indication of what the cyclists thought they did.

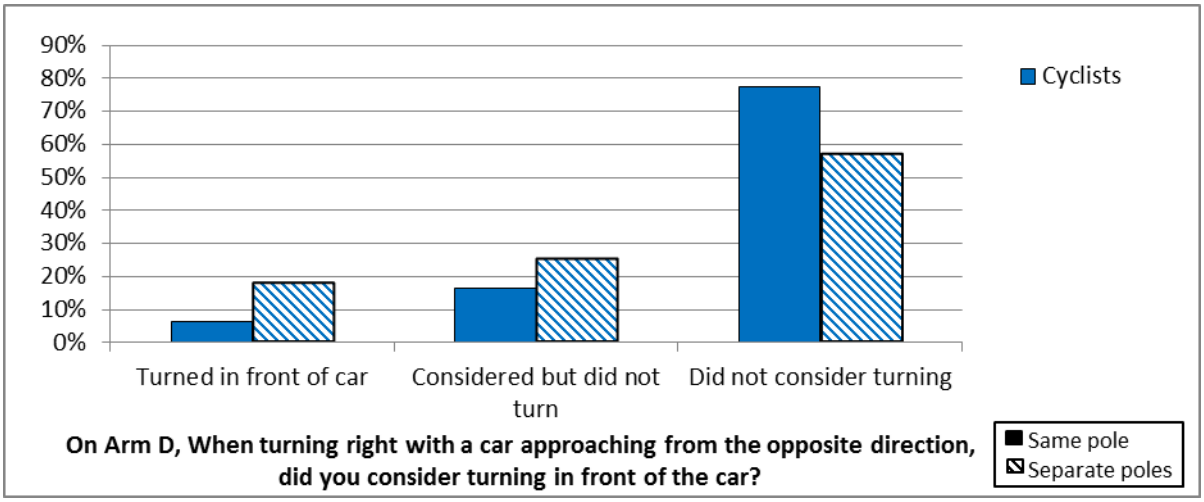

Figure D-13: Proportion of cyclists who said they considered turning in front of an oncoming car

D.4 Using the Low Level Cycle Signals during the trial

Section 3.4.1 of the main report summarised to what extent participants said they looked at the LLCS. This information is presented here in further detail for other visual cues. Findings were similar across the four arms, and therefore some results have been pooled together across the four junction approaches. Results for looking at the LLCS are presented for each individual approach.

D.4.1 Cyclists, car drivers and motorcyclists

D.4.1.1 What people looked at when approaching

Similarly to the M14 Trial, in the M19a Trial the main signals were used more on the approach to the junction than the LLCS by all participant groups (see Figure D-14). In terms of which signals were most important to them, the results were again similar

[3] $p<0.05$

[4] $p<0.1$

between the M19a Trial and the M14 Trial. In general all participant groups said that the main traffic signals on the left were the most important.

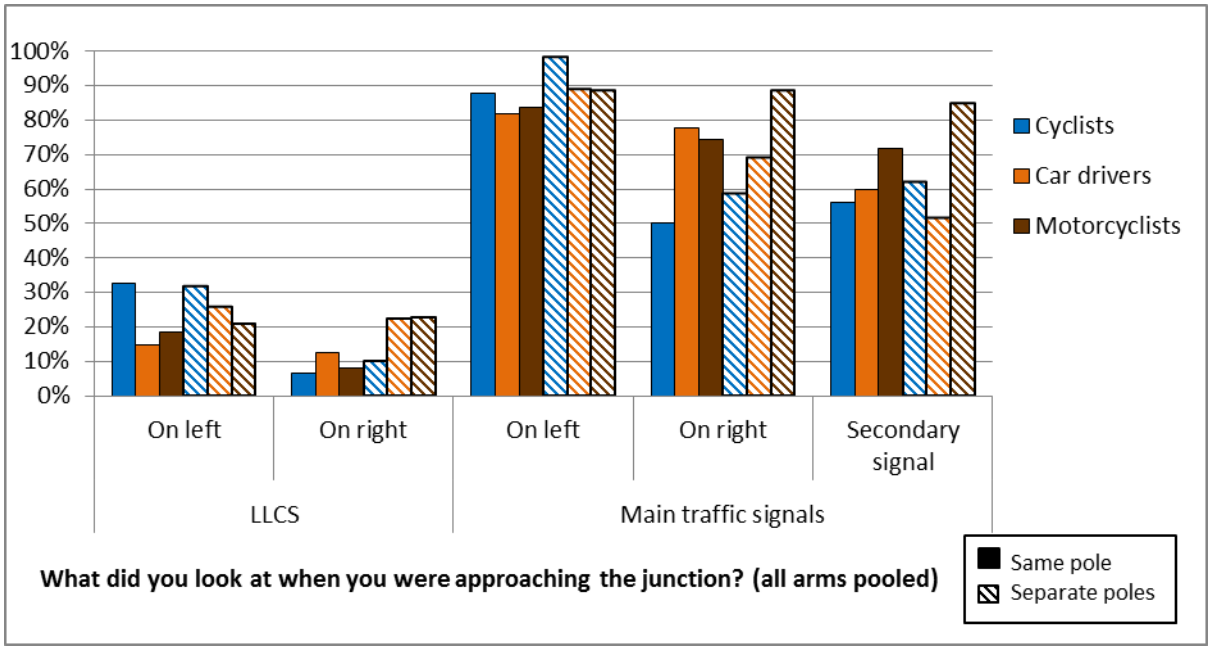

Figure D-14: Proportion of participants who said they looked at the LLCS and main signals when approaching the junction (pooled)

Trends for cyclists were very similar between the M14 and M19a trials with the majority (over 80%) using the main signals on the left and at least 50% using the main signals on the right and ahead. About 30% used the LLCS on the left and about 10% looking at the LLCS on the right in both trials. LLCS were the second most important to cyclists.

Car drivers looked slightly more at the LLCS in the M19a Trial and slightly less at the main traffic signals on the right and ahead. The main signals on the left were significantly[5] less important for car drivers on Arm B, in the M19a Trial than the M14 Trial. More rated the main signals on the island in the middle of the road as most important (in line with the results combined from all arms[6]), and there was also an increase in the importance of the positioning and speed of approaching vehicles. In the M19a Trial, there was an increase in the importance of the position and speed of cyclists in front.

The M19a cyclist and car driver participants looked at non-signal related cues about 10% more when approaching the junction on each arm than those in the M14 Trial. Non-signal related cues were: whether the junction was empty; the position and speed of approaching vehicles; and the position and speed of vehicle behind.

Motorcyclists showed the most difference between the M14 Trial and the M19a Trial overall. In the M19a Trial motorcyclists looked slightly more at LLCS on the right, main signals on the right and secondary signals ahead compared with the M14 Trial. M19a motorcyclists also looked at non-signal related cues over 10% less than those in the M14 Trial. In the M19a Trial, more motorcyclists rated the main lights on the left (and on the right on Arm B) most important as well as the secondary signal in front.

[5] $p<0.05$

[6] As trends were similar across all arms, the results were combined together.

D.4.1.2 What people looked at when waiting to turn left

Figure D-15 and Figure D-16 show results for cyclists, car drivers and motorcyclists when waiting to turn left.

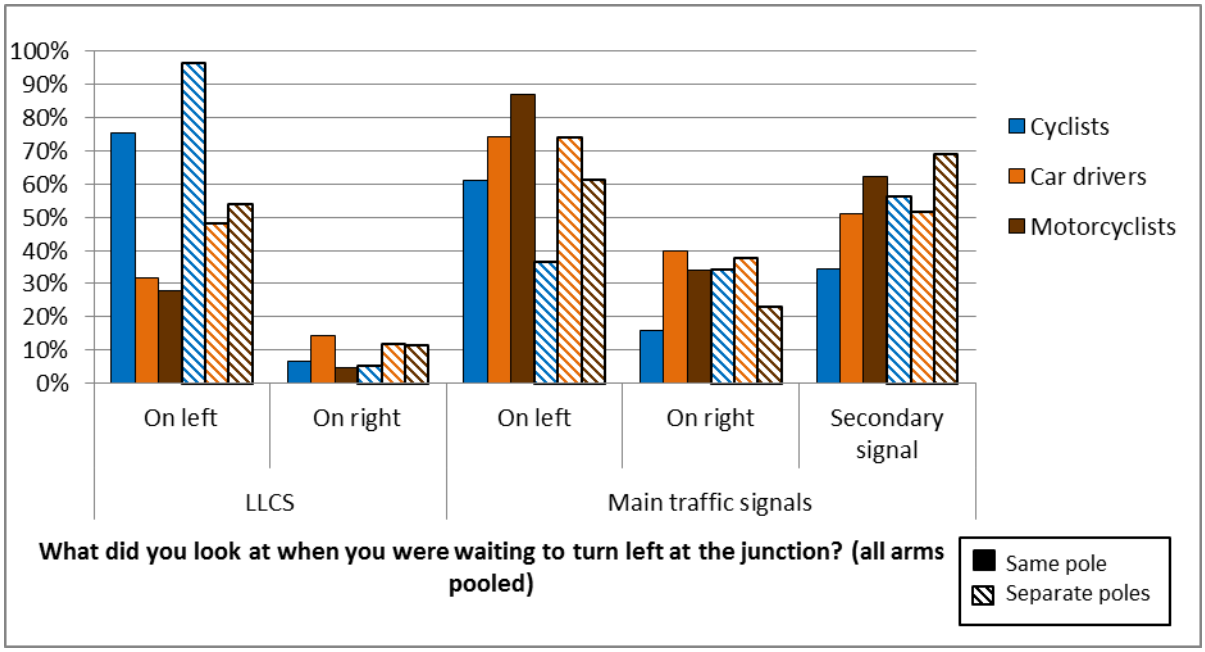

Figure D-15: Proportion of participants who said they looked at the LLCS and main signals when waiting to turn left (pooled)

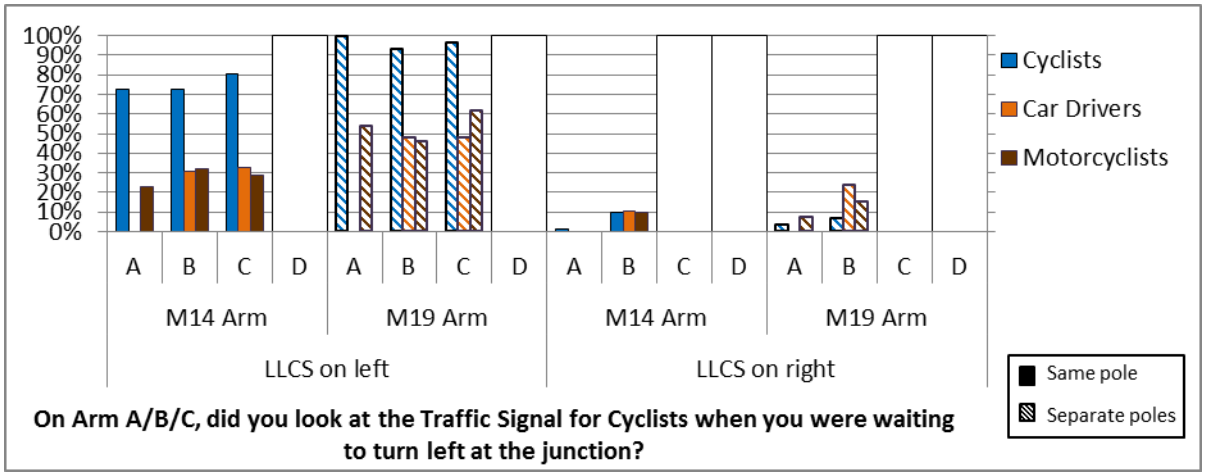

Figure D-16: Proportion of participants who said they looked at the LLCS when waiting to turn left (by each junction approach)

Car drivers

A similar proportion of car drivers said they looked at the main signals in the M14 and M19a Trials. Very few car drivers in both trials looked at the off-side LLCS on Arm A and Arm B.

A number of car drivers suggested that they looked at the LLCS to see if the signals changed at a different time to the main signals:

> *"I did look to see if the cyclist traffic lights changed before the main lights so on these occasions I did check both sets of lights."*

"It did make me consider the cyclist traffic light as well as the main lights."

Specifically referring to turning left at Arm C, another car driver said it was easy to check the LLCS:

"[I] found it easier to check [the] signal for cyclists as well as main light on the left."

Motorcyclists

Slightly fewer looked at the off-side main traffic signals and slightly more looked at the secondary signal in the M19a Trial compared with the M14 Trial.

One motorcyclist commented that it was less easy to see the near-side main signal from the stop line when waiting to turn left from Arm C:

"Less easy to see the main signal front left at stop line."

D.4.1.3 What people looked at when waiting to go straight on

Figure D-17 and Figure D-18 show results for cyclists, car drivers and motorcyclists going straight on.

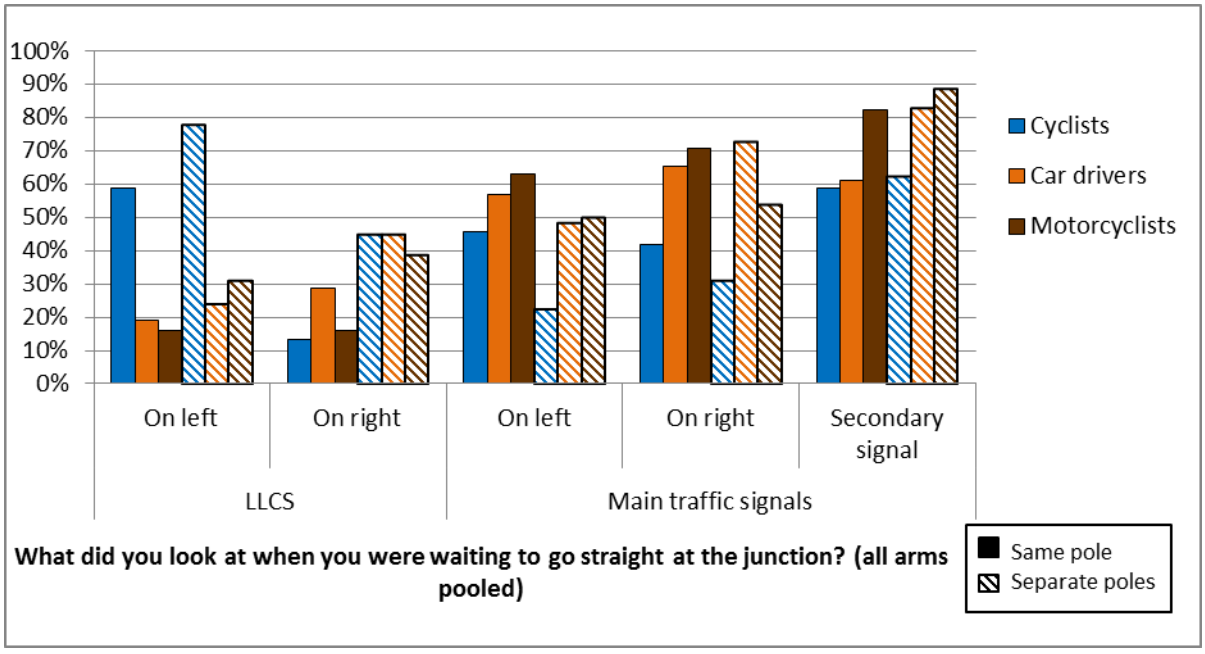

Figure D-17: Proportion of participants who said they looked at the LLCS and main signals when waiting to go straight on (pooled)

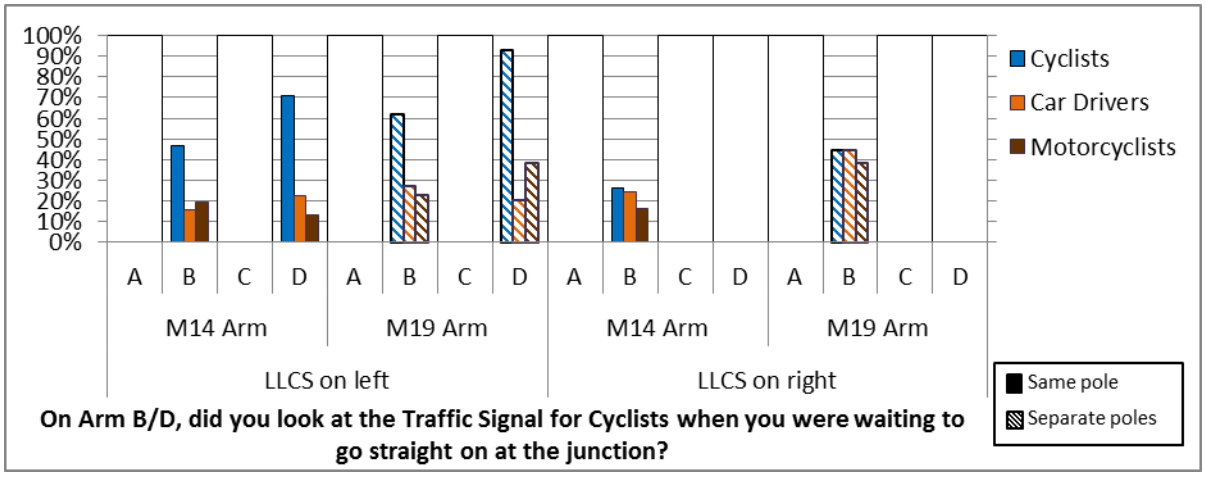

Figure D-18: Proportion of participants who said they looked at the LLCS when waiting to go straight on (by each junction approach)

Cyclists

Participants could only go straight at Arms B and D. At Arm B which had LLCS on both the near-side and the off-side, cyclists looked at both sets of LLCS, (62% looked at the near-side LLCS and 45% looked at the off-side LLCS). When waiting at Arm D which did not have off-side LLCS, 93% of cyclists looked at the near-side LLCS.

Car drivers

M19a car drivers looked slightly less at the near-side main signals and slightly more at the off-side main signals compared with M14 car drivers. The difference is around 10% in both cases.

A couple of car drivers suggested that they looked at the secondary signal when waiting at Arm B because the other signals at the junction were obscured from view by the cyclists in front:

"I always used the far signal in the middle of the road as this was never blocked."

"If they (cyclists) were blocking my view I would look at another set of lights."

Motorcyclists

There were no statistically significant differences between the M19a and M14 Trials for motorcyclists waiting to go straight, although there was a smaller sample size for motorcyclists.

When given the option of the off-side LLCS they used them more than the near-side LLCS. Going straight on from Arm D (with no off-side LLCS) about 10% of the M14 motorcyclist participants said they used the near-side LLCS, whereas in M19a nearly 40% said they used them. On Arm B (with off-side LLCS) the near-side LLCS were used by 20% of M14 and M19a participants and the off-side LLCS were used by almost 40% of the M19a participants and 15% of M14 participants. The signal most used by motorcyclists in both trials was the secondary signal.

D.4.1.4 What people looked at when waiting to turn right

Figure D-19 and Figure D-20 show results for cyclists, car drivers and motorcyclists turning right.

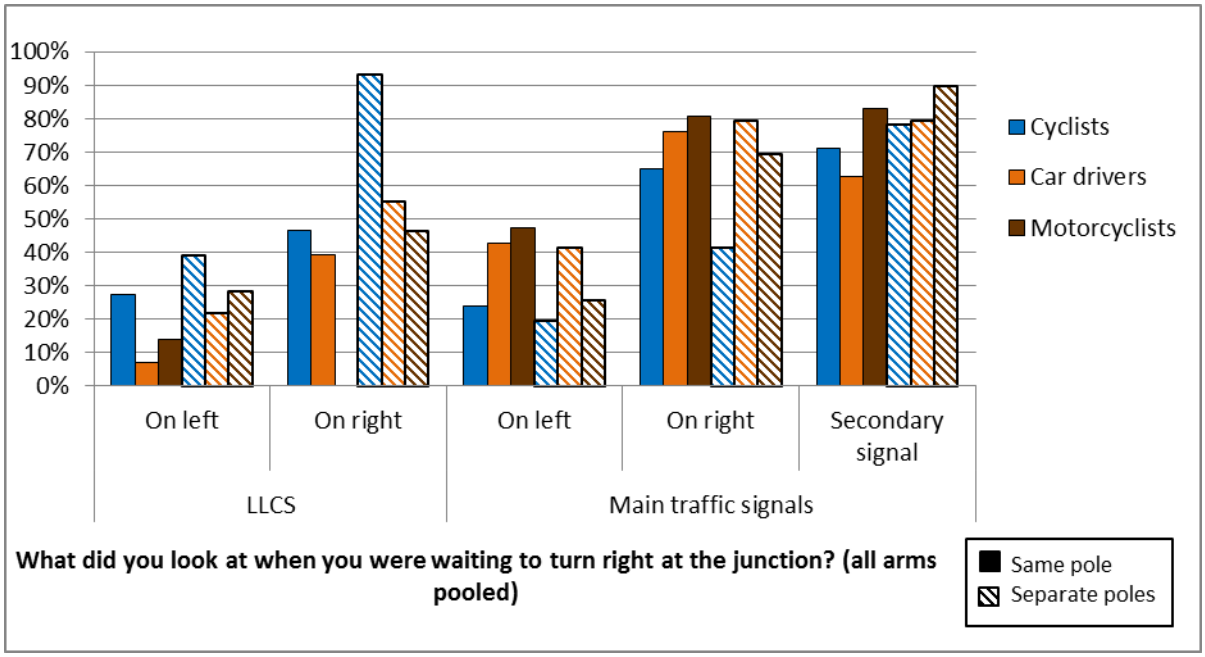

Figure D-19: Proportion of participants who said they looked at the LLCS and main signals when waiting to turn right (pooled)

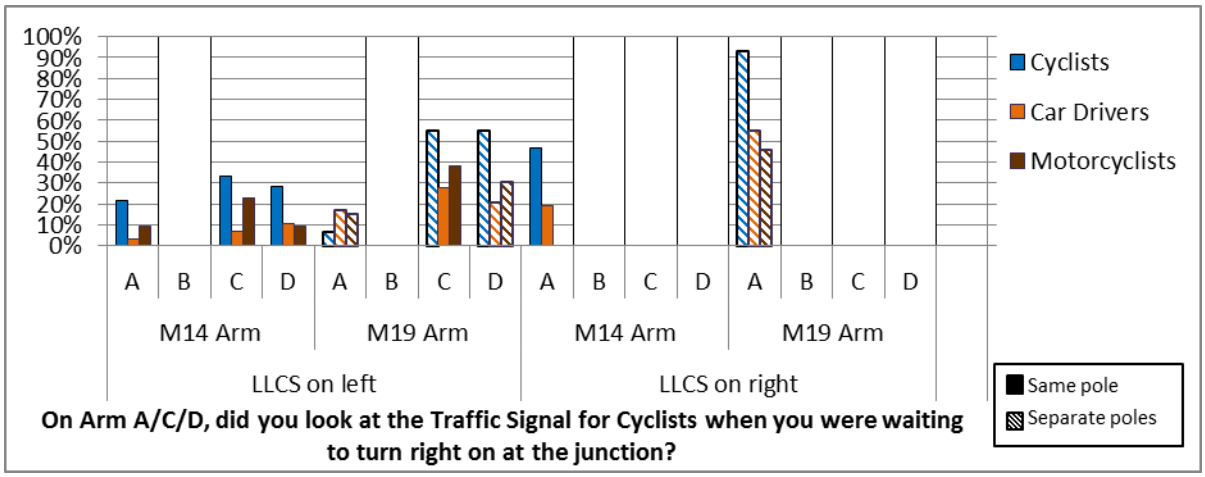

Figure D-20: Proportion of participants who said they looked at the LLCS when waiting to turn right (by each junction approach)

Cyclists

At Arm A, which had both near-side and off-side LLCS, over 90% of cyclists used the off-side LLCS when turning right, however 39% used the near-side LLCS[7]. In contrast, very few cyclists used the off-side LLCS when turning left. On Arm C and Arm D about 80% looked at the secondary traffic signal in front.

[7] In the M14 Trial, there was a low sample size (15) for cyclists who were asked about off-side LLCS on Arm A.

Some cyclists suggested that they may have stopped in the left hand lane on Arm A, despite it being a two lane one- way street with a separate lane to turn right. This may explain why 39% of cyclists looked at the near-side LLCS.

> *"[It] took a few goes to realise the different lane markings for going right, but very easy after that to see signals."*

> *"The first time I entered the cycle box from [the] left as the white line put me off crossing it. I was therefore only in [the] middle of box when I needed to turn right. Other times I corrected my mistake."*

Those cyclists that looked at the secondary signal when turning right commented:

> *"If I was turning right I concentrated on the additional signal."*

> *"[I] didn't look so much at the cycle signal as it was on the left and so look at traffic signal in front."*

Car drivers

Car drivers looked at the main signals about the same amount in both the M14 and M19a Trials. The near-side signal was looked at about 40% and the off-side signal was looked at about 80% in both trials. Car drivers looked most at the secondary signal and the main signal on the right in the M19a Trial. In the M14 Trial, car drivers looked more at the main signal on the right than the secondary signal ahead.

Motorcyclists

In the M14 Trial, none of the motorcyclists said they looked at the LLCS on the right when turning right. 21% fewer motorcyclists looked at the near-side main signal in the M19a Trial compared with the M14 Trial. This was a significant[8] difference.

Motorcyclists looked slightly more at the secondary signal and slightly less at the off-side main signal in the M19a Trial than those in the M14 Trial. These signals were the most used by motorcyclists in both trials.

On Arm A specifically when turning right, motorcyclists reported using non-signal related cues slightly more in the M19a Trial than those in the M14 Trial.

One of the motorcyclists mentioned that when waiting to turn right at Arm A, it was not possible to see the off-side main signal from the stop line and therefore they focused on the secondary signal ahead.

> *"At the stop sign turning right I could not see the main signal at front right and focused on the additional signal at front. The hedge on the right prevented an early view of the traffic approaching from the right."*

D.4.1.5 What was the most important piece of information

Cyclists-

When turning right at Arm C and Arm D, the majority of cyclists said that the secondary signal was the most important factor rather than the LLCS or the primary traffic signals.

[8] $p<0.05$

The importance of LLCS increased for all manoeuvres on all arms from the M14 to M19a Trials. The increase was significant for all going straight and turning right manoeuvres, but not turning left.[9] Results are shown in Figure D-21.

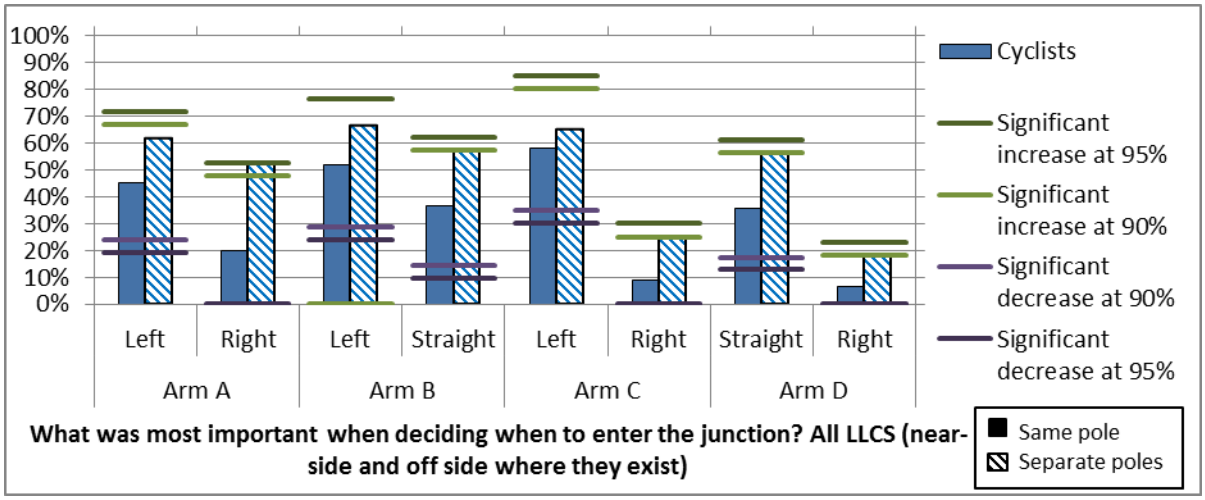

Figure D-21: Proportion of cyclists who said the LLCS or main signals were the most important piece of information

In the M19a Trial, the main signals were regarded as most important by less than 40% (with the exception on turning right at Arm C and Arm D).

There was a significant decrease in cyclists stating the main signals were the most important factor when entering the junction to turn right at Arm A and to go both straight and turn left at Arm B in the M19a Trial compared with the M14 Trial.[10]

Car drivers

There was very little difference between what the M14 and M19a car driver participants felt was most important. In general, the primary traffic signals followed by the secondary signals were valued as most important; however secondary signals were typically considered most important by around 10% fewer participants. As in the M14 Trial, most car drivers in the M19a Trial rated the secondary signal at Arm D most important when turning right across oncoming traffic, when compared with other factors, but like with other manoeuvres, the number of drivers who thought it was most important was less than in the M14 Trial.

More M19a car drivers also said that the position and speed of cyclists in front was the most important factor compared with M14 car drivers.

Motorcyclists

When asked which feature of the junction was most important, more M19a motorcyclists generally said that the secondary signals were most important compared with M14 participants. When turning right on Arm C and Arm D in the M19a Trial, the secondary signals were the most important for over 70% of participants; this is a significant

[9] $p<0.1$ for going straight manoeuvres and turning right at Arm C and Arm D. $p<0.05$ for turning right at Arm A.

[10] $p<0.01$ for turning right at Arm A and going straight at Arm B. $p<0.1$ for turning left at Arm B.

increase[11] on the 30% in M14. The junction being empty was not the most important factor for any of the M19a participants; this is a significant decrease[12] on the M14 Trial where this was most important to 40% of participants.

Near-side main signals were most important when turning left and where present (at Arm A), off-side main signals were most important when turning right.

D.4.1.6 Effect of other vehicles

Cyclists were asked whether having a car behind them affected which signals they looked at. Results from the M19a Trial were similar to those from the M14 Trial with about 80% stating that the car behind them did not affect what they looked at.

A number of cyclists who said the car behind sometimes affected what they looked at said that they looked at the main signals as well as the LLCS to anticipate when the car was moving off and whether this was at the same time as the cyclist.

> *"[I was] more likely to check more signals i.e. [the] signals for cycles and all [the] traffic signals for cars to see if they were going at the same time as me."*

Car drivers were asked whether having a cyclist in front of them affected which signals they looked at. In the M14 Trial about 70% said they were not affected; in the M19a Trial about 60% said they were not affected.

Drivers who said the cyclist sometimes or always affected which signals they looked at gave similar responses to those in the M14 Trial, suggesting that they looked at the LLCS so that they were aware of the cyclists' actions.

> *"It did make me consider the cyclist traffic light as well as the main lights."*

> *"[I was] aware of [the] cyclist, [so looked at] all signals."*

Some said that the position or action of the cyclist caused them to look at signals other than the main traffic signals:

> *"I'd look at the cyclist traffic lights, but only if the cyclist was turning right."*

> *"If the cyclist blocked my view for the nearest signals I looked at the far signals."*

D.4.2 HGV drivers

HGV drivers carried out slightly different manoeuvres to the other road users[13] so are considered separately in the chapter below.

D.4.2.1 Approaching the junction

The cues used by HGV drivers when approaching were similar in the M19 and M14 trials, see Figure D-22. Very few HGV drivers looked at the LLCS on either side when approaching the junction; in general there was a slight decrease from the M14 Trial to the M19a Trial.

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[11] $p<0.05$

[12] $p<0.001$ for all arms pooled together

[13] HGV drivers only went straight at the junction from Arms A, B and D.

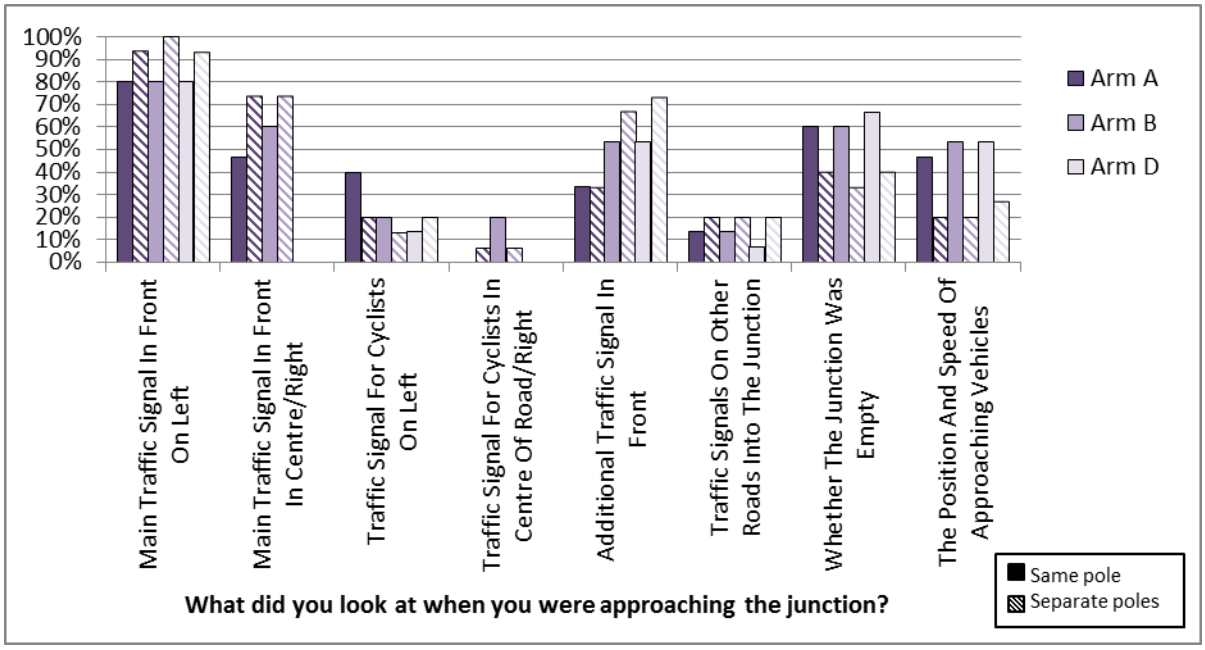

Figure D-22: Cues used by HGV drivers when approaching the junction

D.4.2.2 Going straight on at the junction

When waiting to go straight on at the junction, HGV drivers in the M19a Trial generally used the main signals more and the LLCS less than participants in the M14 Trial as shown in Figure D-23.

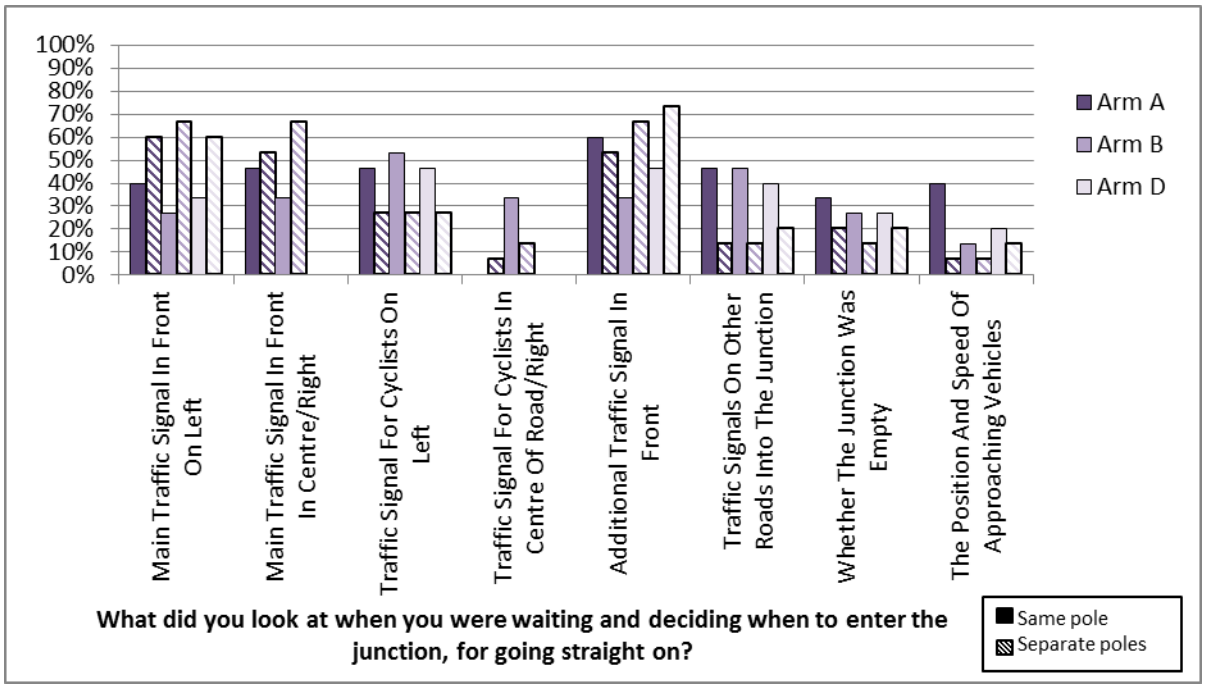

Figure D-23: Cues used by HGV drivers when waiting to go straight on

All the main signals (on the left, in the centre of the road and the secondary signal ahead) were looked at significantly[14] more at Arm B in the M19a Trial compared with the M14 Trial.

About 30% of HGV drivers in the M19a looked at the LLCS on the left compared with between 40% and 50% in the M14 Trial. About 10% of HGV drivers looked at the LLCS on the right/ centre of the road in the M19a Trial. At Arm B, there was a 20% decrease between the M14 Trial and the M19a Trial.

D.4.3 Pedestrians

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

For the pedestrians Arm A, Arm B and Arm D were controlled crossings, Arm C was an uncontrolled crossing 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.

Overall, responses between the pedestrians who experienced the signals on separate poles (M19a Trial) and those that experienced those on the same poles (M14 Trial) were very similar.

D.4.3.1 Deciding when to cross

In both the M14 Trial and the M19a Trial about 30% of pedestrians said that they used the LLCS (in addition to other sources of information) when deciding to cross at controlled crossings at the junction (Arm A, B, D); as did a similar proportion at the Puffin crossing (see Figure D-24).

At the uncontrolled crossing (Arm C), about half of the M14 Trial pedestrians said that they used the LLCS (in addition to other sources of information) when deciding to cross whereas about a third of M19a Trial pedestrians used these signals at Arm C. The same proportion of pedestrians (just over 10%) in the M14 and M19a Trial said that the LLCS were the most important factor when crossing. The biggest proportion in both the M14 Trial (50%) and the M19a Trial (40%) said that whether there was any traffic was the most important visual cue when crossing. This is shown in Figure D-25.

[14] Main signal on the left: $p<0.05$. Main signal in the centre: $p<0.1$. Additional signal: $p<0.1$.

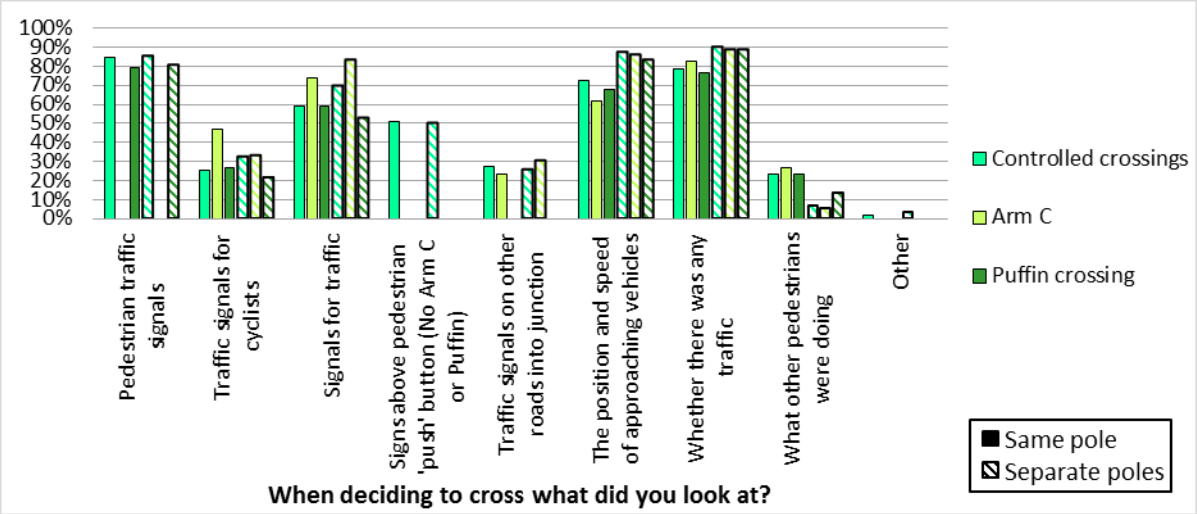

Figure D-24: Cues used by pedestrians when deciding when to cross

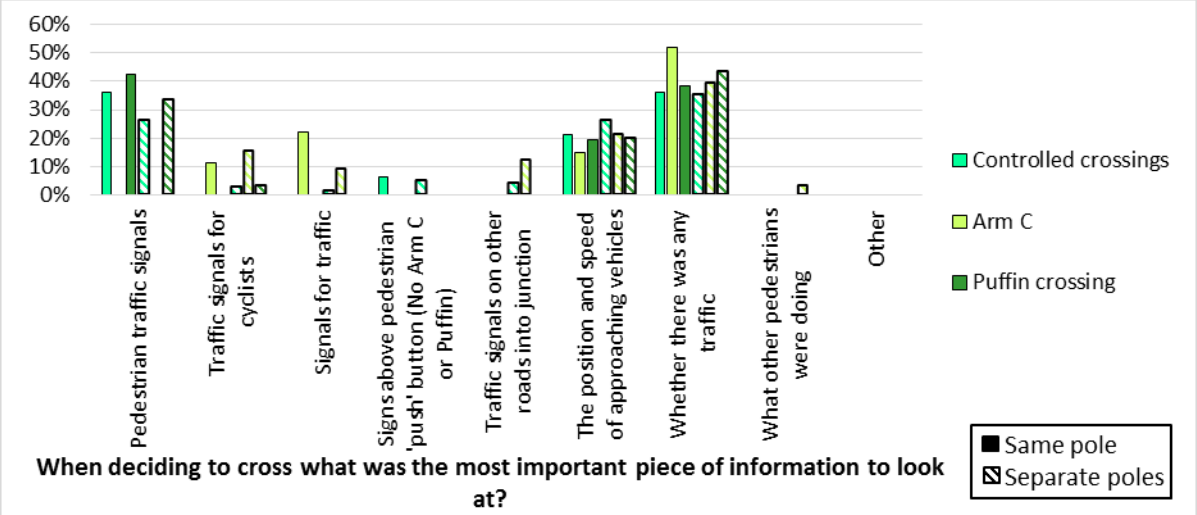

Figure D-25: Which cues were the most important to pedestrians when deciding when to cross

D.4.3.2 The Puffin crossing

The Puffin crossing does not have a cycle reservoir which means that the layout was the same in both the M14 and M19a Trial. The two sets of trial participants gave very similar responses when asked what they looked at; if they noticed the LLCS when walking towards the crossing; and if this affected the initial decision to cross at the Puffin crossing.

D.4.3.3 Crossing the road

Pedestrians were asked about where they had crossed the road during the trial, specifically whether they had walked in the cycle reservoir and whether they had walked between the dotted lines marking the crossing. Results are shown in Figure D-26, Figure D-27 and Figure D-28.

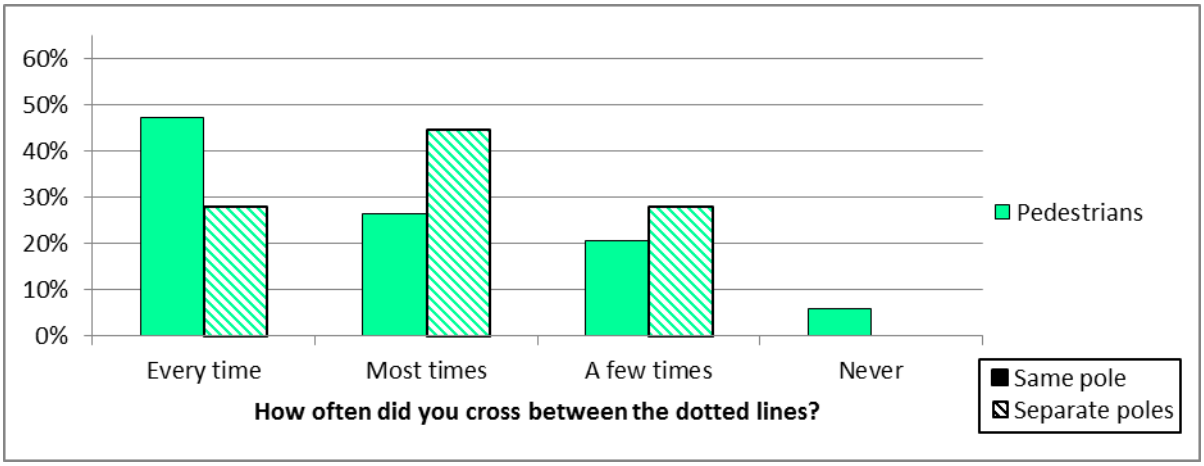

Figure D-26: How often pedestrians used the 'formal' crossing

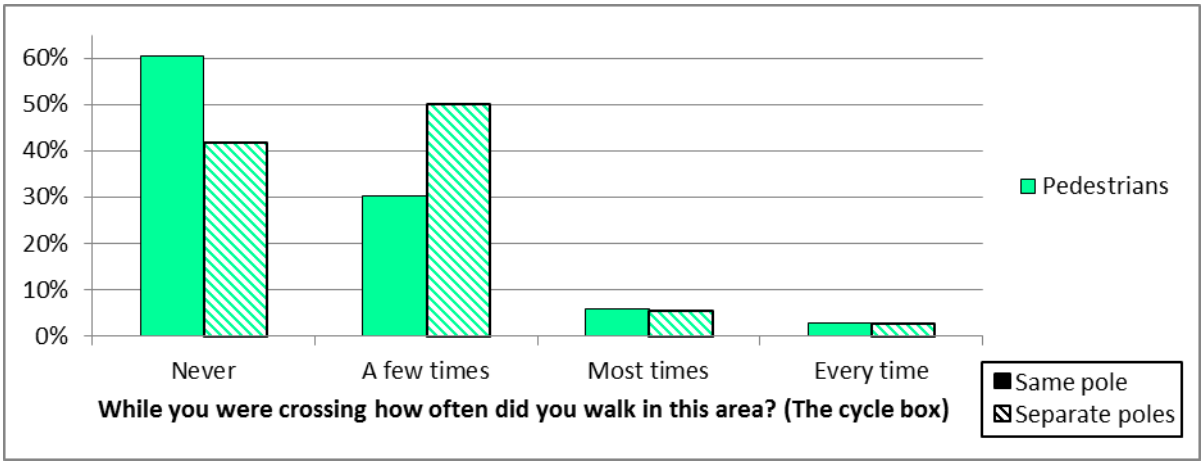

Figure D-27: How often pedestrians crossed within the cycle reservoir

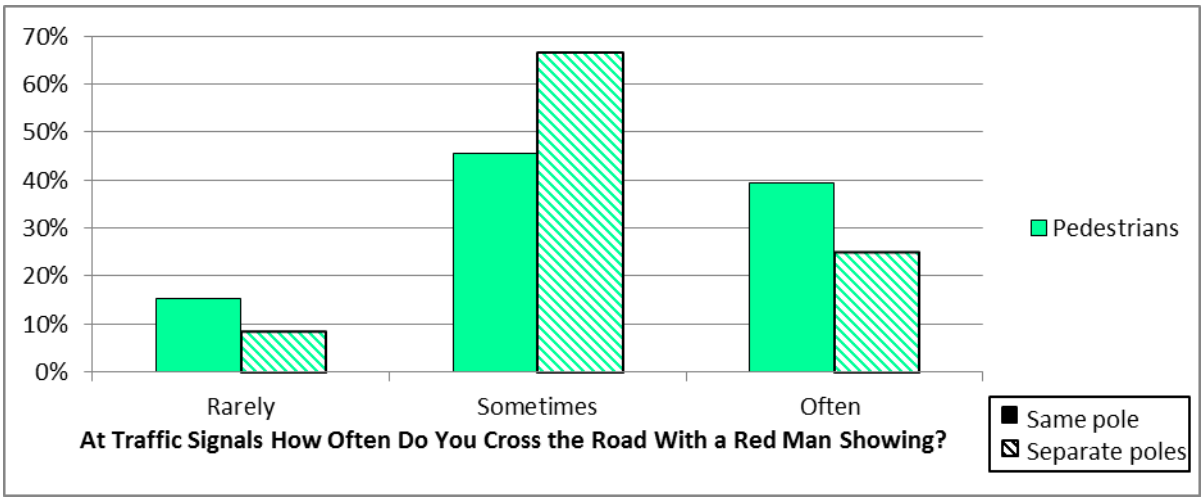

Figure D-28: Pedestrian compliance with the Red Man

There was no significant difference between the M14 and M19a participants who crossed formally[15] or informally[16], when asked about all the visual cues they used and the most

[15] Within the dotted lines (using the pedestrian crossing facility provided).

important visual cue. About 15% of the pedestrians who crossed informally said the LLCS were the most important factor in both the M14 and M19a Trial and about 10% of pedestrians who crossed formally said the LLCS were the most important.

The Pedestrian trial is also covered in Sections 3.4.2 and 3.7 in the main report.

D.5 Attitudes

D.5.1 How easy it was compared with an ordinary junction

Participants were asked how easy it would be to use the junction compared with an ordinary one that has the main signals at the exit of the cycle reservoir and no LLCS. Cyclists were asked about cycling, car drivers about driving; motorcyclists about motorcycling; HGV drivers about driving a lorry and pedestrians about walking. Results are shown in Figure D-29.

A significantly[17] higher proportion of M19a car drivers said the junction was much easier compared with M14 car drivers. Also, significantly[18] more motorcyclists in the M19a Trial said that the junction was easier than those in the M14 Trial. Significantly[19] fewer M19a HGV drivers thought this type of junction was much easier than M14 HGV drivers. In the M19a Trial there was also a significant[20] increase in the proportion of pedestrians who responded 'more difficult' compared with the M14 Trial.

Over 50% of motorcyclists, HGV drivers and pedestrians said the junction was neither easier nor more difficult in both trials. There was a slight increase overall in the proportion of participants across all modes who thought the junction was easier from the M14 Trial to the M19a Trial.

[16] Outside the dotted lines (not using the pedestrian crossing facility provided).

[17] $p<0.1$

[18] $p<0.1$

[19] $p<0.1$

[20] $p<0.1$

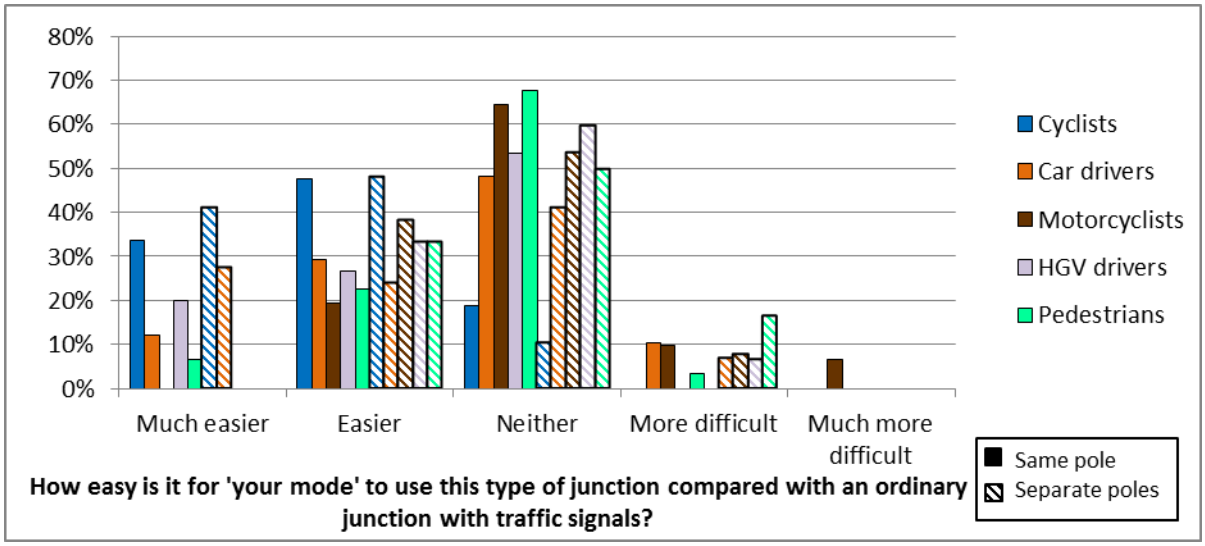

Figure D-29: How easy the junction was to use compared with an ordinary junction

Most comments from participants specifically mentioned the LLCS, more so in the M19a Trial than in the M14 Trial.

Cyclists commented that the LLCS meant it was easier for them to see traffic signals and that it was beneficial to have their own signals.

One cyclist acknowledged that the LLCS did make the junction easier however they also commented that by looking at the signals, a cyclist may not be looking ahead to check the junction is safe.

> *"When you know about them, [it is] easier to look at them if you are near the signal. But you need to look ahead to see what is happening, especially [when there could be] a car cutting across you, so you need to be looking ahead."*

There was little difference in attitudes towards the LLCS and cycle reservoir between frequent, on road cyclists and infrequent cyclists.

Those car drivers that said the junction was much easier gave comments such as:

> *"Any additional signals would benefit all."*

> *"I thought the signals and signs were obvious. Drivers and cyclists know where they can go and where they can't."*

Two car driver comments were that the LLCS would slow car drivers when changing to green, although this could be a good thing, and that drivers may be unsure whether they can 'park in the cycle reservoir'.

One motorcyclist who said the junction was easier commented that the LLCS were a 'great benefit' to them and 'more convenient'.

Pedestrians who said the junction was more difficult suggested that this was because having more signals to look at makes it harder to know when to cross.

> *"They now have to wait for two lots of signals which increases the waiting time at crossings for pedestrians."*

> *"Need to take in more information. Pedestrians need a clear unequivocal signal as to when it is safe to go."*

"Signals need to be all in same place e.g. Cyclists on post of traffic lights otherwise too many places as pedestrians to look at to assess to cross."

Two pedestrians also said that the LLCS were not easy to see when waiting at the crossing.

The majority of HGV drivers said that the LLCS didn't really affect them as a driver because they were following the main traffic signals and therefore there was no difference between the trial junction and an ordinary junction.

Some participants also referred to the cycle reservoir in their comments. Many of the cyclists' comments referred to the benefit of having the cycle reservoir, enabling cyclists to get a head start on the motorists behind.

A couple of participants referred to difficulties with the cycle reservoir:

"[It] felt safer in box and [I] can position myself better for turning etc. But if [there were] lots of cyclists in [the cycle] box then [it could be] hard." [Cyclist]

"Makes it more difficult as trying to filter through cyclists is very hard. If there was a little lane to allow motorbikes to pull alongside it might make things easier." [Motorcyclist]

D.5.2 Perceived benefits

After being asked about their experiences in the trial, participants were asked about who they thought would benefit from the LLCS. They were offered a list of road user types, and the opportunity to suggest others. Responses are provided in Figure D-30.

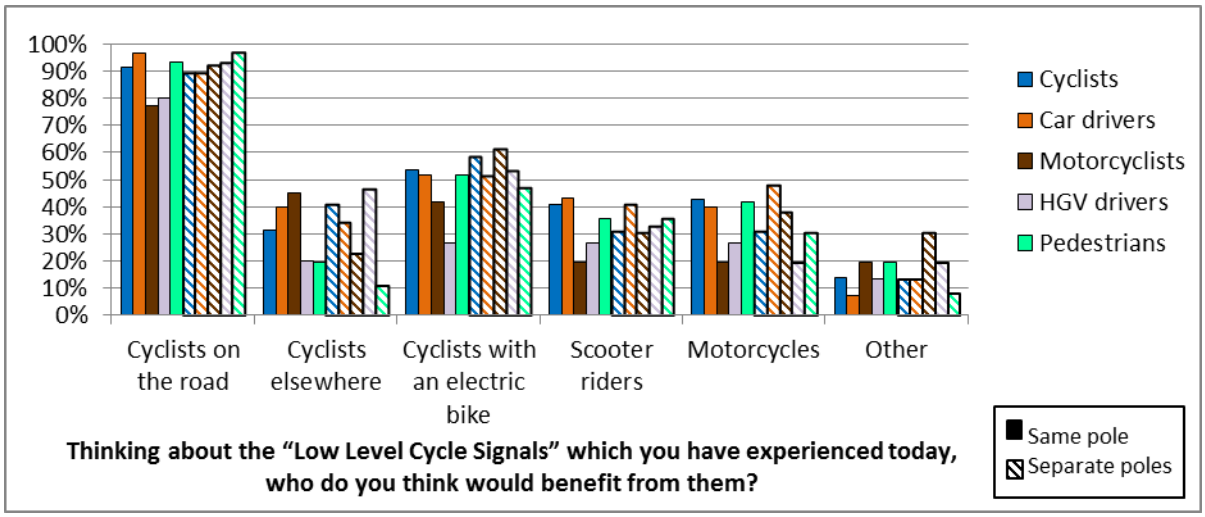

Figure D-30: Perceived benefits from the LLCS

Motorcyclists who said that scooter riders or motorcyclists would benefit generally suggested that the LLCS were easier for these road users to see than the main traffic signals. Some car drivers also suggested that this may be the case. One motorcyclist said the LLCS might help to raise awareness amongst scooter riders and motorcyclists that there is a cycle priority.

"Give cyclists a greater awareness of the traffic light, prevent running red lights. It might also, at least, draw scooter/motorbike rides attention to the fact that there is a cycle priority lane."

Responses from those who said 'other' ranged from everyone benefitting, to motorists and pedestrians benefitting, to no one benefitting. When asked to explain their response, the majority of participants said it would raise awareness of cyclists amongst other road users. Comments included:

"If the cyclist obey[s] signals too there will be less accidents where they sometimes shoot through red lights." [Car driver]

"Pedestrians can see if cyclists are about to go." [Pedestrian]

Some participants suggested that they didn't think there was any benefit to the LLCS:

"Not sure that they are a benefit. Additional signalling can potentially cause confusion." [Motorcyclist]

"No one [would benefit]. It could cause more accidents with pedestrians as cyclists would have to go through main red light to enter box area." [HGV driver]

"I don't see it as a benefit as could be obscured by pedestrians so wouldn't be able to see it." [Cyclist]

Perceived benefits are covered in greater detail in Section 3.3.1 in the main report.

D.5.3 Perceived safety

An overview of the perceived safety is provided in the main report. Comments were split into different categories to understand whether participants were referring to the LLCS, the cycle reservoirs, both of these together or making more general, non-specific comments.

Cyclists

In the M19a Trial fewer participant cyclists referred specifically to LLCS compared with those in the M14 Trial (21% compared with 44%). Alongside this, there was an increase in the proportion of cyclists who made reference to cycle reservoirs in the M19a Trial (44%) compared with the M14 Trial (23%).

All the M19a participants that referred to the cycle reservoirs at the junction said they felt either safer or much safer. Participants commented that cyclists have more space and priority as a result of the cycle reservoir. Some mentioned that it raises drivers' awareness of cyclists at the junction.

"Forces cars to wait behind you at [the] junction rather than try to squeeze you out at lights as some try to."

"The cyclist has a bit more priority as a result of the box so makes it safer."

"Nice box to wait in with drivers more likely to be expecting cyclists to be there."

Other road users

34% of car drivers in the M19a Trial referred specifically to the LLCS (similar to the 36% in the M14 Trial). 21% said that the LLCS made them feel neither safer nor more unsafe, suggesting that they didn't feel they made much difference. 10% said that the LLCS

made them feel safer or much safer. 10% of M19a car drivers (three participants) made reference to the cycle reservoirs compared with 16% of M14 car drivers.

62% of motorcyclists referred to LLCS with respect to safety at the junction. The majority of participants responded 'neither' and one motorcyclist said it as safer.

27% of the M19a HGV drivers (four participants) referred to the LLCS when commenting on safety of the junction, slightly more than in the M14 Trial. 20% of HGV drivers (three participants) referred to the cycle reservoirs in their comments.

64% of pedestrians made reference to LLCS in their comments about safety of the junction. No one referred specifically to the cycle reservoirs. All those that rated the junction as more unsafe referred to the LLCS.

Comments about the LLCS from those who thought the junction was safer include:

> *"Similar as the cyclists, if clearly visible with a choice of signals to view at different moments it makes it easier and safer." [Car driver]*

> *"The more lights at various heights, the better." [Motorcyclist]*

One HGV driver suggested there may be some benefit of cyclists having LLCS to 'obey'.

A few pedestrians also suggested that the LLCS contributed to the junction feeling safer. They commented that the LLCS provide extra information to help pedestrians decide when to cross and they may prevent cyclists from jumping the lights.

> *"May be slightly safer as occasionally cyclists will try to jump existing light systems."*

One motorcyclist suggested that giving cyclists a head start might improve safety at the junction as it would prevent the mixing of cyclists and motorcyclists.

> *"The most dangerous aspect of mixing cyclists and bikers at junctions is the poor behaviour of cyclists. Giving cyclists a head start lets the mayhem go on in front of you where you can see it and do something about it."*

One motorcyclist suggested that the LLCS were not any safer but more convenient:

> *"I would still look up for lights so not any safer but more convenient." [Motorcyclist]*

Some HGV drivers and pedestrians thought the LLCS made no difference to safety. The most common explanation for this was that they follow their own signal rather than the LLCS.

Those participants who referred to the cycle reservoirs suggested the junction felt safer because they had better visibility of the cyclists in front rather than to the side of traffic. One HGV driver referred to the location of the cycle reservoir in terms of pedestrian safety:

> *"Move the boxes to before the lights so pedestrians are much safer and the cyclists don't go through main road lights."*

A number of pedestrians commented negatively that there is the potential for conflict between cyclists and pedestrians:

> *"People [are] likely to step out in front of cyclists."*

> *"Possibly more unsafe as cyclists may set off quicker, catching out any pedestrians who are slower. It may cause collision."*

One pedestrian commented that there was too much information with the LLCS, the main traffic signals and the pedestrian signals.

Perceived safety is also covered in Section 3.8 in the main report.

D.5.4 Influence on modal shift to cycling

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.

Results from the M19a Trial were very similar to those from the M14 Trial with around 20% of car drivers, 40% of motorcyclists, 35% of HGV drivers and 20% of pedestrians saying 'yes', suggesting that if more junctions were like this they would cycle more. Nearly half of the car drivers and one third of cyclists answered 'no', they would not cycle more often in busy traffic, as did 40% of the other participants.

Nearly 30% of cyclists said 'it depends' (compared with 18% in the M14 Trial) suggesting that factors other than the LLCS influence whether they are likely to cycle more frequently. The most common reason given was that it would depend on how busy the area is (also suggested in the M14 Trial). This has an impact on how safe people feel cycling on the roads:

"[It] depends how busy traffic is, no if [there is] heavy traffic."

Caution should be taken from these results as most participants gave non-specific comments rather than referring to the LLCS. This may be the result of the high proportion of infrequent cyclists within the sample of the M19a Trial (around 70% of all participants). Therefore it is difficult to draw any meaningful results from this about whether the use of LLCS would encourage more people to cycle in London.

D.5.5 Suggestions for improvements and other comments

Several suggestions were made about altering the position of the LLCS in terms of angle and location.

"Angle them slightly more to allow cyclists turning right to centre them in their peripheral vision span." [Cyclist]

"Have them on [the] same pole so that all road users attentions are focused in one area." [Car driver]

"Signals need to be all in same place e.g. cyclists [signals] on [the] post of [the main] traffic lights otherwise [they are in] too many places [for] pedestrians to look at to assess to cross." [Pedestrian]

"Put a cycle signal in with the far car signal." [Cyclist]

An early release for cyclists was also a common suggestion from both cyclists and motorists. Alongside this participants indicated that it needed to be clear whether the LLCS and main signals were in sync or had different timings.

"Allow the cyclist a head start of about 10 seconds. This would greatly reduce the conflict and risk for cyclists." [Cyclist]

"[There] needs to be more time between the Green Cycle Light and the main Green traffic light. Didn't think there was much time for the cyclist to pull away ahead of the car traffic." [Car driver]

"Consider having the cycle signals change slightly before the main ones, thus giving cyclists a chance to all away and clear the junction. Education would be needed, however to ensure other road users did not set off too early." [Motorcyclist]

Some participants suggested providing additional information:

"Maybe a sign on the traffic light at eye level telling both cyclists and drivers that the signal is the same as the traffic lights." [Car driver]

"Perhaps a sign to let pedestrians know cycle signals may be different to traffic signals." [Pedestrian]

One of the drivers suggested a flashing warning when the signals for cyclists are green:

"Maybe when they are green they flash so people were more aware of them."

Similarly, one of the pedestrians suggested having a countdown timer to aid pedestrians trying to cross the junction.

D.5.6 Thoughts on a hypothetical scenario with an early release

Participants were asked whether they would ever start moving into the junction in a hypothetical situation when the cycle signal was green and the main signal was red (see Figure D-31).

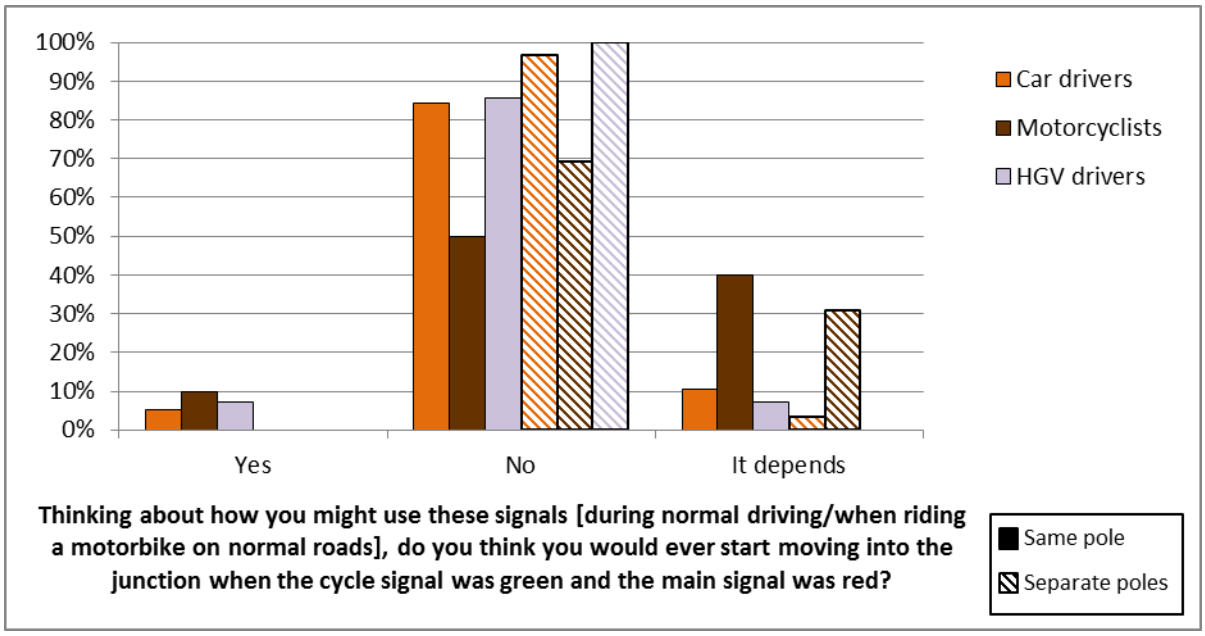

Figure D-31: Hypothetical early release situation

97% of car drivers in the M19a Trial said they would not, which was a significant[21] increase over the 84% in the M14 Trial. The proportion of HGV drivers and motorcyclists

[21] $p<0.1$

who said they would not move on a cycle early release (100% and 69% respectively) was not statistically different in the M19a Trial compared with the M14 Trial (from 86% and 50% respectively).

None of the M19a Trial participants answered 'yes' compared with between 5% and 10% in the M14 Trial.

The proportion of motorcyclists saying 'it depends' was slightly lower in the M19a Trial than in the M14 Trial (31% compared with 40% in the M14 Trial). One M19a car driver gave this response compared with six in the M14 Trial.

When participants were invited to comment on their answer, the majority from each mode (car drivers, motorcyclists and HGV drivers) said that the LLCS were clearly intended for cyclists and did not apply to them, therefore they would follow the main traffic signals.

> *"If I am in a car, I would follow normal traffic lights not those with an image of a bicycle."*

> *"[It] means they light up as a bike symbol. They relate to cyclists only so I would only take instructions from the bigger main traffic lights."*

A number of car drivers also considered this to be the same as running a red light:

> *"Traffic can't go through a red signal."*

> *"To do so would be an offence."*

A few car drivers mentioned that they would feel safer waiting for their signal to turn green. One car driver said that they would not know if other LLCS were green potentially causing conflict with them. One car driver referred to the possibility of there being unnoticed cyclists on the inside of the road, not using the cycle reservoir who may be using the LLCS.

Another car driver made reference to the cycle reservoir in front of their stop line. They said that they would not move into the cycle reservoir until the main traffic signals had changed as the area is for cyclists only.

One HGV driver made a suggestion on how the LLCS should be implemented to make them more obvious as cycle only lights:

> *"If cyclists are to receive a separate indication to proceed, I suggest that even though the lights are a cycle symbol, their lights should be placed in a unit which made a very definite distinction between them and the main traffic light. On an arm off the main light support for example, perhaps in a high-viz coloured box or surround."*

One motorcyclist also suggested that it may be confusing if different junctions had their own LLCS settings:

> *"I would presume that this would mean different release times for cyclists vs. other vehicles and would obey the main lights - difficult though if different junctions had individual settings."*

Of those participants that responded 'it depends', the car driver and one of the motorcyclists said that it would depend on whether there were cyclists in the cycle reservoir and how much traffic there was on the road. The other motorcyclists suggested they might presume that the LLCS and main traffic signals were in sync with no early release for cycles and therefore move forward:

"Could possibly assume that the phasing matches and take this as a general green."

"Obviously you should not, but perhaps it might catch you out one day if [you are] not fully paying attention. You might presume they are the same as the normal signals but may not be."

One suggested that if they were made aware of the early release, they probably would not move forward on a cycle green:

"Inadvertently, through anticipating/noticing amber on the cycle signals. If [I was] made aware I doubt I would move prior to main signal changing."

Suggestions for improvements and other comments is also covered in Section 3.3 in the main report.

Appendix E Further analysis of questionnaire data (M19b Trial: with an early release)

E.1 Introduction

Throughout this appendix the following terminology has been used:

- 'M14 Trial' – Trials where the LLCS changed to green at the same time as the main signals. Both signals were on the same pole, at the front of the cycle reservoir. Participants experienced the signals both covered and uncovered.
- 'M18 Trial' – Trials where the LLCS changed to green either 2, 3, 4 or 5 seconds earlier than the main signals; i.e. with an 'early release'. Both signals were on the same pole, at the front of the cycle reservoir.
- 'M19a Trial' – Trials where the LLCS changed to green at the same time as the main signals. Participants experienced the LLCS at the front of the cycle reservoir and the main signals on a separate pole in line with the back of the cycle reservoir, which was set back 5 metres.
- 'M19b Trial' – Trials where the LLCS changed to green either 2, 3, 4 or 5 seconds earlier than the main signals; i.e. with an 'early release'. Participants experienced the LLCS at the front of the cycle reservoir and the main signals on a separate pole in line with the back of the cycle reservoir, which was set back 5 metres.

E.2 The sample

E.2.1 Participant characteristics

E.2.1.1 Age

Compared with the previous trials, the sample of cyclists was generally slightly older, as shown in Figure E-1. Compared with the M18 Trial, the M19b Trial sample had fewer cyclists aged 18 to 24 (20% compared with 30%) and more aged 55 to 64 (24% compared with 14%). There were also fewer car drivers aged 35 to 44 (7% compared with 20%).

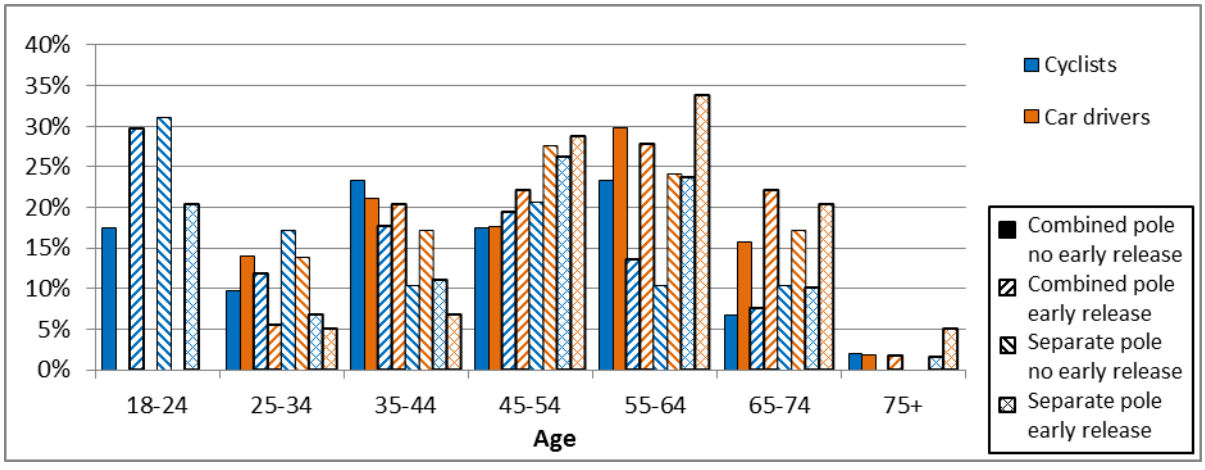

Figure E-1: Age characteristics

E.2.1.2 Gender

The gender split of the M19b Trial was similar to the M18 and M19a Trials with about 65% male and 35% female cyclists and about 60% male and 40% female car drivers (see Figure E-2).

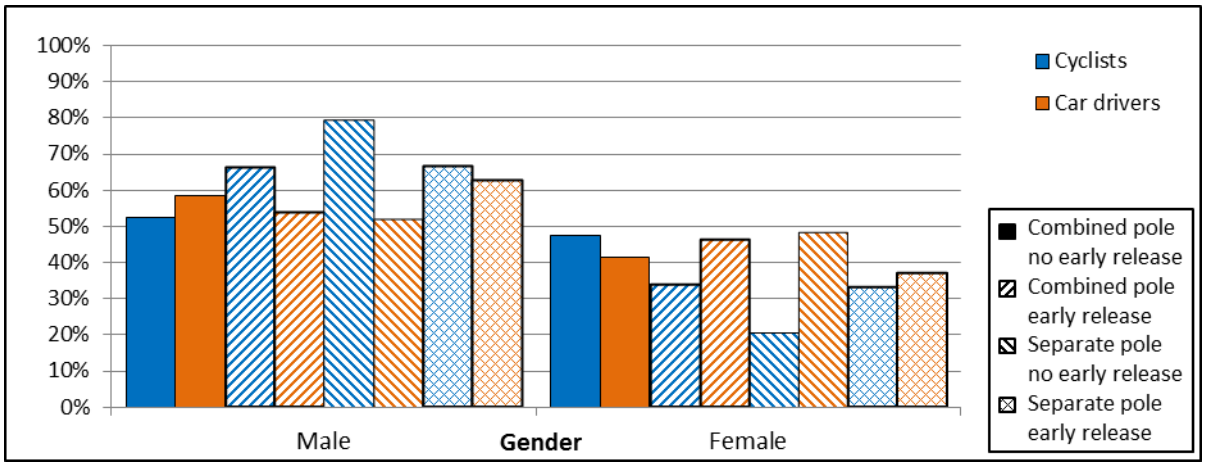

Figure E-2: Gender characteristics

E.2.1.3 Typical cycling journeys

Half of the M19b cyclists were frequent cyclists, cycling once a week or more (see Figure E-3). There were no substantial differences between the M19b Trial and the M19a and M18 Trials.

About 70% of cyclists said they usually cycle on roads, which was similar to previous trials. Fewer (9%) in the M19b Trial said they cycle in London often (once a month or more) compared with the M19a Trial (31%) and M18 Trial (21%).

In the M19b Trial, 28% of car drivers said they cycle frequently (once a week or more), which was an increase on the M19a Trial where only 11% of car drivers were frequent cyclists, and a slight increase on the M18 Trial where 16% gave this response.

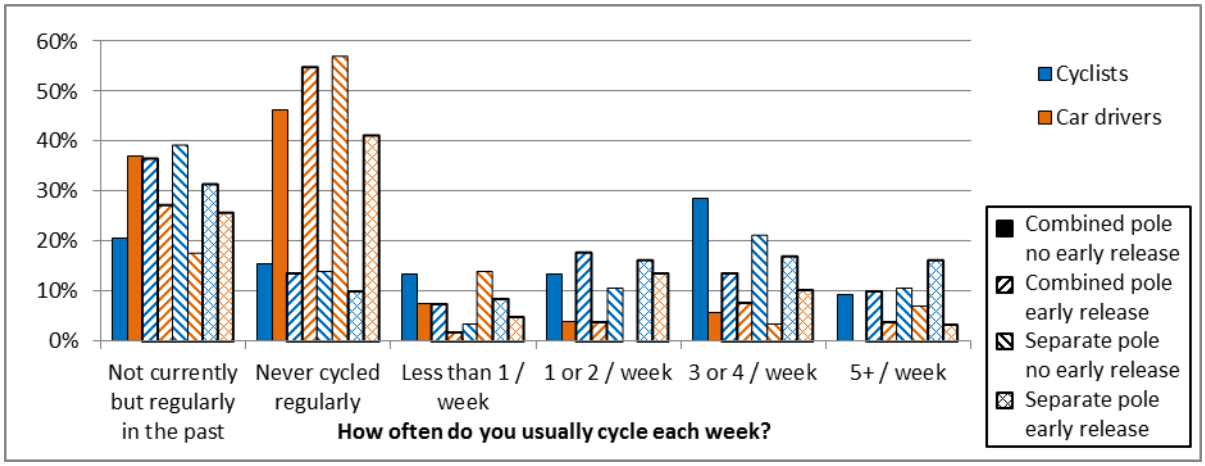

Figure E-3: Cycle frequency

E.2.2 Experience of traffic signal junctions

E.2.2.1 Junctions with traffic signals

When asked how often they use junctions with traffic signals when cycling, 34% of cyclists in the M19b Trial said they did so more than once a week. 32% of cyclists said they had never used junctions with traffic signals when cycling. These results are similar to the M19a and M18 Trials.

Of those cyclists in the M19b Trial who had previously used junctions with traffic signals, about 75% said they never go through a red signal. Two cyclists answered that they 'mostly' go through a red signal. However, one participant suggested that they usually go through a red and amber signal but not a red signal.

E.2.2.2 LLCS

When asked whether they had seen or heard of the LLCS before, 63% of cyclists and 61% of car drivers responded 'no'. About 20% of participants reported seeing the LLCS in another country. These results are very similar to the M18 and the M19a Trials. As in previous trials, a few participants (about 10%) thought they had seen the LLCS in the UK. These participants were most likely referring to media coverage about the trials or the signals on Toucan crossings.

E.2.2.3 Cycle reservoirs

Slightly fewer cyclists (68%) in the M19b Trial had seen cycle reservoirs before compared with those in the M19a Trial (83%) and in the M18 Trial (76%). Slightly more car drivers in the M19b Trial had seen cycle reservoirs before (81% compared with 75% in the M19a Trial and 69% in the M18 Trial). Results were similar to previous trials, with only 14% of cyclists and 25% of car drivers who had seen the cycle reservoirs before, using junctions with them frequently (once a week or more). 26% of cyclists and 10% car drivers in the M19b Trial, who had seen cycle reservoirs before, said they had never used them.

In the M19b Trial, 88% of cyclists said that they enter cycle reservoirs either 'every time' or most times' when cycling. 10% of cyclists said they 'sometimes' use cycle reservoirs. These results are very similar to the previous trials.

As in previous trials, all of the car drivers in the M19b Trial said that they would 'never' wait in a cycle reservoir when there were cyclists around. When asked what they would do if there were no cyclists around, 17% of car drivers said they would 'rarely' stop in the cycle reservoir, and one car driver said they would 'often' stop in the cycle reservoir. These results are similar to the M19a and M18 Trials. Comments suggested that some of the car drivers may wait in the cycle reservoir in busy, queuing traffic.

E.2.3 Summary

The participant characteristics were fairly similar between the M19b Trial and the M18 and M19a Trials. The age of M19b cyclists was slightly older compared to the previous trials, although the age of car drivers was about the same. Most of the other sample characteristics were similar to that in previous trials.

E.3 Experiences from the trial

E.3.1 Understanding of the signals and the junction

E.3.1.1 Understanding the LLCS and early release

Figure E-4 shows the results of participant understanding of the LLCS. Responses were classified into the categories 'traffic signals for cyclists'; 'normal traffic signals'; 'unsure who they were for'; 'for car drivers'; and 'pedestrian or cyclist crossing'.

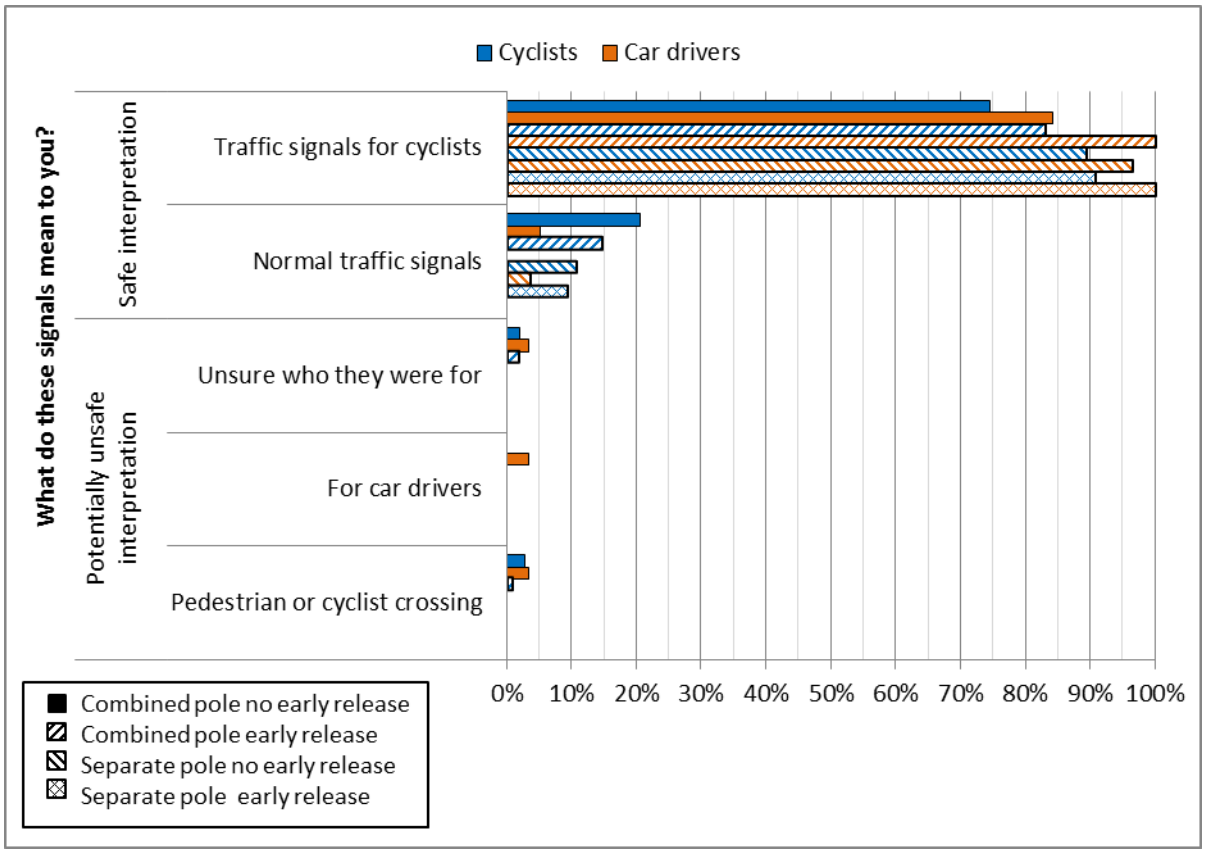

Figure E-4: Understanding of the LLCS

E.3.1.2 Understanding the layout

Comments from participants concerning the layout and understanding of the separate poles included:

> *"It would be tempting to use the cyclists signal to go. By being apart you had to concentrate on the main traffic light. However you could anticipate the signal changing." [Car driver]*

> *"Good separation of cycle lights from vehicle lights." [Car driver]*

> *"They were quite clearly a separate function." [Car driver]*

> *"Easier to see these lights as a driver and when they change to green, it's a signal that the main lights are about to change because sometimes the main lights are at an awkward angle to keep watching them." [Car driver]*

"Need to be in line with [the] cyclist stop [line], not vehicle stop line, so think [this] is correct. If [the LLCS were] below main signals [they] would not be lined up correctly and might be confused for a main signal repeater for vehicles." [Car driver]

"About right, [there was] clear differentiation between these and the main lights." [Car driver]

Understanding of the signals and the junction is also covered in Section 4.1 in the main report.

E.3.2 Approaching the signals

E.3.2.1 Duration of the early release

Figure E-5 shows the proportion of participants who noticed the difference in duration of the early release.

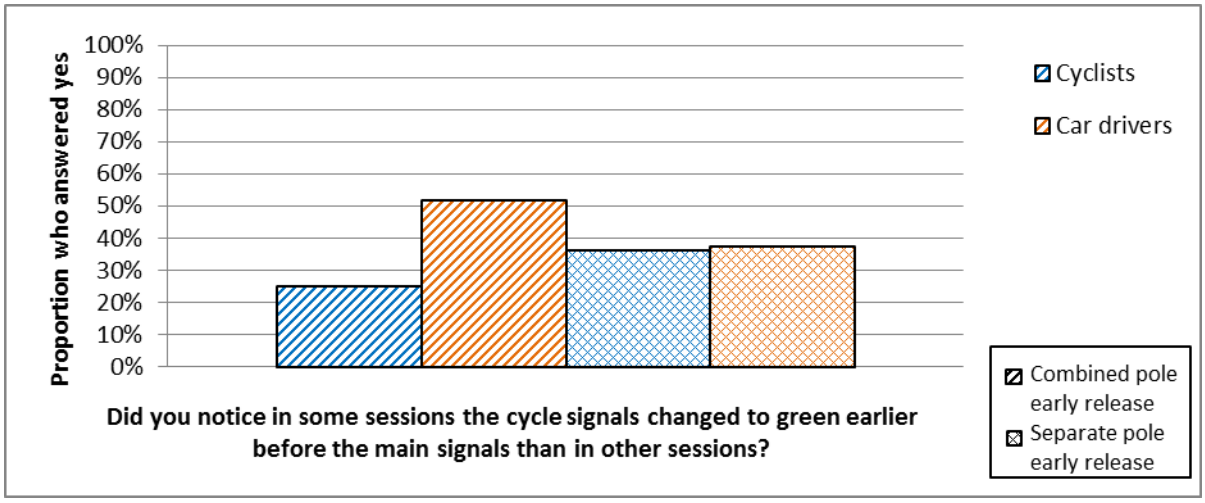

Figure E-5: Proportion of participants who noticed the difference in duration of the early release

Figure E-6 shows the proportion of participants who said they were affected by the difference in early release durations. When comparing those participants who had the two and four seconds early release against those who had the three and five seconds early release, in both the M18 and M19b Trials, the cyclists noticed the difference more between the three and five seconds release and the car drivers noticed the difference more between the two and four seconds release.

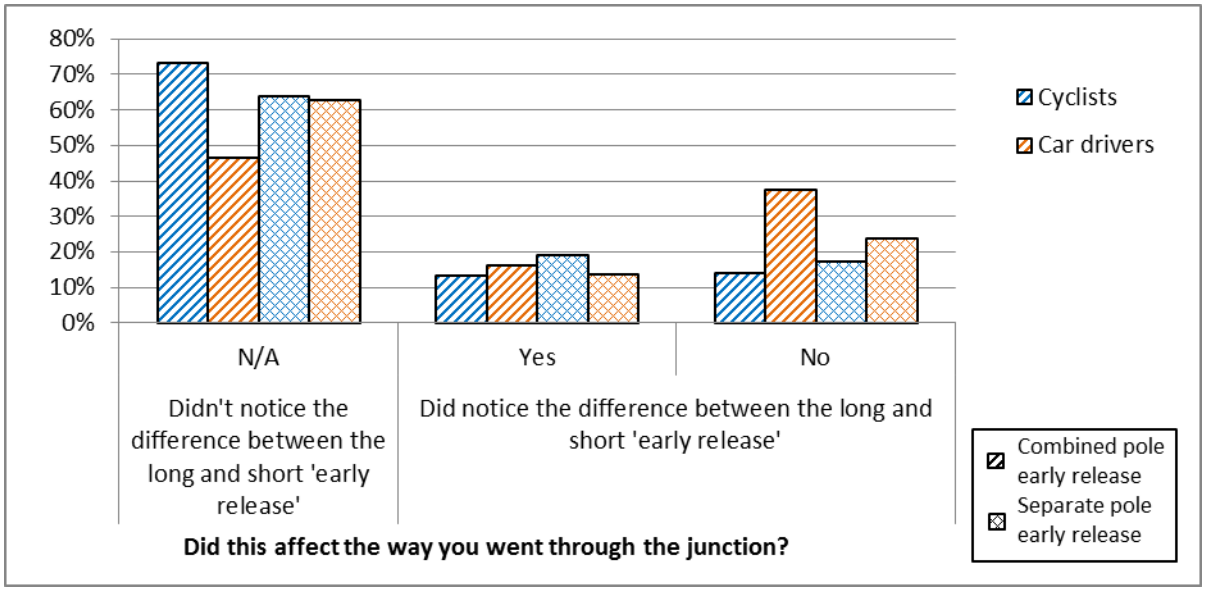

Figure E-6: Proportion of participants who said that the different durations of the early release affected how they went through the junction

Most car drivers said they did not notice the difference as their focus was on the main signals, although a few car drivers said that they were distracted by the LLCS.

"I almost pulled away instead of waiting for the main traffic light."

"It distracted me and I'm not keen on waiting for cyclists."

E.3.2.2 Views on the layout

Figure E-7 shows that slightly more car drivers (80% compared with 69%) thought the LLCS were located about right. 4% of cyclists and 5% of car drivers in the M19b Trial suggested that the LLCS should be located further away from the main signals. None of the participants in the M19a Trial gave this response. There were no significant differences between the two trials.

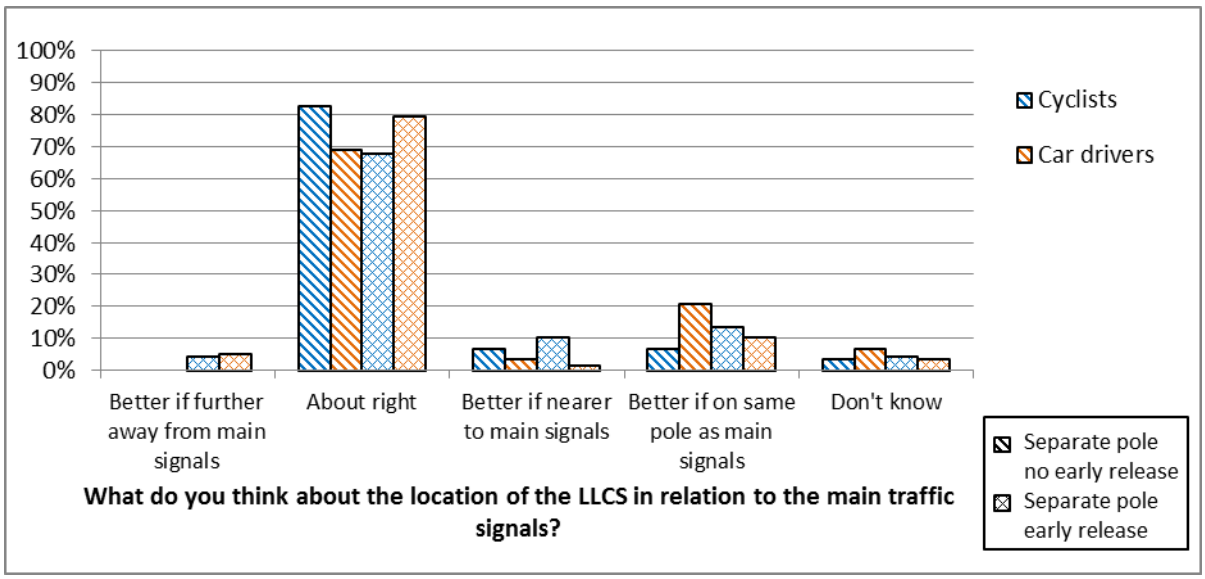

Figure E-7: Views on the separate poles

Most cyclists commented that the LLCS were easy to see and understand, although not so good for turning right if they were only present on the near-side:

"[The location was] good for turning left and straight ahead, not so good for turning right." [Cyclist]

Those participants that responded 'about right' suggested that having the LLCS and the main signals on the same pole may be confusing, with drivers potentially moving off on the wrong signal:

"It would be confusing if the signals were in the same field of vision." [Cyclist]

"They are good because they are separate, will reduce confusion." [Cyclist]

Cyclists who said the LLCS should be located on the same pole as the main signals felt that this would make the LLCS easier to see and would be safer if all road users could see the signals. A number said that they automatically look at the main signals so might miss the LLCS if they were not on the same pole. One cyclist said they originally thought the LLCS were for another stream of traffic:

"At [the] outset of [the] trial I felt, due to their location, that they were for another stream of traffic, even pedestrians." [Cyclist]

Some car drivers suggested the LLCS would be better on the same pole as the main signal so they were easier for drivers to see and know what cyclists were doing.

Those participants who suggested that the LLCS should be located further away from the main signals suggested that they may confuse car drivers on separate poles. As they were within a driver's eye line, there was concern that a driver may go on a cycle green when the main signal remained red.

"[Move them further away] so as not to be confused with main signals." [Car driver]

"As they were directly in my line of sight if distracted it would be quite easy to look at the green symbol and think it was for me." [Car driver]

One cyclist suggested that they felt the LLCS were too close to the main signals which may distract cyclists:

"Cyclists less liable to be distracted by main signals. Also makes it more apparent that signals apply to cyclists only." [Cyclist]

Two cyclists suggested that the LLCS were too far away and they did not notice them at first. These participants commented that they initially thought the LLCS were pedestrian lights. The responses of these participants throughout the post-trial questionnaire suggest that they did understand that the LLCS were signals for cyclists on the road.

"Their presence was not immediately obvious. I thought they were pedestrian signals at first. When turning right if positioned in the centre of the road you had to look left to see them and not where you were going." [Cyclist]

"[I] didn't notice them at first and thought they were pedestrian lights as they were so low and so far from main signals." [Cyclist]

Participants who thought the LLCS should be placed higher commented that the signals may be obscured either by cyclists or pedestrians at their current height.

"I would wonder about finding a position for these lights that would be visible to a number of cyclists in the waiting box at busy times e.g. in London at rush hour. Easy here for us as individual cyclists, what about a big group?" [Cyclist]

"The low level signals could be obstructed by pedestrians waiting on the footway. Secondary cycle signals would help." [Cyclist]

Some commented on stopping closer to the kerb because of the LLCS:

"I stopped where I could see the signal better so that was normally beside the low lever signals."

"[The LLCS] made me want to stop towards the left side to see it better, this only changed when turning right."

"Waited on the left to turn left or go straight on, then on the right to turn right and could see the signals well from both positions."

"Sometimes [I] stopped closer to kerb so that the LLCS was more in line of sight."

Some commented on stopping further back because of the LLCS:

"[I] always stopped far enough back from front line to be able to see the lights clearly."

"[I] moved slightly back from front of box so did see signals clearly."

"[I] sometimes stopped at the back of the box so I could see them. [I] would move forward if [there was] a vehicle behind."

"To have a clear view I stopped further back."

E.3.3 Moving through the junction

E.3.3.1 Turning right across the path of oncoming traffic

Figure E-8 shows the proportion of cyclists who said that they considered turning if front of oncoming traffic.

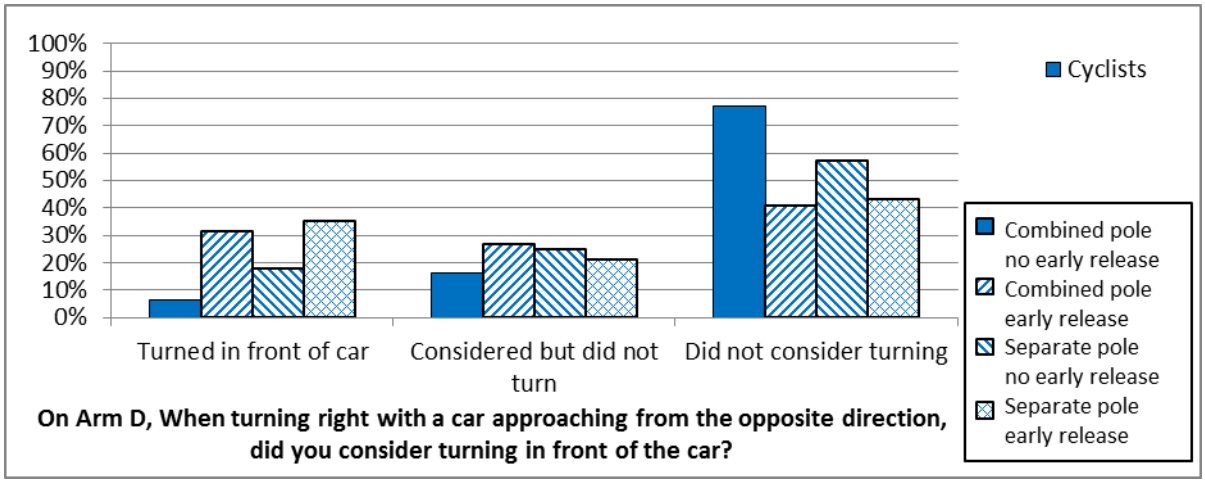

Figure E-8: Proportion of cyclists who considered turning right in front of an oncoming car

The main themes of comments are shown in Figure E-9.

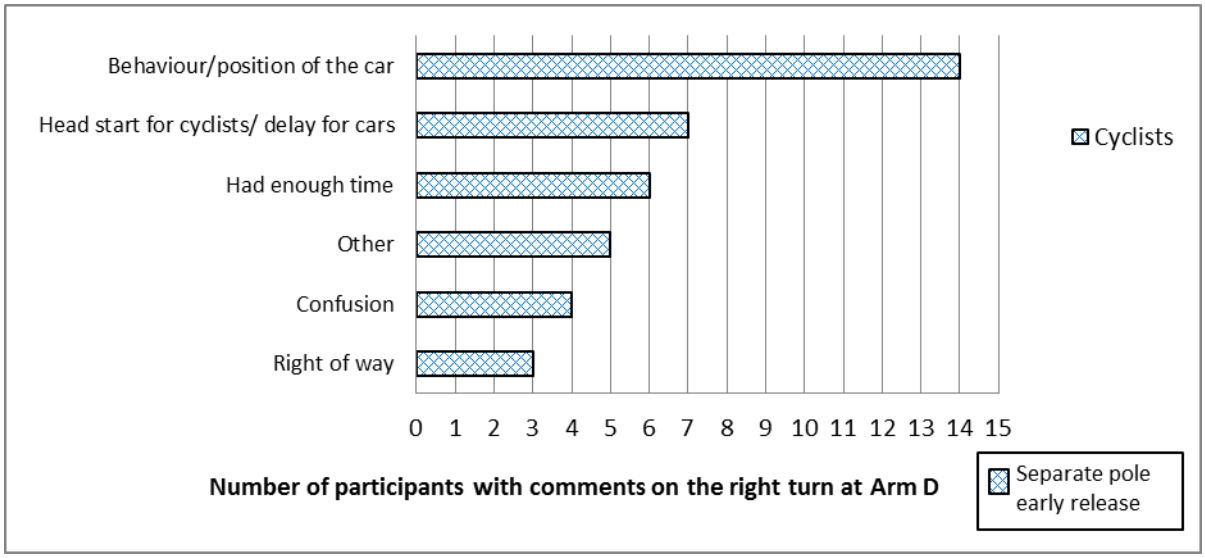

Figure E-9: Comments on the early release in relation to the right turn at Arm D

Comments related to the behaviour or position of the approaching car[22]:

"I judged the distance between myself and the car and safely managed a right turn." (Cyclist)

"I was much further across the junction than the car so felt safe to turn in front of it." (Cyclist)

Comments related to the early release:

"The signal let me go first so I had plenty of time." (Cyclist)

"As my light was green and the car did not pull off at the same time as me, it felt like I had the right of way." (Cyclist)

"With the delay I could easily turn in front safely which I think is good as this prevents cyclists being stuck within the junction." (Cyclist)

Comments regarding right of way at the junction:

"I was unsure of how much time I had and who had right of way." (Cyclist)

"Got confused and just kept going - almost forgot the car was also coming just saw the green cycle light and went." (Cyclist)

In M19a Trial, the LLCS changed to green at the same time as the main signals. In M19b Trial, some cyclists experienced an early release of 2 and 4 seconds, whereas other cyclists experienced an early release of 3 and 5 seconds. Responses for the separate pole trial were broken down by which early release scenarios the cyclists experienced. In the separate poles trial, significantly[23] more cyclists said they turned in front of the car with the longer early release (3 and 5 seconds) than those with a shorter early release (2 and 4 seconds). Figure E-10 shows this.

[22] In M19 Trial 4, there were 113 responses to the question on whether they considered turning right in front of the car; of these 40 said that they did turn in front of the car and 39 gave explanations.

[23] $p < 0.01$

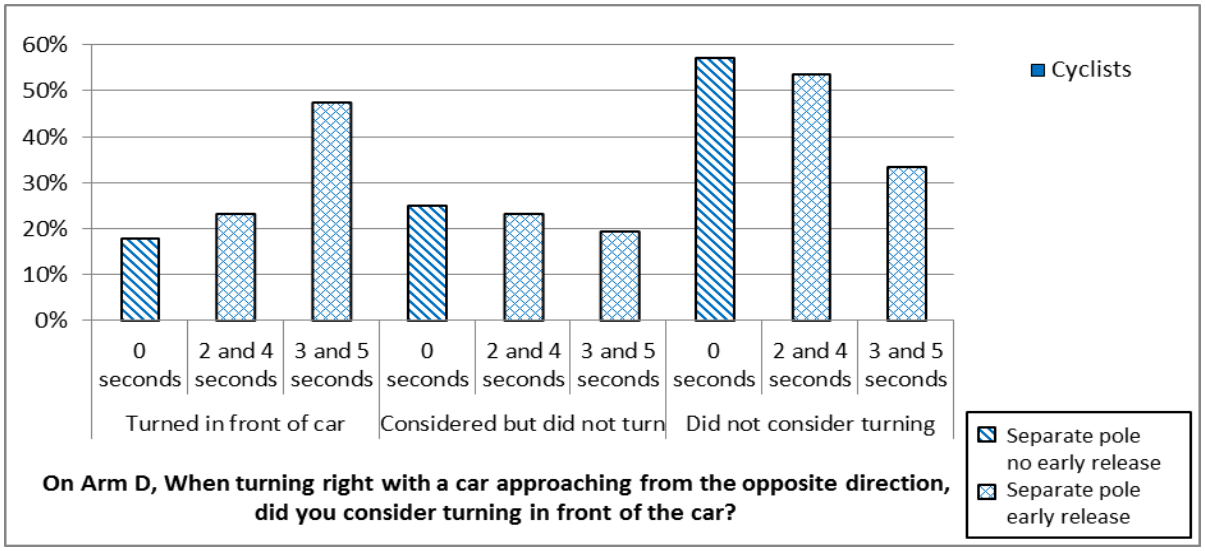

Figure E-10: Effect of the early release on right turning across oncoming traffic

E.4 Using the Low Level Cycle Signals during the trial

E.4.1 What people looked at

E.4.1.1 Cyclists

Figure E-11 and Figure E-12 show the proportion of cyclists who said they looked at the LLCS and main signals.

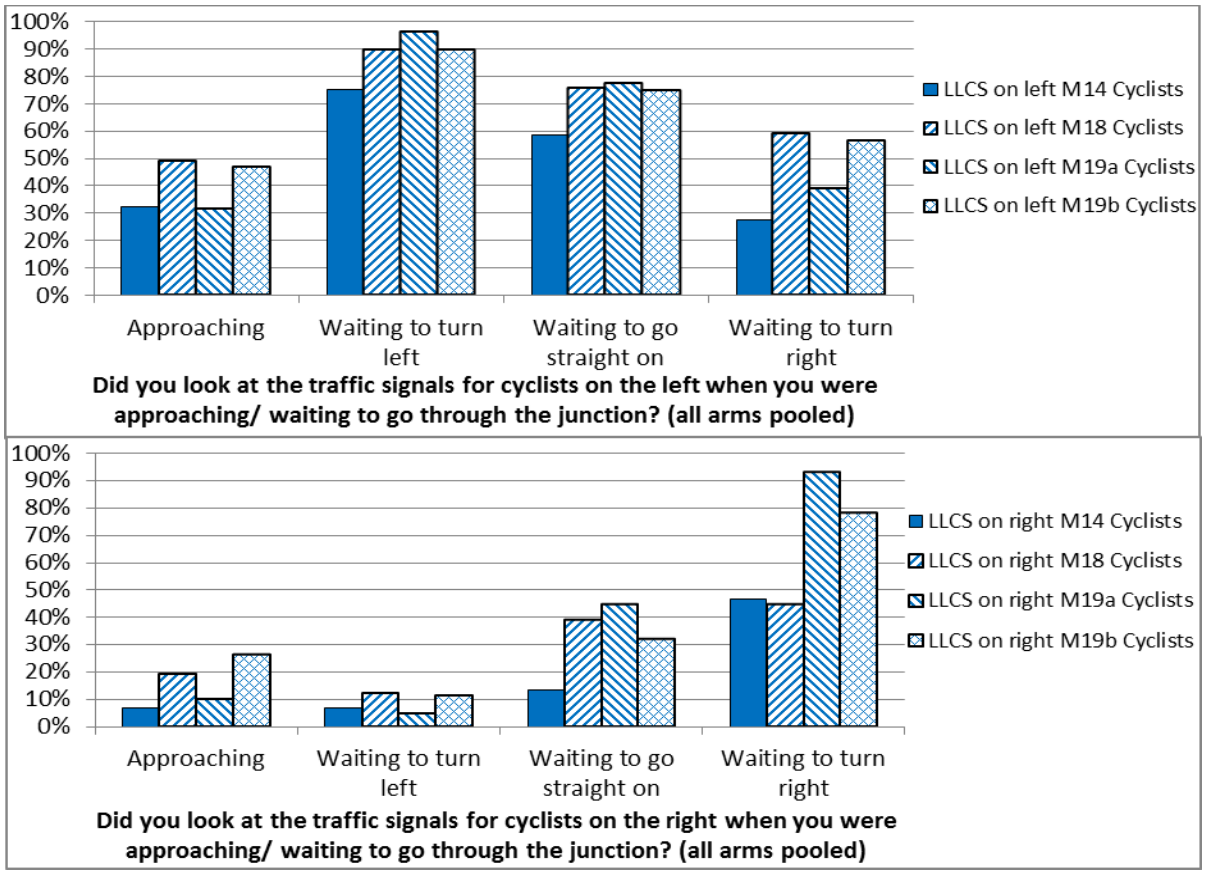

Figure E-11: Proportion of cyclists who said they looked at the LLCS

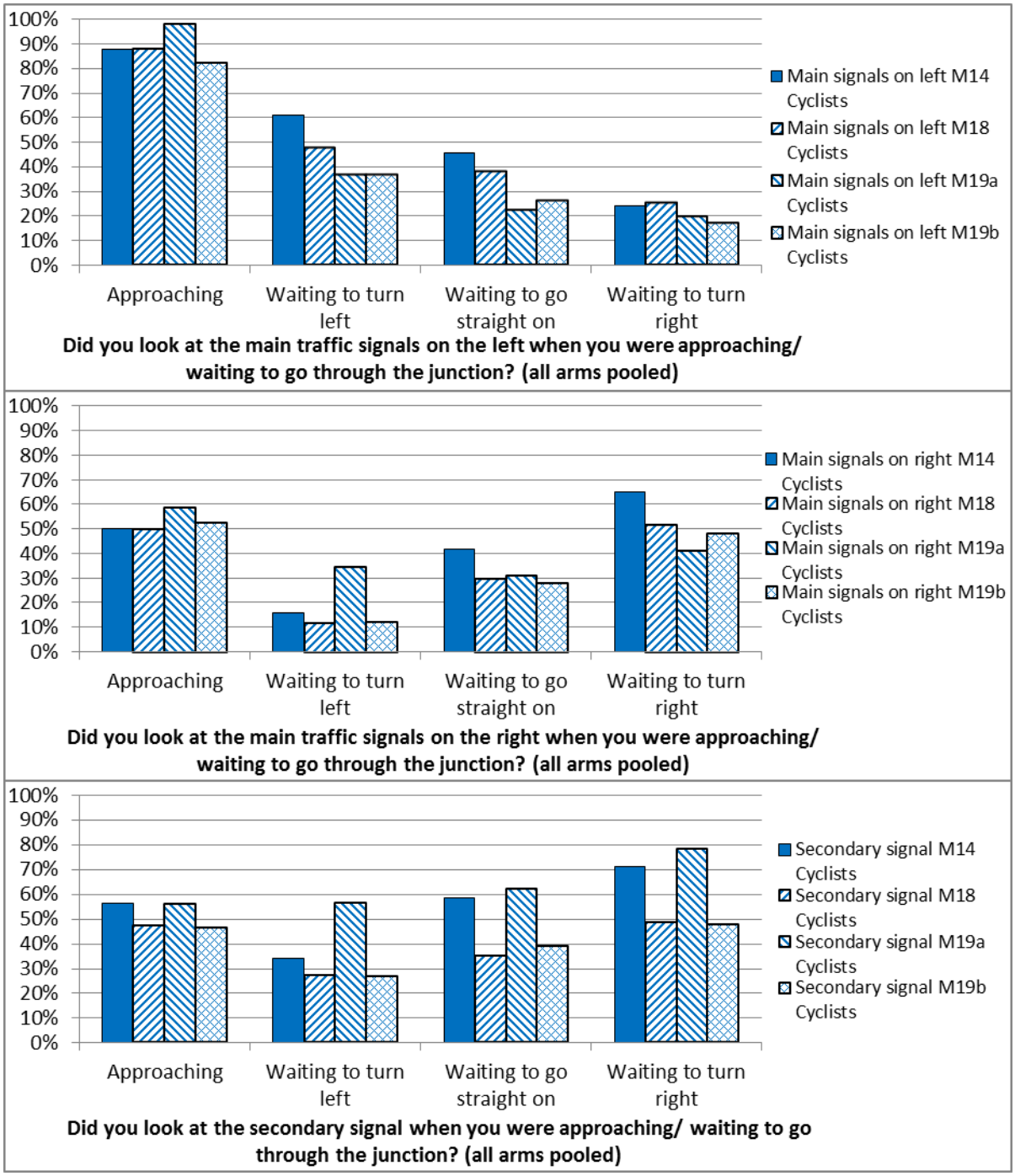

Figure E-12: Proportion of cyclists who said they looked at the main/secondary signals

Cyclists looked more at the main signals on approach to the junction than LLCS, as in the previous trials. Significantly[24] more cyclists said they looked at the LLCS when approaching the junction in the M19b Trial compared with the M19a Trial (47% and 26% for those on the left and right, compared with 32% and 10%). There was little difference in this when comparing the M19b Trial with the M18 Trial. Significantly fewer M19b cyclists said they looked at the near-side main signals on approach (83%) than in the

[24] LLCS on left: $p<0.01$, LLCS on right: $p<0.05$.

M19a and M18 Trials (98% and 88% respectively); however these signals were still the most looked at when approaching the junction.

Slightly fewer cyclists said they looked at the near-side LLCS when waiting to turn left in the M19b Trial compared with the M19a Trial; however slightly more said they looked at the off-side LLCS. When waiting to go straight on, about 70% of cyclists in the M19b Trial looked at the near-side LLCS which was about the same as the M18 and M19a Trials. Slightly fewer M19b cyclists looked at the off-side LLCS when waiting to go straight on compared with the M19a and M18 Trials (32% compared with 45% and 39% respectively).

When waiting to turn right, significantly[25] more cyclists looked at the near-side LLCS in the M19b Trial compared with the M19a Trial (57% compared with 39%). This is related to a higher proportion of cyclists (nearly 75%) in the M19b Trial looking at the near-side LLCS at Arm C and Arm D, (where there were no off-side LLCS present) to see the early release, whereas in the M19a Trial cyclists used the secondary signal more.

Cyclists in the M19b Trial looked at the off-side main signals a similar amount to those in the M18 and M19a Trials when approaching the junction (between 50% and 60%) and when waiting at the junction to go straight ahead (about 30%). Slightly more M19b cyclists looked at the off-side main signals when waiting to turn right compared with those in the M19a Trial (41% compared with 48%). This was about the same as in the M18 Trial (around 50%).

In their comments, cyclists mentioned looking out for approaching traffic more than in the previous trials.

> *"[It was] easy although more aware of traffic that could be coming from other junctions."*
>
> *"[I] had to keep aware of other cyclist. Some would cut in front of you and turn right across you as you were going ahead. Most would wait to turn right and then let you go straight ahead. So more likely to be hit by another cyclist as cars are used to waiting to turn right across oncoming traffic."*
>
> *"I just checked whether there was also a cyclist approaching from the one-way street."*
>
> *"Turning left always easy & safe. Pay attention to traffic turning same way opposite to you."*

One cyclist also suggested that they could not see the main traffic signals from their stopping position in the cycle reservoir:

> *"When I moved into cycle area I could only see bike lights." [Cyclist]*

E.4.1.2 Car drivers

Figure E-13 and Figure E-14 show the proportion of car drivers who looked at the LLCS and the main signals.

[25] $p<0.01$

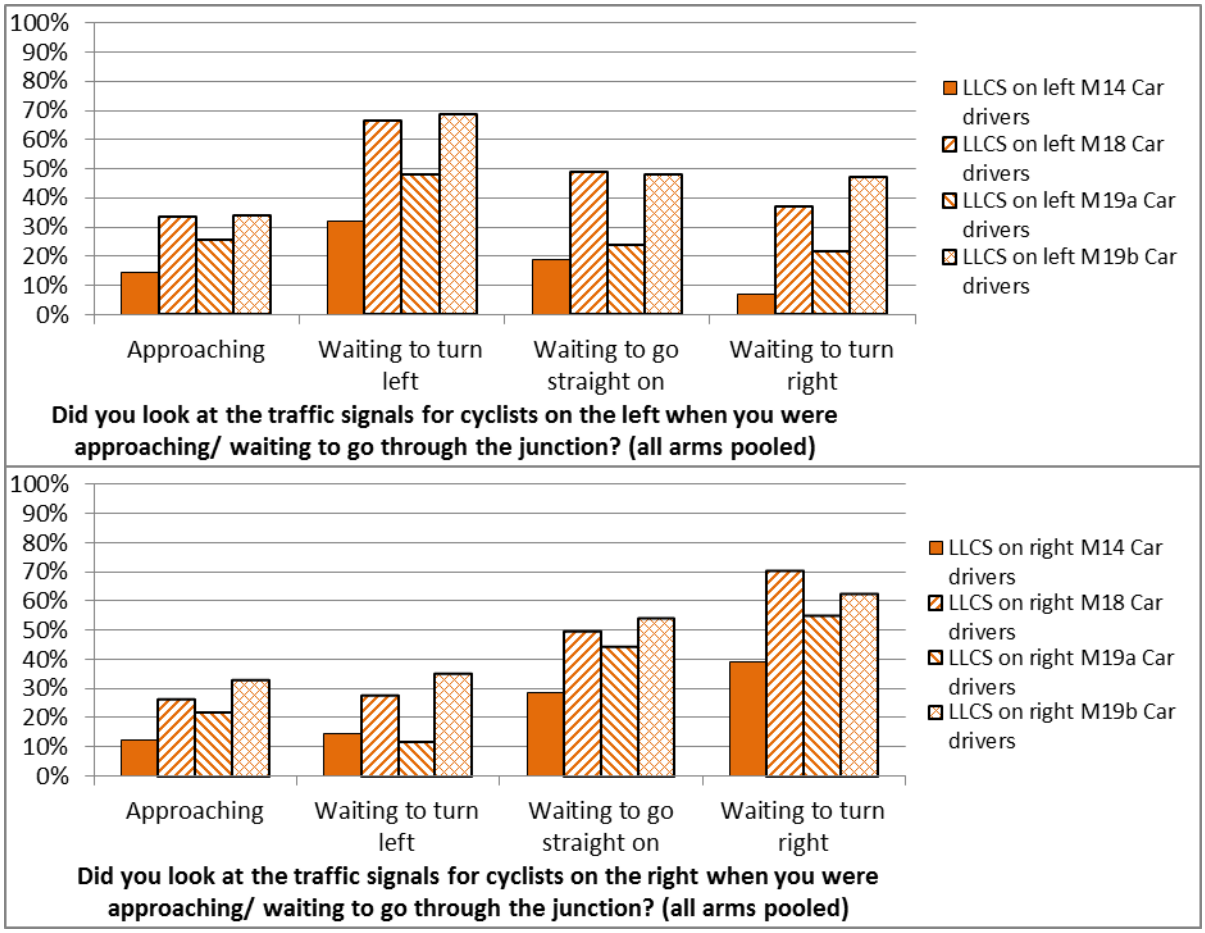

Figure E-13: Proportion of car drivers who said they looked at the LLCS

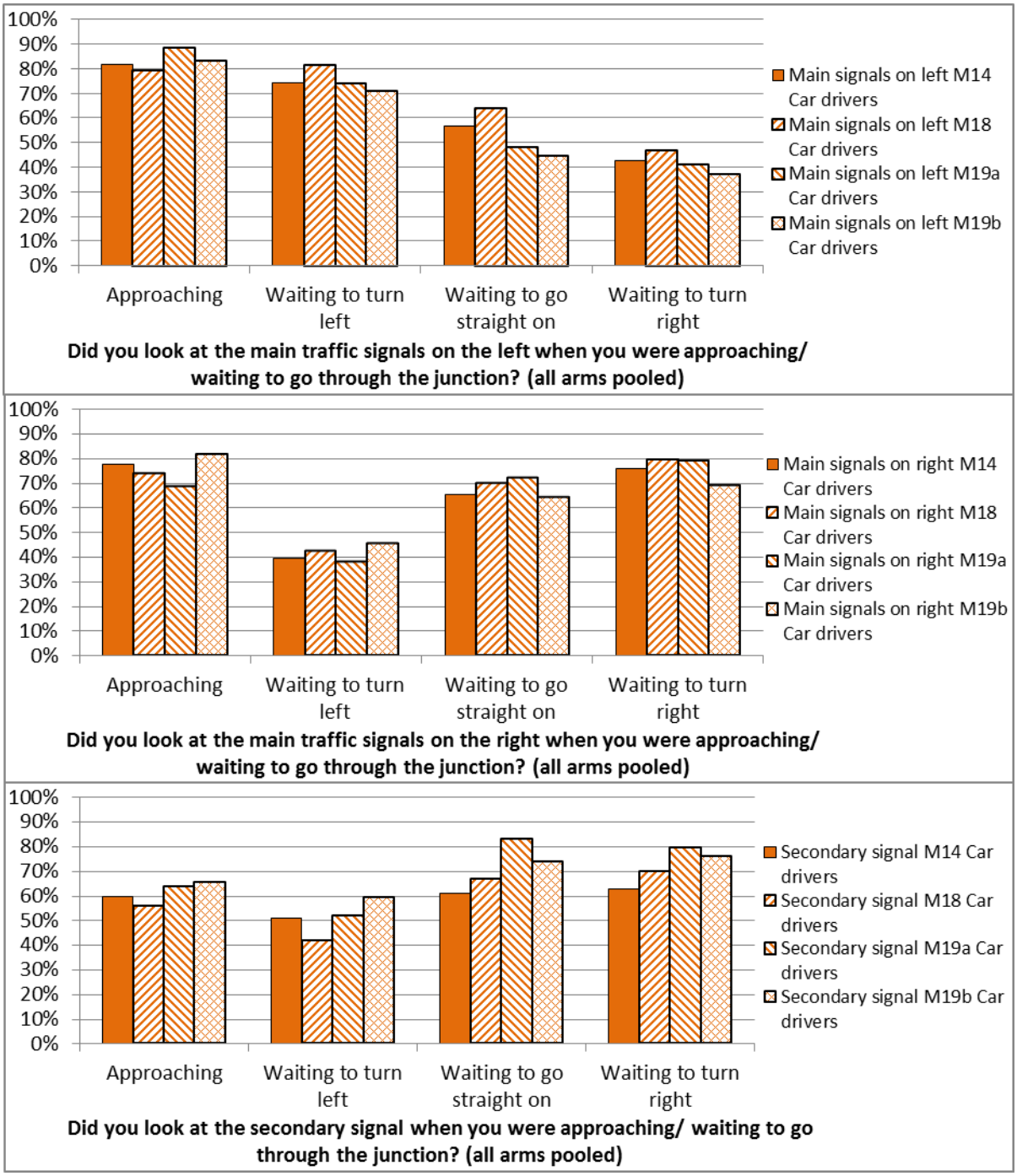

Figure E-14: Proportion of car drivers who said they looked at the main/secondary signals

M19b car drivers also looked more at the near-side LLCS when approaching the junction in the M19b Trial compared with the M19a Trial; however this was not a significant difference (34% compared with 26%). The proportion of car drivers looking at the near-side LLCS was very similar between the M19b and M18 Trials, with the exception of turning right, when significantly[26] more car drivers used the near-side LLCS in the M19b Trial compared with the M18 Trial (48% compared with 37%).

[26] $p<0.1$

In the M19b Trial, significantly[27] more car drivers looked at the off-side LLCS when turning left than those in the M19a Trial (36% compared with 12%). Compared with the M19a Trial, there was also a slight increase in the proportion of M19b Trial car drivers looking at the off-side LLCS when approaching the junction (33% compared with 22%) and when waiting to go straight on (54% compared with 45%) or turn right (63% compared with 55%). When comparing the M19b Trial against the M18 Trial, slightly more car drivers looked at the off-side LLCS when approaching the junction (33% compared with 27%); when waiting to turn left (36% compared 28%) and when waiting to go straight on (54% compared with 50%). There was a slight decrease for right turning (70% compared with 63%).

Significantly[28] more M19b car drivers looked at the off-side main signal when approaching the junction than in the M19a Trial (83% compared with 69%). Results for car drivers stopped at the junction were similar across all the trials, with about 40% looking at the off-side main signals when waiting to turn left; about 70% when waiting to go straight on; and between 70% and 80% when waiting to turn right.

There was no significant difference in the proportion of car drivers looking at the secondary signal when waiting to go straight ahead or turn right. When comparing the M19b Trial against the M19a Trial, there was a slight increase in the proportion of car drivers looking at the secondary signal when waiting to turn left (59% compared with 52%); and a slight decrease in the proportion looking at it when waiting to go straight on (74% compared with 83%).

When stopped at the junction waiting to turn, car drivers looked at the LLCS and the main signals about the same amount. About 70% of car drivers looked at the near-side LLCS and main signals when turning left and about 65% looked at the off-side LLCS and main signals when turning right.

More car drivers in the M19b Trial looked at non-signal cues than in the M19a Trial, however fewer used these cues than in the M18 Trial.

Comments from car drivers:

> *"[I] looked at cycle lights to know when cyclist was moving off and to see when my lights were changing."*
>
> *"[I] looked at [the] vehicle signals to go, though [I] used [the] cycle signals as a red amber 'get ready to go'."*

E.4.2 What was the most important piece of information

E.4.2.1 Cyclists

Section 4.4.2 of the main report shows the proportion of cyclists who thought the LLCS were the most important source of information.

About 10% of cyclists in the M19b Trial thought the main signals were the most important piece of information; this was very similar to the M18 Trial.

[27] $p<0.01$

[28] $p<0.05$

A very similar proportion of cyclists rated the secondary signal as most important in the M19b and M18 Trials. This was generally below 10% of cyclists; however it was about 20% for the right turn at Arm C where there were only near-side LLCS (see Figure E-15).

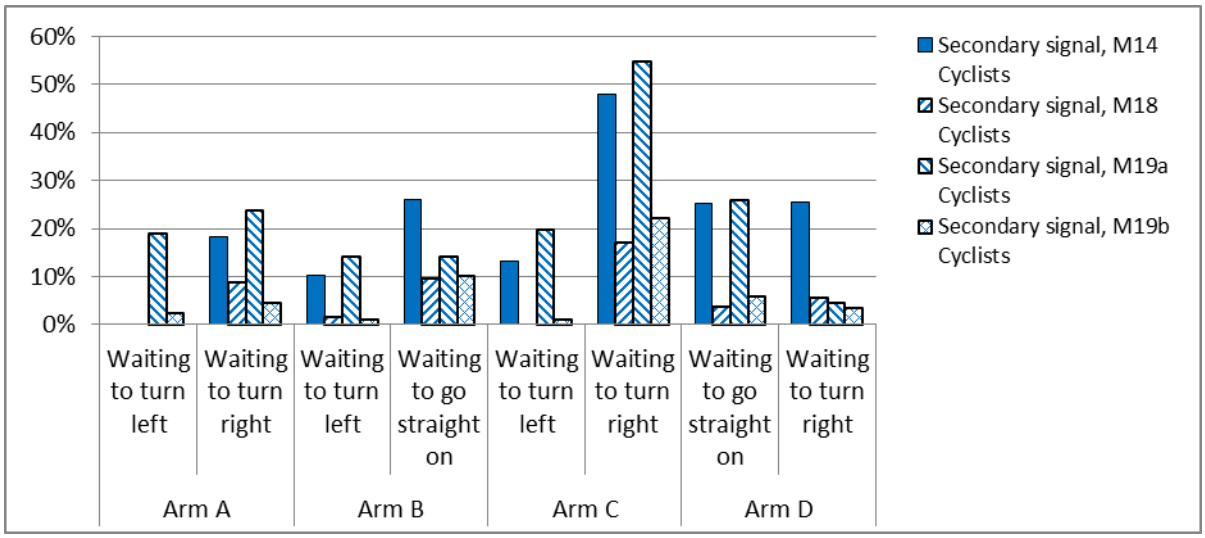

Figure E-15: Proportion of cyclists who felt that the secondary signals were the most important

E.4.2.2 Car drivers

As shown in Figure E-16, there was a significant decrease in car drivers who felt that the near-side main signals were most important when turning left at Arm C[29] (38% compared with 59%); going straight on at Arm D[30] (19% compared with 42%); and turning right at Arm D[31] (9% compared with 28%). There was also a significant[32] decrease in those who thought the off-side main signals were most important when turning right at Arm A in the M19b Trial compared with the M18 Trial (33% compared with 52%). Significantly[33] fewer drivers thought the off-side main signals were most important when going straight on at Arm B in the M19b Trial compared with the M19a Trial (20% compared with 48%). Results are shown in Figure E-17. Figure E-18 shows the proportion of car drivers who felt that the secondary signals were the most important piece of information.

[29] $p<0.1$

[30] $p<0.05$

[31] $p<0.05$

[32] $p<0.1$

[33] $p<0.05$

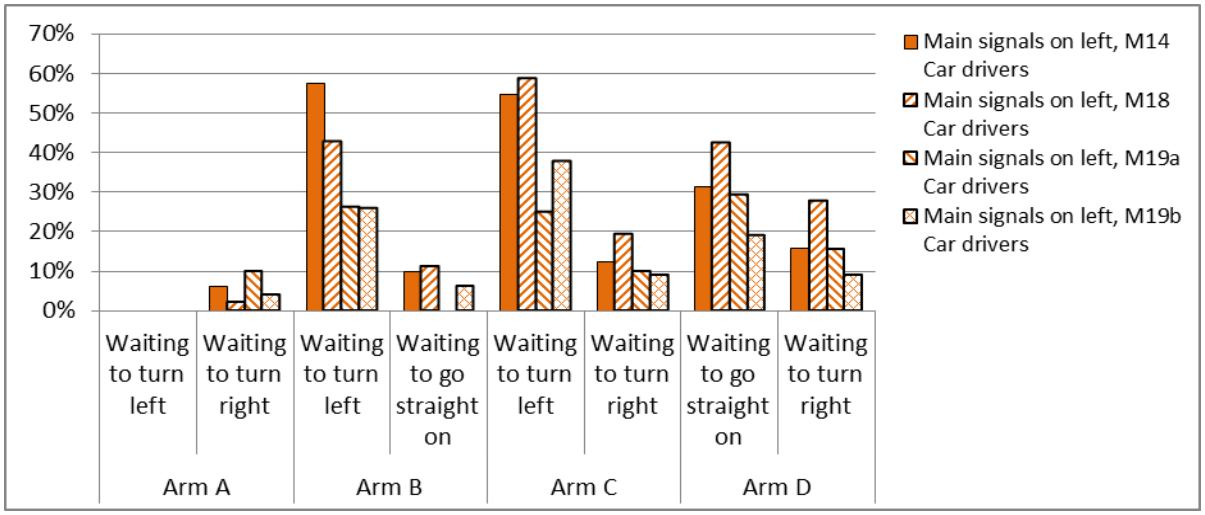

Figure E-16: Proportion of car drivers who felt that the near-side main signals were the most important

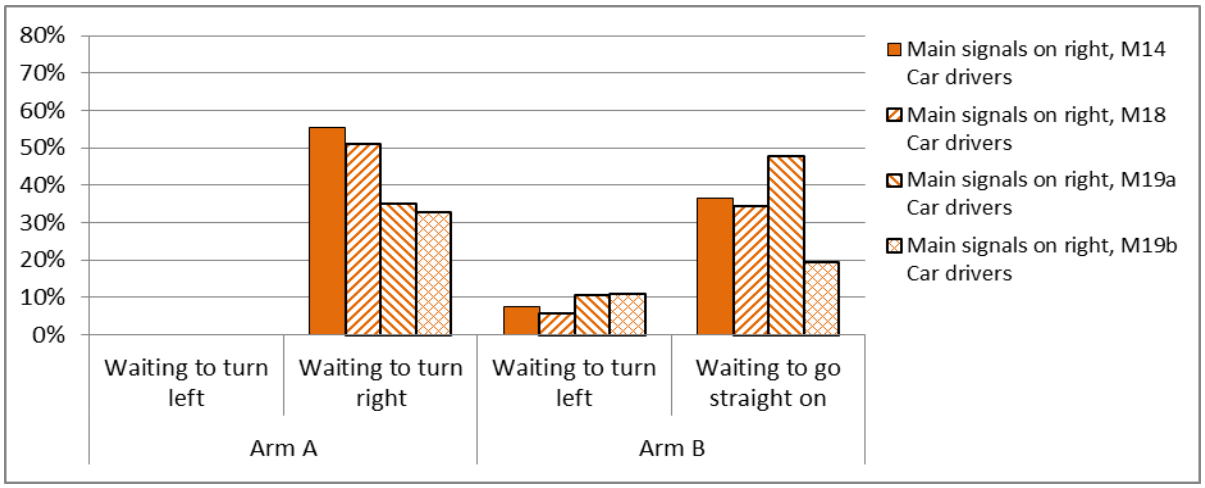

Figure E-17: Proportion of car drivers who felt that the off-side main signals were the most important

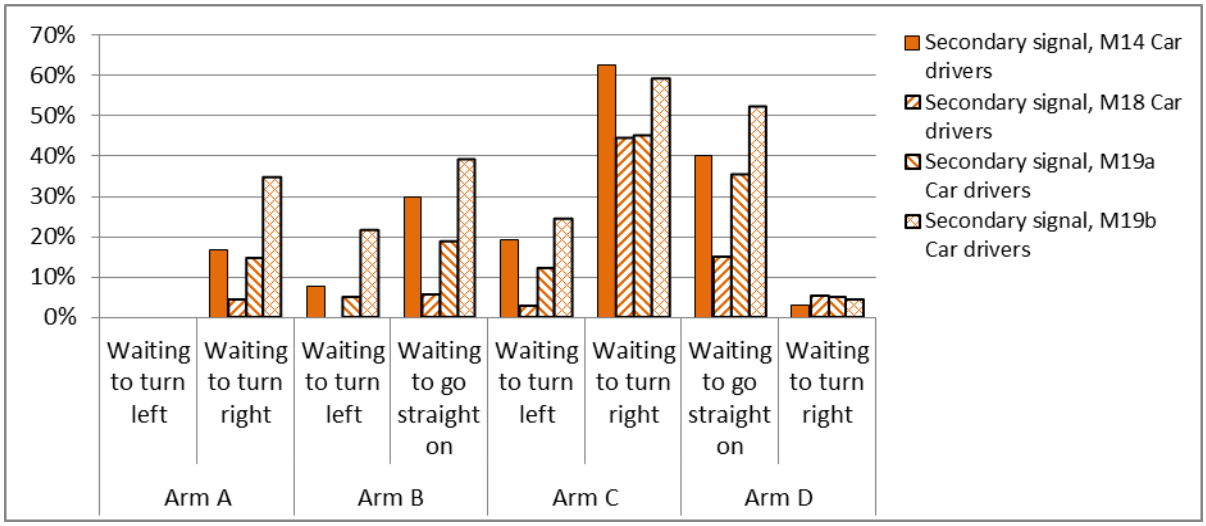

Figure E-18: Proportion of car drivers who felt that the secondary signals were the most important

What people looked at is covered in Section 4.4 in the main report.

E.5 Attitudes

E.5.1 How easy it was compared with an ordinary junction

Figure E-19 shows how easy participants thought it was to use the trial junction compared with an ordinary junction. As mentioned previously, the participant sample consisted largely of residents of the Wokingham/Bracknell area, where few junctions have ASLs. Thus many participants interpreted an "ordinary" signal junction to be one without an ASL; as such many of their comments for this question related to ASLs. Where possible, comments have been classified as to whether they refer specifically to the LLCS, the cycle reservoir, or the separated poles.

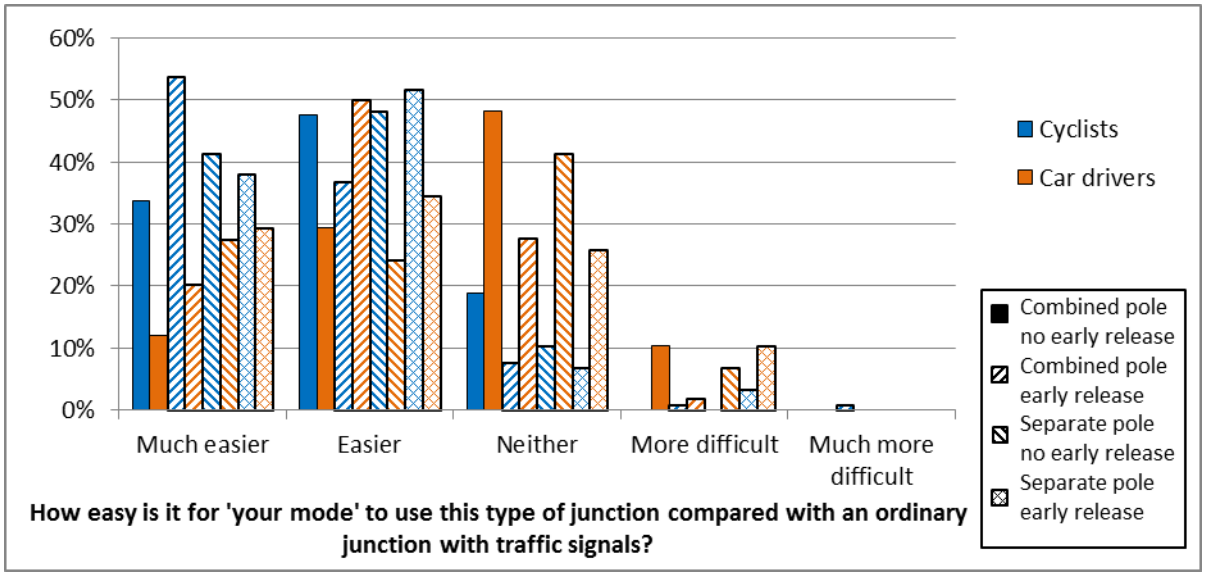

Figure E-19: How easy the junction was to use compared with an ordinary junction

Comments from both cyclists and car drivers were very similar between the M19b and M18 Trials. There was also very little difference between the comments from those participants who answered 'much easier' and those who answered 'easier'.

Participants (both cyclists and car drivers) generally said that the junction was 'easier' or 'much easier' to use when referring specifically to the LLCS. Most said the LLCS made it easier for cyclists to see the traffic signals and easier for car drivers to understand what cyclists were going to do.

Two cyclists thought that the LLCS made the junction more difficult to use as they felt they were unclear and might mean that cyclists take their focus away from what is going on in the junction ahead.

> *"I found the LLCS rather ambiguous and unclear and they take your focus off the wider view of the junction and traffic movements." [Cyclist]*

> *"You do not clearly see the cycle lights. When you do look at them you are not looking at the road judging for yourself whether people have skipped the lights." [Cyclist]*

The majority of those cyclists who referred to the early release (about 20% of the total) said it made the junction 'much easier' or easier to use. There was a significant[34] decrease in the proportion of cyclists who answered 'much easier' in the M19b Trial compared with the M18 Trial.

Two cyclists suggested that the LLCS with early release made the junction more difficult to use.

Those that commented on the early release in both the M18 Trial and the M19b Trial said that it took the pressure of the cyclists and provided a gap between the cyclists and the main traffic, enabling the cyclists to complete their manoeuvre in the junction before the cars behind had set off.

One cyclist suggested that the LLCS with early release made the junction more difficult to use as they were not sure whether to adhere to the LLCS or the main traffic signals.

> *"[The LLCS were] more difficult because they are uncommon. If [the] cycle signal [is] at green but [the] main one [is] at red, which do you adhere to? Cycle signals on segregated lanes would be ok but these left me slightly confused." [Cyclist]*

The most common comments from car drivers were that it enabled them to prepare for the main signals changing to green and made them more aware of cyclists and their movements. These reasons were also common in the M18 Trial.

> *"It makes you look at cyclists moving off and ensures they are clear of junction. It's also an early warning that traffic lights will soon turn green." [Car driver]*

E.5.2 Perceived safety

E.5.2.1 Overall view

Participants were asked how safe it was for them to use a junction they experienced compared to an 'ordinary' junction, see Figure E-20.

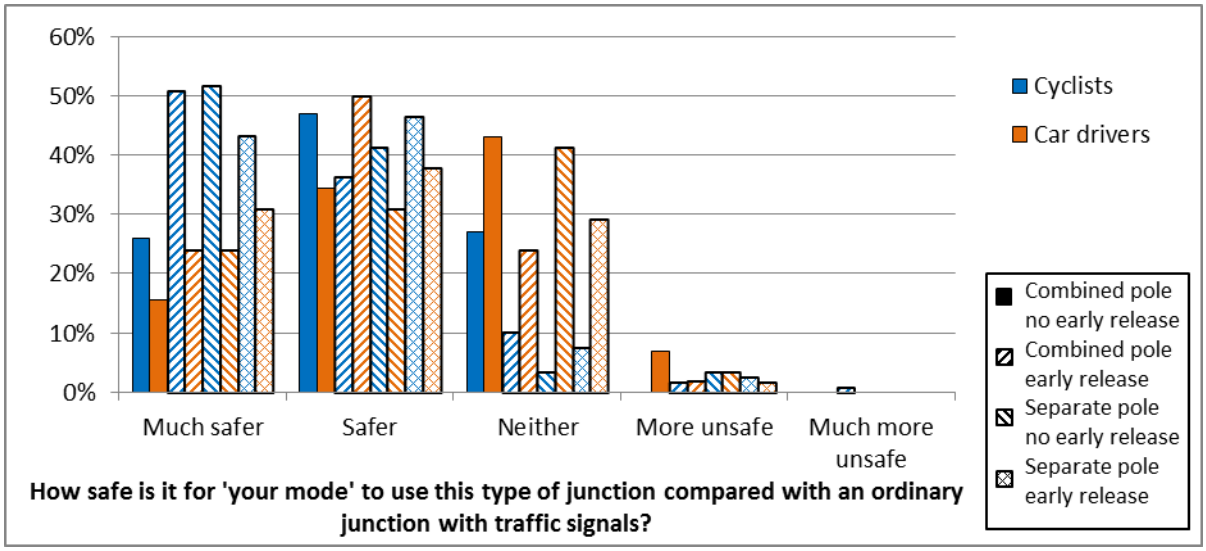

Figure E-20: Perceived safety of the junction compared with an 'ordinary' junction

[34] $p<0.01$

Comments were split into different categories to understand whether they were referring to the LLCS, the cycle reservoirs, both of these together or making more general, non-specific comments in relation to the perceived safety of this type of junction.

Results from the M19b Trial were similar to the M18 Trial, with about 40% of cyclists suggesting that the LLCS contributed to the junction feeling 'safer' or 'much safer'. Compared with the M19a Trial, there was a significant[35] increase in cyclists who felt the LLCS contributed to improved safety.

About 25% of those cyclists who mentioned the LLCS gave general comments about the signals increasing the safety of the junction:

"Cyclists will start to rely on signalling more than road sense."

"You do not clearly see the cycle lights. When you do look at them you are not looking at the road judging for yourself whether people have skipped the lights."

"Other motorists will think you've jumped the lights."

About 20% of car drivers in the M19b Trial specifically mentioned the LLCS in terms of making the junction feel 'safer' or 'much safer'. This is a similar proportion to the M18 Trial. Out of these car drivers, about 40% suggested it was the early release that made them feel safer.

Perceived safety is also covered in Section 4.7 in the main report.

E.5.3 Thoughts on a hypothetical scenario with early release

Similarly to the previous trials, the majority of car drivers in the M19b Trial said 'no' when asked whether they would ever start moving into the junction when the cycle signal was green and the main signal was red (see Figure E-21).

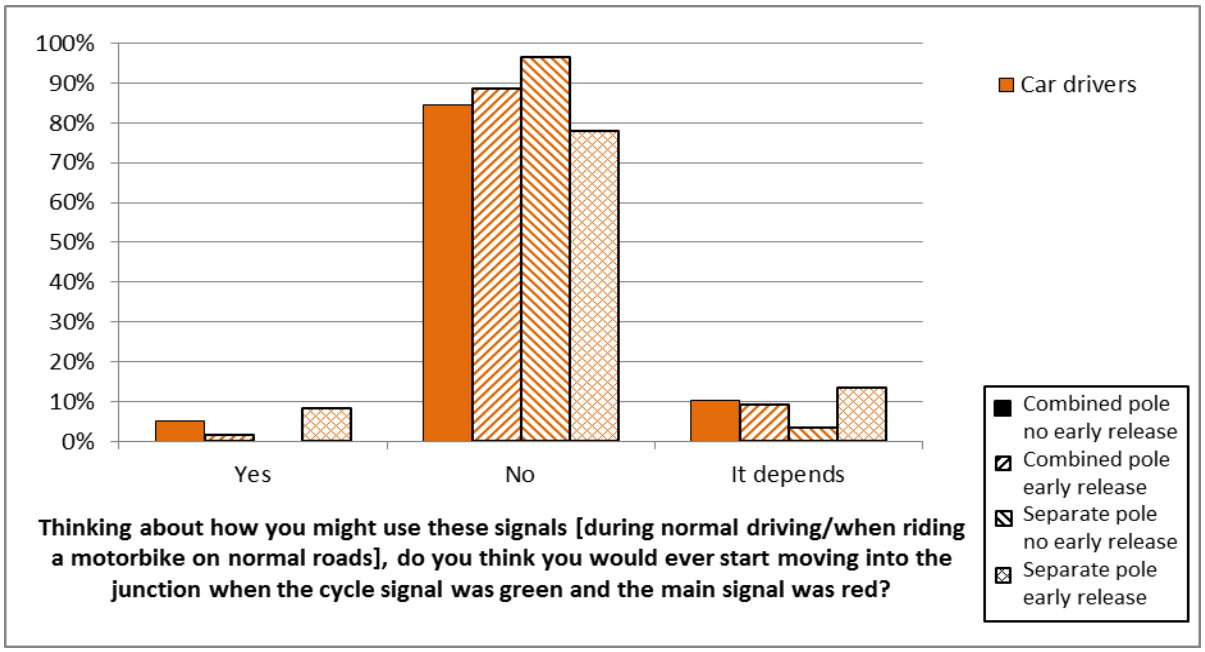

Figure E-21: Hypothetical early release situation

[35] $p<0.05$

In the M19b Trial this majority was the smallest of all the trials with just under 80% responding 'no' compared with nearly 90% in the M18 Trial and over 95% in the M19a Trial.

E.5.4 Overall perception

E.5.4.1 Cyclists

Results from the M19b cyclists were very similar to the previous trials, with about 90% providing positive feedback about the LLCS, just fewer than 10% feeling ambivalent and 3% giving negative feedback. Figure E-22 shows this.

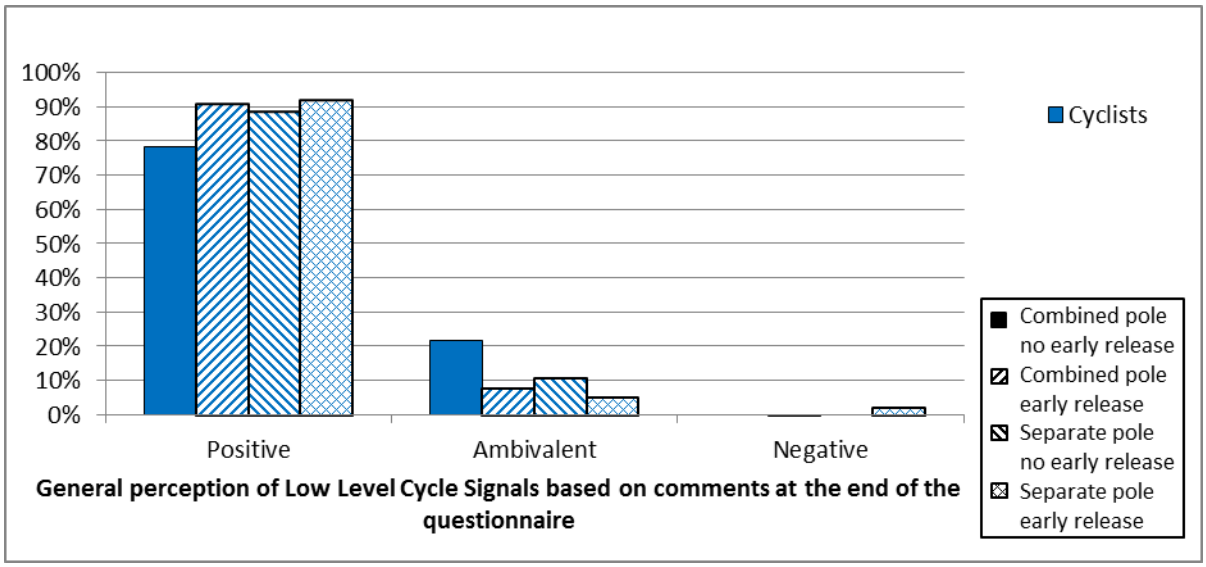

Figure E-22: Cyclists' overall perception of the LLCS

Positive comments included:

"Gives slower vehicles a chance to gain distance from quicker ones."

"I found the cycle lights very clear and easy to follow and use."

Comments from those who were ambivalent about the LLCS, included suggestions of a longer early release, cycle lanes leading up to junctions and signage or education informing road users that the LLCS only apply to cyclists.

"Longer head start if they are to be used. Position on opposite side of junction where more in line of sight (and make bigger)."

"Signage to advise all road users that the signals and waiting zones only apply to cyclists. Signage to advise that you may still need to give way to oncoming traffic."

Those cyclists who provided negative comments suggested that it is better to have fewer signals, so people would still be looking ahead to check the junction.

"The few signals the easier and safer." [Cyclist]

"Remove them. Have the larger signals possibly with green light arrows. Have cycle paths crossing the junction." [Cyclist]

E.5.4.2 Car drivers

Results from the M19b car drivers were similar to the previous trials, with the majority providing positive feedback about the LLCS, about 20% feeling ambivalent and 2% giving negative feedback (as shown in Figure E-23). When looking at all trials together, car drivers were slightly more positive about the M18 and M19b Trials with early release than the M14 and M19a Trials without early release. A slightly higher proportion of car drivers were positive in the M18 Trial compared with the M19b Trial. Slightly fewer drivers were 'ambivalent' towards the LLCS in the M19b Trial compared with the M19a Trial.

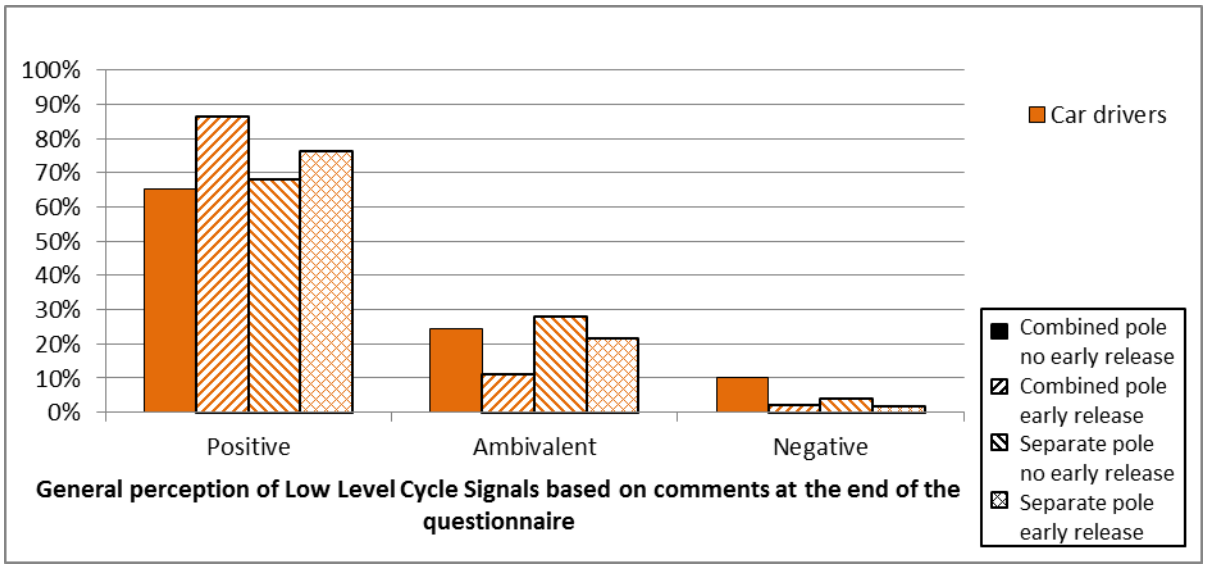

Figure E-23: Car drivers' overall perception of the LLCS

Positive comments from M19b car drivers included:

> *"Very safe, very good for cyclist and makes the driver stop and think about cyclists and giving them preference which is a good thing."*

> *"When motorists are waiting at the traffic lights sometimes it can be at a different angle. Low light system would help."*

Some comments from those who were ambivalent included:

> *"Safe for cyclists but more difficult for drivers as the drivers had to cross the junction very slowly being the cyclist."*

> *"There is a clear temptation for drivers to use the amber for cyclists as their own amber signal. Where there are no cyclists, this would be a problem. However if the habit is fixed, it will spill over to times when cyclists are present, thus negating the purpose."*

Negative comments were related to the potential for car drivers to move on a cycle signal green rather than a main signal green.

> *"If distracted it could be quite easy to go on the cyclist light as it is right in your line of vision."*

Appendix F Focus group findings (M19a Trial: no early release)

F.1 Introduction

Focus groups were conducted with typically 8 to 10 participants. Due to the small sample sizes, the findings in this section are not statistically significant, rather they add further qualitative context to the more robust findings from the questionnaires and video data.

F.1.1 Road user groups

There were five focus groups conducted for the M19a Trial, as follows:

A. A focus group for cyclists was conducted on August 12th 2013. Seven participants took part in the focus group (5 males and 2 females). Five of them cycle for leisure, one commutes by bike every day and one is an occasional cyclist. All seven participants consider themselves to be confident cyclists, however four of them are less confident cycling in busy areas and one was confident cycling in London. Five of the seven participants are also car drivers.

B. A focus group for car drivers was conducted on August 20th 2013. Eight participants took part in the focus group (4 males and 4 females). All eight drive a car every day with all eight describing themselves as a confident driver, but with one who avoids motorways. Six of the participants do not cycle and two participants cycle off-road only. The participants had a range of trial experience between them (having taken part in between 0 and 3 other trials).

C. A focus group for motorcyclists was conducted on August 22nd 2013. Six male participants took part in the focus group. They all used their motorbikes regularly, at least twice a week. Five of the six participants described themselves as a confident motorcyclist. One of the participants cycled occasionally.

D. A focus group for HGV drivers was conducted on October 7th 2013. Eight male participants took part in the focus group. One participant only drives a HGV sporadically, mostly driving vehicles under 3.5 tonnes. One participant drives 50 miles a week but never in urban areas. The remaining six drive longer distances, between 150 and 1000 miles a week, with four sometimes driving in urban areas and two often driving in urban areas, particularly London and Reading. Three drivers stated that they did not find any journeys difficult. Of the five drivers who did have difficulties driving, three stated that they found driving in urban areas such as London difficult; three stated that they found busy motorways like the M25 and M6 difficult and one participant stated that he found driving on narrow country lanes difficult. None of the HGV drivers cycled.

E. A focus group for pedestrians was conducted on September 11th 2013. Ten participants took part in the focus group (3 male and 7 female). All of the participants regularly walked on the public highway, seven every day and three a few times a week. Four participants regularly take longer (in excess of 2 miles) walks. Four participants do not drive at all; two drive regularly for work; two drive most days and two drive occasionally. Seven of the participants do not cycle, one participant cycles to work 2-3 times per week, one participant cycles 3 times per week for leisure (sometimes in London) and one participant cycles about once a month for leisure.

F.1.2 Experience of traffic signal junctions

F.1.2.1 LLCS

A small number of the focus group cyclists suggested that they had seen LLCS for cyclists within the UK. However this was in relation to seeing cycle signals on a Toucan crossing or on a dedicated cycle path rather than on the main carriageway.

Several of the focus group motorcyclists were familiar with low level signals as they had seen them abroad.

F.1.2.2 Cycle reservoirs

The majority of focus group motorcyclists suggested that in an everyday environment they would not enter the cycle box under a red light:

"They are just for cyclists"

"If you wait in the box it is 3 points on your license so never wait in them"

However some did go on to suggest that often enter the cycle box:

"I would use them all the time, [though] not today because you were filming me"

"When you ride in town, it is a race, I've got to get there before everyone else so if there is a gap in the box it is human nature to get into it"

Two motorcyclists suggested that the presence of cyclists affects the decision to enter the cycle box:

"If there were 3 push bikes in it I would stay out of it, if there was just one push bike then I would go into it"

The motorcycle riders who had experience of riding in London suggested that couriers and scooter riding commuters almost always entered to cycle box:

"In London where you have scooter riders and commuters they may go over the line"

"Couriers in London will use the box"

All modes in the focus groups stated that a cycle reservoir differentiated from the rest of the road with a colour surface treatment was more obvious.

The HGV drivers that drove in urban areas stated that they complied with the cycle reservoir, and rarely entered a cycle box by mistake when driving in urban areas.

F.2 Experiences from the trial

F.2.1 Understanding of the signals and the junction

F.2.1.1 Noticing the separate poles, the cycle reservoirs and the LLCS

The majority of the focus group cyclists used the main traffic lights on the Arm and used the LLCS once in the cycle box.

Focus group cyclists suggested that the LLCS were not visible from a distance and that on the approach to the junction the larger traffic lights were used by them instead. It

was noted that road users are used to looking up to traffic lights and therefore the cycle lights were out of the sight line.

A number of focus group cyclists suggested that they undertook the trial route a number of times before noticing the lights.

"[the low level lights] aren't visible until you get into the box"

"To start with I didn't notice the lights or the box so I just stopped at the line, then I noticed the box and cycle symbol on the third time round"

"[the low level] lights are out of sight line"

There was some concern on the approach that cyclists may be unaware of the presence of the cycle box if there was heavy traffic obscuring it. Similarly, focus group participants suggested that if there were higher volumes of cyclists or vehicles, the low level lights could be obstructed during busy periods.

"From a distance you couldn't see the low level lights, only once you were in the box"

Whilst the focus group cyclists commented on the high number of poles and traffic lights, none commented that they found these to block the view of the junction or to impede on the view of the low level lights.

Initially about half of the focus group cyclists suggested that the cycle reservoir and combined LLCS were overlooked by themselves as they primarily focused on understanding their route. However, after navigating the route for the second or third time, all participants confirmed that they did see the additional road markings and furniture and entered the cycle box.

Focus group cyclists suggested it was their habit (as car drivers) to look at the large traffic lights which were in their sight line and this led to some participants passing the LLCS a number of times prior to noticing them.

"[I was] looking at the green man rather than the cycle lights"

"[I'm] so used to looking up or ahead for traffic lights [I] didn't notice the low level lights"

Not all focus group car drivers were aware of the cycle box markings initially, with a number indicating that they drove the layout a number of times before becoming aware of its presence.

Half of the focus group car drivers noticed the LLCS on the initial arm compared to the remainder of the group who inferred that they drove the layout up to three times before observing the LLCS.

"Didn't notice anything…the lights were very subtle"

A number of focus group car drivers suggested that they did not initially notice the LLCS as they were out of their sight line.

All focus group motorcyclists noticed the LLCS initially on approaching the junction. In some instances they were noticed from quite far away whilst others identified them at a much closer proximity.

Focus group motorcyclists all observed that the LLCS were in sync with the traffic lights.

Half of the focus group HGV drivers noticed the LLCS. Four participants did not notice the LLCS at all. Three noticed them on the first run and one noticed them after a few runs through the junction. Those that did see them found it easy to see them:

"The bike signals [drew my eye to them]"

Of those that could not see the signals one stated that:

"You're looking out for your own lights… I would see [the LLCS] as a distraction so I would ignore it"

"[I only look at] the main lights, and any hazards which might occur once it's green"

Two focus group pedestrians specifically mentioned the LLCS when asked what was different about this junction.

Most focus group pedestrians noticed that the main signals were at the entrance to the cycle reservoir.

F.2.1.2 Understanding the separate poles

The majority of the focus group cyclists were unfazed by the location of the low level lights and cycle box beyond the main set of traffic lights. It was inferred that once it was understood that cyclists should enter the cycle box, the secondary traffic lights and low level lights were sufficient in instructing when to go.

A number of focus group car drivers suggested that the location of the main traffic lights before the cycle box acted as an additional method of conveying to drivers where they should stop. Some went on to suggest that this would increase compliance with cycle reservoirs:

"The first car should always stop at the first lights when queuing"

"The traffic light location at the start of the box stopped drivers going into the box. It was something different so felt should stay out of the box as a driver"

When asked about having the signals on separate poles, all focus group HGV drivers agreed that they did not mind which poles they were on as long as their signals were clear:

"As long as I can see my light, and my light is clear, then I'm fine"

Pedestrians

Four of the focus group pedestrians were confused about the location of the crossing point, having noticed that the main signals were at the back of the cycle reservoirs.

"I think the traffic lights for cars were before the cycle bit so I found that a bit strange and kept thinking that's where I should cross, behind the lights rather than at… the crossing which… [meant I crossed] behind the cycle lights."

"At the moment [on normal junctions] the traffic lights for the cars is where the crossing is so... I cross where the traffic lights are"

Some participants stated that the presence of the green surface treatment on Arm D made the correct crossing point more obvious.

F.2.1.3 Understanding the cycle reservoirs

Some of the focus group cyclists were unsure whether motorcyclists and scooters were also allowed to use the cycle box, with the majority suggesting that all two wheeled vehicles would be likely to use the box whether they were allowed to or not. Participants felt that the use of the box should be restricted to cyclists and that this would need enforcement with motorists who abuse this – perhaps through fines.

"Are motorbikes and scooters allowed in these boxes as well?"

The majority of the focus group cyclists understood how to negotiate the layout on the Arm and suggested that the layout was self-explanatory. However, a few of the participants suggested the cycle box itself was not immediately obvious to them, with some needing to trial the route a number of times before entering the cycle box.

"Second time around I noticed the box, you don't see it on the Arm"

Once the focus group cyclists had seen and interpreted the cycle box for its purpose, it was used by all.

The majority of focus group car drivers understood that they could not enter the box.

The general consensus of focus group car drivers was that on first observing the cycle reservoir, this was interpreted to be for cyclists. Some participants suggested the cycle symbol indicated to them that cyclists had priority at this junction and it gave them as drivers an increased awareness of cyclists. Other participants assumed that this box was to allow cyclists to the front of queuing traffic and allowed them time to pull away from the junction in advance of the remaining traffic.

"Made me give priority to cyclists"

"…thought cyclists should pull away first"

Focus group car drivers suggested that upon first seeing the cycle box they understood that this was a reserved area for cyclists and that cars should stop at the first line.

"This was a reserved area for cyclists"

A small number of focus group car drivers suggested that the positioning of the main traffic lights assisted in their decision of where to stop, however others suggested the location of the lights were irrelevant to their decision which was based on the location of the first stop line.

All focus group car drivers were in agreement that the cycle box was for cyclists only and that cars would wait behind the first stop line.

There was full agreement that the cycle boxes were only for the use of cyclists and all focus group motorcyclists observed this during the trial, with all of them stopping at the first stop line and not entering the box.

The focus group HGV drivers all showed that they understood what the cycle reservoir meant, and what they were expected to do at this point in the junction:

"Do not enter"

"Stop at the first line"

They all said that they are very wary of them, and would rarely enter them by mistake.

All of the focus group HGV drivers understood how to use the junction. There was a general perception that the junction was clear and simple to use.

F.2.1.4 Understanding the LLCS

A number of focus group cyclists had concerns for the junction incorporating low level lights for both pedestrians and cyclists, suggesting that these could be confusing for both cyclists and pedestrians as either party may follow a green light rather than their specific symbol.

> *"…pedestrian crossing and cycle crossing lights together could be confusing"*

Initially two focus group car drivers suggested that they thought the lights were to assist cyclists to cross the traffic, with the remaining participants all assuming the lights were to aid cyclists on the carriageway.

The focus group motorcyclists were immediately aware that the LLCS were targeted specifically at cyclists. This assumption was based on the association between the cycle lights and cycle box which had a large cycle symbol.

> *"…associated the lights with the cycle bay"*

All focus group motorcyclists agreed that the LLCS were unlikely to confuse pedestrians, however some suggested that the lights should be angled away from the sight lines of drivers and motorcyclists.

> *"angle lights into the road, could dazzle motorcyclists and drivers"*

The focus group HGV drivers understood the purpose of the LLCS:

> *"To let the cyclists get away first [and] clear the box so we can get out"*

There was a general consensus from all focus group HGV drivers that the LLCS were not of any significance to them:

> *"You're only looking at [the main] red light, and that's it"*

None of the four focus group HGV drivers that noticed the LLCS said that they look at them at all after the main signals went green.

One focus group pedestrian thought that the purpose of the cycle signals was not immediately obvious. All other participants thought that there was no confusion around the LLCS, and showed a good understanding of their purpose:

> *"To tell the cyclists [what to do], just the cyclists, rather than them having to follow the car traffic lights, or them having to make their own judgment."*

One focus group pedestrian did not notice the signals straight away.

Most of the focus group pedestrians agreed that no additional information or marketing would be required to explain the purpose of the signals.

> *"No [extra information or marketing is required], because the light actually had a bicycle on them, so I assume they are for cyclists"*

F.2.2 Approaching the signals

F.2.2.1 Entering the Cycle Reservoir

The focus group cyclists suggested that the location of the LLCS would neither deter nor encourage cyclists into the cycle box. It was discussed that despite the cycle box being located beyond the main traffic lights, cyclists were guided into the cycle box and then observed the low level lights.

> *"You would get used to getting straight into the box, can't see why you would stop before the box once you knew what it was for"*

The focus group cyclists had mixed views over whether they felt the location of the main traffic signals affected their own positioning on the road when waiting for the traffic lights. Some focus group cyclists suggested that they were not affected by the first set of lights as these were interpreted to be for the traffic on the main carriageway and as such were confident to enter the cycle box and use the LLCS. However, some focus group cyclists suggested that on the approach to the junction they tended to use the main traffic lights as this was their usual experience and method, and therefore did not enter the cycle box. However, with repetitions of the trial they then used the cycle box and went past the first set of lights.

> *"Initially, I felt I didn't want to pass the main lights into the box but then I did"*

> *"Felt inhibited at first but then got used it"*

There was confusion between the focus group cyclists over how the cycle box should be entered. Some participants were unfamiliar and therefore unsure whether to use the dotted tail to the left of the box or to approach the box from the centre of the road. The 'tail' leading into the cycle box was described as ambiguous with a number of participants suggesting they were unsure of its purpose.

> *"Not sure what the dotted line leading into the box was for"*

Many of the focus group cyclists were unsure of the correct road position whilst located within the cycle box. Some participants suggested they moved across the cycle box, some however felt that in heavy traffic cyclists may be less likely to do this.

> *"Was confused what you were supposed to do? Were you supposed to move into the tail [markings] and across the box or were you supposed to go up the traffic on the other side?"*

> *"If it had been busier with two lanes of traffic [I'm] not sure people would have gone down the left hand side of traffic and then moved across to the right"*

As the focus group cyclists became more familiar with the layout they moved to the side of the road in which they were exiting to.

F.2.2.2 Compliance of other road users staying out of the Cycle Reservoir

Concerns were expressed by a number of focus group cyclists that motorcyclists were less likely to adhere to road regulations and were likely to enter the cycle box.

> *"Anything on two wheels is likely to enter the box, bikes, motorcycles, electric bikes, motorbikes and scooters".*

The majority of focus group car drivers suggested that they would wait outside of the cycle box regardless of the location of the traffic lights. However a limited number suggested they would be more likely to enter the cycle box if the traffic lights had been located on the far side of the box.

"If I see a cycle box, I would stay out of it, some are with or without lights, it's irrelevant".

A small number of the focus group car drivers suggested that if the cycle box was empty they were more likely to enter the space with their cars, whereas the majority stated it was irrelevant whether there were cyclists - they would still not enter the cycle box with their cars.

Many focus group motorcyclists reported that currently a number of motorcyclists and scooter riders wait in the cycle box (particularly in London), however with the addition of LLCS they think that they and others would be less likely to do so. Therefore, suggesting that cycling safety would be improved.

Focus group motorcyclists suggested that some scooter riders, motorcyclists or couriers may be tempted to enter the box and this was felt to be especially true in London where there are high volumes of commuters and couriers.

"In London where you have scooter riders and commuters they may go over the line"

"Couriers in London will use the box"

F.2.2.3 Compliance with red light

Some of the focus group HGV drivers were concerned that it would encourage cyclists to jump lights as it would become normal for them to cross the first set of lights to enter the cycle reservoir.

F.2.3 While stopped at the junction

F.2.3.1 Size of Cycle Reservoir

A small number of focus group car drivers commented that the cycle box was too wide on the 2-lane approach, suggesting that the cycle box should direct cyclists to stay on the left hand side of the road when entering the junction. However, in contrast other focus group car drivers suggested that it was necessary for the box to be adequately large to accommodate high volumes of cyclists. Conversely, other focus group car drivers suggested that the box should be larger. This was felt to be particularly pertinent in London where there are higher cyclist numbers.

"Box needs to be wide for safety"

"The box should be wider, would be too small for London"

When asked about the size of the cycle reservoir, one focus group HGV driver stated that he thought it was too big. Two focus group HGV drivers, who drive regularly in urban areas, countered that in London they would need to be larger to cater for the high number of cyclists:

"[If they were larger] the cyclists would be in front of us, instead of queuing up either side of us"

"They would need to be twice the size [in London]"

One focus group HGV driver went on to say that the size of the cycle reservoir is not the important factor, it's the fact that an obvious cycle reservoir is there. This kind of junction layout would make him more aware that cyclists may be in the vicinity and to be more cautious, even if there are no cyclists in the vicinity.

F.2.3.2 Other comments on LLCS

A few focus group motorcyclists suggested that the LLCS should be angled further away from motorcyclists as they can potentially dazzle riders to no benefit and because it is tempting to watch them rather than the main traffic lights, as they are situated in a more comfortable viewing position. It was suggested that this would also reduce the risk of motorcycles or other vehicles going on the LLCS.

"Angle lights into the road, could dazzle motorcyclists and drivers"

Some motorcyclists suggested that further angling the LLCS into the cycle box, allowing just the cyclists to observe them, could pose an issue for approaching cyclists.

"Could be angled further into the road"

"In the dark could be dazzling in the dark or in bright sunlight"

F.2.3.3 What people looked at when stopped

A number of focus group cyclists suggested that they used the secondary traffic signals, with others suggesting they used a combination of the secondary signals and LLCS. Although the layout was considered as a new concept, it was suggested that as with other new road furniture, road users will become familiar with it and will come to use the secondary or LLCS as their primary information source with repetition.

"…is useful to have the other one in the distance if one is blocked"

"It's another source of information, once in the habit of using them"

"People would get used to using them and then that would become their primary light to look at"

A small number of focus group cyclists suggested that rather than looking for the cyclist lights, they looked for the pedestrian lights.

The focus group participants were confident that car drivers would continue to use the main traffic lights, with little concern that they may use or become confused by the addition of the low level lights.

"The fact that they (low level lights) are smaller than the main lights would influence car drivers not to use them"

"If you are in the box and with the lights adds to safety as you are away from the main traffic"

There were a few concerned focus group motorcyclists who felt that some motorcyclists may follow the cyclists rather than waiting at the light, although they themselves would be more willing to hold back beyond the first white line to give cyclists space compared to how they currently do.

One focus group motorcyclist suggested that he preferred to use the LLCS because when riding a motorbike they were at eye level rather than looking up, which traffic lights require due to their position.

"[I] noticed them straight away because I don't like looking up for the lights so looked straight ahead and saw them"

All the focus group HGV drivers agreed that they did not base any part of the decision to pull away on the LLCS. They only pulled away using the main signals and they did not mind where this signal was located, as long as they could see it from their cab.

There was agreement amongst all the focus group HGV drivers that they only concentrated on the main signals, all other signals at the junction were not at all important.

Most focus group pedestrians didn't look at the LLCS when waiting at the junction to cross, they also said that they would not notice that they were there:

"They were not really at our angle"

"I only noticed them when I was walking up towards a crossing, not when I was at a crossing"

"If you're standing there ready to cross, it's on the other side of the pole so you can't see it"

There was concern that if they arrived at a junction and were unaware that there were the cycle signals at the junction, they may come into conflict with cyclists as they would base their decision to cross on the main traffic signals and may not be aware that the cyclists have been given an early release by the LLCS.

F.2.3.4 Junction Arm Design

The trial involved different layouts on the four junction approaches, with some arms having LLCS on both sides of the road and other arms had them present just on the left hand side. The cycle boxes ranged from no colouring with a cycle symbol to green shading with a cycle symbol.

Whilst some focus group cyclists looked left immediately, as their confidence grew many of them used the lights on the side of their chosen exit point, when available.

A limited number of focus group cyclists inferred that initially they used the left hand traffic lights but when confident about the layout they opted for the light located to the direction they were travelling to.

"I used the lights on the side of the direction I was travelling in"

The focus group cyclists generally suggested that they used the lights on the side of the road in which they were travelling.

"Would always look to the left lights first and then looked to the right"

Focus group cyclists suggested that they preferred the green shading due to the increase in visibility. One participant also suggested it gave an added perception of safety from other road users.

"Felt more protected by the green shading"

Focus group car drivers were favourable of the green shaded cycle box and felt this helped drivers' awareness of the box from a further distance than just a cycle symbol on the tarmac.

"The green background was more prominent"

However, some focus group car drivers noted that coloured tarmac should be consistent with other road markings, which varies for different regions.

Some focus group car drivers suggested that they found it unnecessary to repeat the lights on both sides of the road, whereas others suggested this could be beneficial during busy periods for cyclists, however made no difference to drivers.

"If there were lots of cyclists in the box would be good to have lights on the right too"

Arm B was favoured by the majority of focus group car drivers. This was attributed to the large number of visual aids which participants found helpful with the suggestion that this meant that if one set of lights were blocked or failed it was helpful to have an additional set. Furthermore, the Arm B layout was considered to favour pedestrians as it was suggested that the traffic island would slow vehicles and assist with pedestrian crossing. A further benefit of the island identified, was that it would prevent motorists from having sufficient space to attempt to overtake cyclists exiting from the junction, thereby offering the cyclists additional protection.

"[I] liked all the visual aids"

"You could have cars overtaking on some junctions, the [traffic] island would prevent this"

In contrast, a small number of focus group car drivers suggested that there was too much road furniture on Arm B and instead favoured Arm D. Those who preferred Arm D suggested that the layout provided more space for vehicles and the use of the green shaded cycle box was favoured due to its increased visibility compared to just the cycle symbol.

The majority of the focus group motorcyclists preferred Arm D as it was suggested that the secondary light was well positioned to reduce oncoming traffic from blocking it and the visibility of the cycle box was improved with the green shading.

"Arm D was good – the light wouldn't get hidden so easily by on-coming traffic"

"[Arm] D was the best, it would be obvious on a red light with no central reservation"

"A light on the left and a repeater on the right is preferable"

A number of focus group motorcyclists also favoured Arm B, suggesting that this had clear markings, however participants suggested that this layout would benefit from the addition of green shading.

"The main light on the right can often be hidden by the on-coming traffic this couldn't happen"

"Also liked [Arm] B but with green shading"

Focus group motorcyclists preferred the green shaded cycle box compared to the cycle symbol on unpainted tarmac.

"If you were tired and just saw tarmac with the symbol then you might not pay so much attention"

"Green one was easier if filtering around the outside of the traffic, rather than looking for the symbol you can see it from a distance"

However, several focus group motorcyclists highlighted concerns that tarmac shading is inconsistent across the UK, with colours having different meanings in different cities (e.g. for bus lanes and cycles lanes).

"Colour coding is really good, but need to rationalise the colours as different colours mean different things…need a common code".

It was noted that Arm B was very narrow to turn into and there were concerns that if there were high numbers of cyclists and wider vehicles then this could be a safety issue.

"Liked the markings on [Arm] B, however turning left into [Arm] B was very tight"

"…would be good to have staggered lighting on Arm B to let cyclists get through the narrow junction first"

The focus group HGV drivers preferred Arm B because there were more lights close to the cab and the cyclist had two sets of lights, some thought that this would be safer for cyclists.

The focus group HGV drivers generally agreed that they prefer the green marking in the cycle reservoir, this was because it was more obvious to them. When asked what the most important factor on a junction to make them aware of cyclists they all stated that it was the green box.

One focus group pedestrian thought that more information would improve the experience for all the users so thought that the signal layout which she experienced was very good. She also said that if you were to use the junction as it was designed (not jay walking) then it was safe:

"If you use them properly there will not be any problem"

Another focus group pedestrian preferred Arm C because there was less information and she could make the decision to cross herself. Two other participants agreed with this sentiment:

"The control was given back to the pedestrian because there was not a plethora of signage all over the place."

However when asked about how they would treat this junction with more traffic on the road, one focus group pedestrian said that they may find Arm C difficult, most agreed with this:

"The fact that there was not much traffic meant I could cross without looking."

One focus group pedestrian stated that the green cycle reservoir was more obvious than the other arms and another suggested that this would be less likely to mistakenly cross next to the first pole into the cycle reservoir.

F.2.4 Moving through the junction

F.2.4.1 How easy it was compared to an ordinary junction

A number of focus group car drivers had concerns that cars could become stranded in the cycle box during traffic jams or if they were not anticipating the traffic lights to turn red.

"Cars could end up in the box by mistake in heavy traffic".

All focus group HGV drivers agreed that if a group of cyclists pulled away using the LLCS, they would still be looking out for other cyclists in the area:

"If the first lot of cyclists have already gone then the second lot who come up, [who have not stopped at the signals and therefore] will be going faster… [I would look out for them] just the same"

F.2.4.2 Turning right across the path of oncoming traffic

Some focus group HGV drivers were slightly concerned that cyclists would not understand that they did not have right of way when turning right. This is discussed further in Section G.3.4.

F.2.4.3 Pedestrians crossing behaviour

Four focus group pedestrians all thought that the green of the cycle box was important for distinguishing the cycle box from the crossing point:

"I kept getting confused about where I was crossing because of the [position of the] traffic lights, the green highlighted where I was meant to cross"

The rest of the focus group pedestrians stated that there would be no difference between their crossing behaviour with the LLCS and at a normal crossing. And the presence of the LLCS or the green cycle reservoir did not make any difference to how they crossed.

Most focus group pedestrians agreed that the green cycle box was important in showing them that they should be cautious when stepping into it, and a cycle symbol alone was not enough:

"It differentiated itself clearly from the rest of the road"

"If it was a different colour I think it would prevent me from walking into it, it would keep me out of it [because] it makes it a bit more obvious to me"

"If I was at a pedestrian crossing then I would not step into the green box, I would presume that was for cyclists…if it did not have any colour then I would not even consider [the cycle reservoir]"

"If you have come from an angle [and the pedestrian signal are green, you may try and cross], if it was a green box I probably would not go, but if it was a normal colour [with a cycle symbol] then I probably would walk"

"If I was late arriving… I would cut across, but if I saw the box was green… then I probably wouldn't because I would be worried about cyclists"

One focus group pedestrian said that the island on Arm B encouraged her to cross the road though the cycle reservoir:

"Because there's that island in the middle you've only got to look one way and if there is nothing coming you [can] cut before you get to the crossing – we crossed behind the cyclist rather than in front of them"

Two focus group pedestrians stated that they mistakenly crossed through the cycle reservoir due to the island on Arm B:

"[You are aiming for] the raised island… [and afterwards] you do see the dotted bit for the pedestrian but because that is [not that obvious I crossed at the wrong point]."

"I genuinely thought I had crossed… [on the crossing]"

When asked about their crossing behaviour, eight focus group participants did jay-walk, although they said they would not when walking with children. There was a general consensus that most of their crossing was related to traffic movements rather than pedestrian signals:

"I am used to crossing when there is no traffic"

Focus group participants said that when the pedestrian signals are red they often crossed based on the traffic conditions and the main signals (generally the secondary signals). They went on to say that they did not check the LLCS before crossing:

"Pedestrians do look at the traffic signal and the cycle signal are smaller, [so we would not] notice them"

On all arms, including Arm C, no pedestrians used the LLCS as part of their decision to cross, even when they were cutting the corner and crossing with the LLCS in full view.

The above points can be summarised as follows: Pedestrians stated that they often 'jay walked', and when doing this based their decision on the actions of the traffic and the main signals. There was concern that they may cross in front of a moving cyclists as they would be unaware of the LLCS early release. The green cycle reservoir may make the presence of cyclists more obvious but some cyclists suggested that a mechanism to make them aware of the early release may be necessary.

Pedestrians stated that they sometimes crossed at the wrong point, crossing into the cycle reservoir due to the presence of the main traffic signal pole. The green cycle reservoir made pedestrians more aware of the correct crossing point.

F.3 Attitudes

F.3.1 Did people like the junction layout and LLCS?

A few focus group cyclists suggested that they were indifferent to the low level lights, suggesting they carried little or no benefit.

"Can't see the point…at the moment if the lights are green you know to go and red you stop, not sure they are that useful".

The majority of focus group cyclists felt that the cycle box provided cyclists with priority and space.

The majority of focus group cyclists suggested that it was necessary to have both a large cycle box to fit the demand of cyclists in combination with the lights.

A number of focus group car drivers suggested that the LLCS were irrelevant and didn't provide any advantage or benefits to cyclists. It was suggested that as the lights changed simultaneously with the main traffic lights although the cycle box provided cyclists with additional space the lights themselves were irrelevant.

The focus group HGV drivers were generally ambivalent towards the LLCS and the signal set back:

"To me as a lorry driver there is no benefit or non-benefit [with the implementation of LLCS]"

One of the focus group HGV drivers did not understand why cyclists would be given a different set of lights, he thought extra signals for them were unnecessary and went on to say:

"Cyclist never use lights anyway"

The focus group HGV drivers were mostly positive or ambivalent towards cycle reservoirs. They had no strong opinion about the size of the cycle reservoir, but some were supportive of using cycling infrastructure to make them and other HGV drivers consider cyclists more. They all felt that they should only be introduced where there are enough cyclists to make it worthwhile.

One focus group HGV driver suggested that he would be frustrated by this kind of infrastructure as he felt that cyclists were already given too many advantages.

The focus group pedestrians were generally ambivalent towards the LLCS. When asked directly for their opinion on them three felt that the LLCS were unnecessary, the remaining seven thought that cyclists should be taken into consideration when designing junctions.

Most focus group pedestrians were ambivalent or positive towards the signals. Participant 1, who cycled in London regularly said that he did not like them:

"I don't see why cyclists should need another set of reminders. [There should be] a single truth which is just one light for all vehicle traffic"

Two focus group pedestrians thought that the junction displayed too much information. The rest of the group were comfortable with the amount of information on display:

"I didn't think I needed all of the information but other people might."

F.3.2 Perceived benefits

All focus group pedestrians thought that cyclists would benefit from the introduction of the LLCS:

"It was… [good] because the pedestrians have pedestrians [signals], the [green] man. And the bike [signal] was [for] the cyclist"

One focus group car driver suggested a benefit of stopping vehicular traffic further back from the junction could be to assist with HGV and bus turning circles.

"[the extra space] helps the buses and HGVs [with their] turning circles".

F.3.3 Perceived safety

Several focus group cyclists suggested that the LLCS (as experienced in this trial with no additional head start) whilst providing cyclists with eye level lights had little impact on safety. However, it was suggested that if the lights could give cyclists a few seconds head start over other road users this would provide a big advantage to cyclists and would assist with safety.

"Having the lights change a few seconds ahead would be a big benefit"

The majority of focus group cyclists felt that the cycle box provided cyclists with priority and space which would allow them to pull away from traffic with priority. Participants suggested that giving cyclists an area to pull off in advance of the vehicles queuing behind made them feel safer as it gave them more space.

"You're safe in front of the cars and they are not going to cut you up"

"…you know you have the priority ahead of the traffic"

"Good to get the wobble of the cyclist out of the way before the cars come"

"…having the box in front of the cars meant I could move off more safely in front of the cars".

The focus group participants suggested that the cycle box would benefit cyclists and increase cyclist safety due to the extra space and priority they are afforded at a green light.

"Gives cyclist an easier view of the traffic lights"

It was suggested that safety could be further improved by combining the layout with additional cycle infrastructure such as segregated cycle lanes for entering and exiting the junction.

A limited number of focus group cyclists had concerns that vehicle drivers would expect cyclists to be only in the box, however cyclists could still be located amongst the traffic which could be dangerous.

"More convenient but not safer"

Some cyclists suggested that they may make more unsafe manoeuvres to take advantage of the benefit the LLCS and cycle reservoir offered, such as riding on the pavement.

There was discussion and debate between the focus group car drivers surrounding the road position of cyclists. Some participants suggested cyclists should remain to the left of the traffic to allow for overtaking vehicles. Whereas, in contrast about half of the participants suggested cyclists would be safer if they positioned themselves in the centre of the box.

"…if the cyclist stays on the left vehicles might try to overtake"

"Cyclists should wait in the centre"

All of the focus group car drivers agreed that the combined layout of the cycle box and LLCS was a safer design for both drivers and cyclists. The reasons given for this included cyclists benefiting from the additional priority and space; there being an increase of traffic management; and road users having a greater awareness of where to expect the cyclists or drivers to be waiting.

"Drivers and cyclists will benefit, much safer"

"Cyclists will have more priority so safer"

"…more management of traffic so should be safer"

Focus group car drivers suggested that the presence of the cycle box meant they had an increased awareness of cyclists and thus gave cyclists priority, leading to a safer road layout.

A limited number of focus group car drivers were concerned that if there were high volumes of cyclists and drivers, safety could be compromised.

A number of focus group car drivers suggested that further cycling infrastructure was required as part of a wider improvement to safety.

Focus group motorcyclists were divided in opinion over the relative increase in safety which the layout could provide. Some suggested that cyclists would benefit from the cycle box, with others suggesting that the layout did not offer cyclists much alternative to the current road layout.

"[I] think they [LLCS] are a good idea"

Concerns were raised for those cyclists approaching the junction once the main lights had changed to green from drivers turning left. A limited number of motorcyclists suggested that the layout could make drivers less aware of cyclists approaching the cycle box as they would expect the cyclist to be in the box.

"It will help but there will still be cyclists coming up who haven't reached the cycle box yet"

The focus group HGV drivers agreed that this kind of infrastructure would make it safer for cyclists turning left and could stop accidents when HGVs turn left across cyclists because:

"[The cyclists] have already gone"

One focus group HGV driver was concerned that the combined layout incorporating the cycle reservoir and LLCS would encourage cyclists to undertake HGVs so they can enter the box.

None of the focus group pedestrians thought that overall the whole junction design would overly impact pedestrian safety because the junction largely remained the same from a pedestrian's point of view. Four pedestrians felt that the LLCS could make it slightly more unsafe for pedestrians due to the potential to cross in the cycle reservoir due to the location of the main signal poles. Five pedestrians felt that the junction was neither safer nor less safe for pedestrians.

Six pedestrians thought that this junction layout would make it safer for cyclists, particularly with an early release and turning left. The remaining four thought it was less safe for cyclists. There was some concern that car drivers may use the LLCS.

One focus group pedestrian suggested that they LLCS should be positioned in such a way so that pedestrian could see them clearly from the crossing point for the crossing to be safe, others agreed with this. Another participant thought that the LLCS should be introduced with a pedestrian countdown system so he, as a pedestrian, was more informed at the crossing.

There was a general agreement that the green cycle reservoir was an important factor in making the junction safe as it would highlight the presence of cyclists.

F.3.4 Discussion of impact on specific manoeuvres

The focus group cyclists felt that the cycle box would particularly assist with cyclists turning left, as cyclists would be ahead of vehicles and would have made the manoeuvre prior to the vehicle reaching the junction.

"…felt safer turning left as you can get in front of the driver"

A number of focus group cyclists were also car drivers and suggested that vehicle drivers would prefer to have cyclists located in the cycle box as this would deter them from weaving in the traffic. Participants suggested this would enable drivers to know where to expect cyclists to be located.

"As a driver I would prefer the cyclists to be safer"

"As a car driver, the fact you have the cyclist in front of you, rather than down the side of you makes it safer as they are in your vision"

A limited number of focus group car drivers suggested that whilst the layout was likely to improve the safety for cyclists turning left, they had concerns for slower cyclists as it was felt drivers may not be expecting them having assumed all cyclists have exited the junction.

In addition, if travelling straight-on, focus group car drivers were concerned that cyclists may stay to the left of the cycle box rather than in the centre tempting some drivers to overtake on the junction.

When turning right there were concerns that if oncoming lanes of traffic moved at the same time, there could be safety issues with cyclists either cutting across the oncoming lane or waiting in the centre of the junction.

Focus group motorcyclists suggested that there are safety issues with vehicles turning left and cyclists continuing straight on. Whilst it was felt that this potential conflict would be reduced for cyclists located in the cycle box and who are able to pull away in front of vehicles, there were concerns for those cyclists approaching the junction once the main lights had changed to green.

"When you indicate to turn left cyclists still come down your left hand side".

"Could be a recipe for disaster if turning left"

The focus group HGV drivers agreed that the infrastructure would make it safer for cyclists turning left and could stop accidents when HGVs turn left across cyclists.

There was concern from some of the focus group HGV drivers that the signals would give cyclists turning right a false sense of right of way. One suggested that they would need some kind of filter to make the manoeuvre clearer:

"The only way you're going to get around [the problem of turning right] is if you've got a filter light [for cyclists]"

Another focus group HGV driver disagreed and said that he thought this design was no different to a normal junction:

"The onus of safety is on the person making the right hand turn"

F.3.5 Influence on modal shift (willingness to cycle)

Whilst there were varying opinions on the advantages of the proposed layout, a number of focus group cyclists suggested that this layout would need to form part of a wider infrastructure improvement of cycling facilities. In particular, more segregated cycle lanes are needed with improved lighting. Focus group cyclists criticised cycle lane routes which have abrupt endings and felt that these should continue to form complete journeys.

A number of focus group cyclists suggested that if their whole journey was formed of segregated cycle routes they would then be encouraged to cycle or to allow their children to cycle in London.

Focus group car drivers suggested that the layout provided increased management of traffic and therefore the layout would improve safety and for some, would increase their willingness to cycle in London.

In addition, the layout was suggested to make cycling easier due to the regulated format. Road systems were criticised as being typically ambiguous and it was suggested this layout enabled cyclists and drivers to have an awareness of their expected road position.

"This makes cycling easy…regulated formula to follow"

"…drivers and cyclists have their own areas and you know where to expect them"

However, the majority of focus group car drivers suggested that the layout would not be sufficient to encourage them to cycle. Participants suggested that although this design was a positive step towards increasing safety further cycling infrastructure was required.

"…step in the right direction…more needed, not just this in isolation"

Several focus group car drivers suggested that the layout may encourage cycling within London if adopted due to the safety benefits, particularly if an early release feature for cyclists was implemented. However, there were a number of car drivers who suggested that this design needed to form part of a much larger cycle infrastructure improvement to have an impact and the layout in isolation was not sufficient in encouraging more cycling.

The majority of focus group motorcyclists did not currently cycle and suggested that the layout would not influence them to cycle in London.

All focus group HGV drivers do not cycle at all, mostly because it did not fit with their lifestyle. None of them felt that the LLCS would make it more likely that they would cycle.

No focus group pedestrians felt that the LLCS provided enough of a benefit to encourage them to cycle on busy urban roads.

F.3.6 Suggestions for improvements

Focus group cyclists suggested that the cycle box would require further signage detailing that the cycle box was for cyclists' use only. One participant likened the necessary signage to that used on bus lanes to inform motorists of its controlled use. They said that they saw this as being successful in restricting the use of the bus lane to just buses.

"Bus lanes often say buses only so why not say cyclists only"

Focus group cyclists suggested that the layout could be improved with the addition of more cycle symbols rather than one large symbol. Participants suggested that these could be displayed in such a way to infer that the cycle box was two lanes and encourage those turning right to wait to the right side of the box.

"On the one way road which was very wide would have been better to have cycle symbols on both lanes…so if you are turning left or right you would be presented with one in your field of view".

It was suggested by the focus group car drivers that adequate signage was necessary as well as publicity campaigns to inform road users of the new layout and how it should be navigated.

"…publicity campaign similar to the Think Bike campaign"

Focus group car drivers suggested that the correct use of the layout should be enforced with fines to ensure cars do not enter the cycle box. In addition, it was suggested that if cyclists did not use the cycle box properly and did not enter the box through the dotted tail they should also be prosecuted.

"Tail shows where the cyclists should enter the box, if this isn't followed cyclists should be prosecuted"

One focus group car driver suggested just having green and red lights and removing amber on the LLCS to deter cyclists from pulling away early.

"…cut out the amber light, [as this] may make cyclists concentrate more and stop [them] pedalling off early"

Some focus group car drivers suggested making the bike signal flash green to make it more obvious to road users.

"Could make the green bike flash to make it more obvious"

However, others disagreed with this and were concerned that this may make cyclists hesitant as a flashing pedestrian symbol means continue to cross if already in the intersection, but do not start to cross.

"A flashing cyclist light may make the cyclist hesitate to continue".

One focus group car driver suggested that the cycle lights should be raised higher for car drivers to observe. However, the remainder of the group suggested that this could restrict the view for the cyclists and felt this was unnecessary with the lights positioned at the correct height.

"Should have the cyclists' lights higher for drivers to see as well"

Some focus group motorcyclists suggested that the position of the traffic lights and LLCS would affect whether motorcyclists were likely to follow the main lights or LLCS. The participants had differing views with some preferring to have the lights on same poles and others suggesting it was preferable to have separate poles.

"Traffic lights on separate poles were easier because they were separated"

One focus group HGV driver felt that this was only part of the way towards a solution for making the roads easier and safer for all users. He thought that more segregation was necessary away from the junction.

"[As a cyclist] the minute you come from… [the LLCS], you're into another [dangerous] situation which needs to be addressed as well"

One user thought that it was important that they were not implemented in isolation:

"If you're going to have them they need to be pretty much everywhere… [all signals] need to follow the same rules"

Another HGV driver felt that they should be implemented, along with greater enforcement of cyclists jumping red lights.

Some focus group HGV drivers agreed that this type of infrastructure would not mean they would check for cyclists more, or pay any more attention to cyclists compared to a normal junction with a cycle reservoir.

Some focus group HGV drivers said that it would need to be in areas which had a lot of cyclists to be useful.

One focus group pedestrian suggested that in London the LLCS may be obscured by pedestrians, and another suggested that the LLCS would not be appropriate in busy areas:

> *"…In London, there would be hundreds of people milling around and you'd easily obscure them… so they would be irrelevant."*

Some pedestrians suggested that they would like to be able to see the LLCS.

The one focus group pedestrian who did not notice the LLCS straight away suggested that it may be necessary to inform the public that they may be introduced:

> *"I didn't notice them until I had crossed the road a good few times, so maybe something so that everyone knows that… [they are going to be introduced] but then after that I am sure it's okay."*

F.3.7 Hypothetical thoughts on a scenario with early releases

It was suggested by the focus group cyclists that if the lights could give cyclists a few seconds head start over other road users this would provide a big advantage to cyclists.

It was suggested by a few focus group car drivers that cyclists could further benefit from the layout by having a few seconds head start from the main traffic to allow cyclists adequate time to leave the junction.

> *"Because cyclists will be at the front, they will have time to move away first safely"*

> *"Low level lights seemed irrelevant because they turned green at the same time as the big lights"*

It was suggested that if cyclists were given an early release, the opposite flow of traffic should be held back to allow adequate time for cyclists to get across the road.

> *"…if turning right the opposite traffic will need to be held back"*

> *"Potential for an accident unless you give cyclists an early start"*

The majority of focus group motorcyclists suggested that cyclists would benefit from a head start to pull away from the junction. It was felt that this would assist cyclists in giving them sufficient time to move away from the junction prior to vehicles.

> *"No benefit to cyclists if lights are in sync…needs to be fully integrated into the cycle network".*

> *"If you do stagger the lights then you give cyclists a chance to get going at the junction"*

> *"Would be good to give cyclists a head start"*

There were concerns that motorcyclists may go on the low level green light if cyclists were given a head start.

"If you stagger the lights then you would need education and an advertising campaign"

"You would need education if you are going to have the lights staggered otherwise people might start to go on the amber of the cycle lights"

Focus group motorcyclists suggested that an adequate awareness raising campaign would be needed if lights were to be staggered to make road users understand the specifics.

The focus group motorcyclists who suggested that they currently use the cycle box stated that if staggered lighting was implemented, this would deter them from waiting in the cycle box whilst on their motorcycle.

"If staggered lighting was implemented then I wouldn't go in the box as then I would be getting in their way"

"Would be looking ahead for my signal as the low level signal does have a bike symbol suggesting it is just for the bikes"

It was agreed by all focus group motorcyclists that if the LLCS gave cyclists a head start to the remainder of the traffic then they would wait behind the first stop line outside of the cycle box.

"…would stop behind the first white line if cyclists got a head start"

Some focus group motorcyclists suggested that if the lights were staggered then it would be better to have the lights on the same pole so it was clear to those unfamiliar to the road system that two sets of staggered lights were present.

"If you are going to have the lights staggered then I think you need to have the two lights together so you know cyclists can go but your [main traffic] lights are still red otherwise people might go on the green cyclist"

"If going to give cyclists a head start I think the lights should be on the same side"

A number of motorcyclists suggested that they observed the LLCS rather than the main traffic lights and were concerned that if cyclists were to be given a head start, this could be an issue for motorcyclists.

"…thought I'll go on that one but then thought oh no have they staggered them? But they weren't staggered"

"watched the cycle lights for me to set off so if staggering could cause an issue".

When the focus group HGV drivers were asked to imagine an early release, many were ambivalent towards the idea. One participant, who said that he drove HGVs in London regularly, said that he waited for cyclists to leave the cycle box anyway, so the signals were unnecessary:

"Sometimes you've got to sit there and wait for… bikes to come past you… I think it would be a waste of money"

One focus group HGV driver thought that early releases was a good idea for safety in heavily urbanised areas, saying that it would remove cycles from dangerous situations:

"By giving them that little bit of a jump on the rest of the traffic, you are… giving them a chance to get out of the way"

There was concern from one focus group HGV driver that drivers who were unfamiliar with the layout may follow the cyclists through the junction if it had an early release. All of the other participants disagreed with this:

"I'm not looking at the little bicycle light, I'm looking at my big light. If their light says go and mine says stop… I would not be confused as I know my light is saying stop"

None of the focus group HGV drivers thought that it would have an overly negative impact on the road network.

All of the focus group pedestrians were concerned about using a junction with an early release if they did not know about the early release:

"If the… pedestrians weren't aware that the cycle signals could be different… to the traffic signals… I would not feel safe"

"If there was different lights for cars and different lights for cyclists there would be more to judge before you go but people might not realise that [the LLCS go early] so it might make it less safe"

"If they are not in sync then it's a problem, because pedestrians assume they will be"

"[If the main signs were red] I'd probably walk [because I would not be looking at the LLCS]"

However one focus group pedestrian said that he noticed the LLCS and assumed that they would have an early release, so was more cautious when cyclists were in the area.

It was suggested that a sign would be necessary to warn pedestrians that cyclists may have an early release. Some participants thought that this would make the junction more confusing and that the design should be intuitive, and not require a sign. Leading on from this, there was a suggestion to have an LLCS repeater on the other side of the pedestrian crossing, facing the cyclists, which the pedestrians could see.

Some focus group pedestrians thought that an early release could cause problems for safety as they would not be expecting cyclists to go when the cars were stopped:

"We cross when the traffic is halted, so if the traffic is stopped and then bikes started going [I] would not be expecting [that]"

"If I was looking … at the main traffic lights and if they were red I would probably think it was safe to cross."

"I might make a decision to cross … because the cars are stopped and suddenly, one microsecond later that cycle light has gone green and the cyclists are kicking off"

There was some concern that if the signals had an early release this would be dangerous as pedestrians would not be aware of this and walk into the road.

F.3.8 Realism of the trial

The majority of focus group cyclists suggested that the road layout for the trial was realistic as it provided a good simulation of a real road system. However, some participants suggested that the trial was unrealistic due to the lack of sufficient vehicles.

It was noted by some focus group cyclists that the trial was undertaken with low levels of traffic and in busier conditions they foresaw that some cyclists may be reluctant to move across the box.

The focus group cyclists suggested that there was a lot to consider on the approach to the junctions, suggesting a number of road markings were ignored as other areas were focused on.

> *"I didn't see the road markings on the approach as I was too busy concentrating on where I was going to go"*

Focus group car drivers suggested that more road users were required to simulate a more realistic environment which should include HGVs and vans. In addition, it was suggested that focus groups consist of both cyclists and drivers so there can be debate and understanding between the two groups.

Focus group motorcyclists suggested that future trials needed more road users including pedestrians and cyclists to simulate a more realistic scenario. In addition, participants suggested allowing participants to negotiate the junctions in their own time to simulate more conflict between cyclists and motorcyclists.

> *"Unrepresentative today as only had one cyclist, if you go to London it's like a cavalry charge"*

The focus group HGV drivers said that what they were asked to do could have been improved by including cyclists on the trial so they could better understand how the signals worked in relation to cyclists.

All focus group pedestrians felt that the trial was limited by the lack of other traffic

Appendix G Focus group findings (M19b Trial: with an early release)

G.1 Introduction

Focus groups were conducted with typically 8 to 10 participants. Due to the small sample sizes, the findings in this section are not statistically significant, rather they add further qualitative context to the more robust findings from the questionnaires and video data.

Two focus groups were conducted for the M19b Trial:

- Cyclists – 3rd September 2013 (experienced 2 and 4 second early release)
- Car drivers – 21st August 2013 (experienced 2 and 4 second early release)

G.1.1 Participant characteristics

G.1.1.1 Cyclists

Seven participant cyclists took part in the focus group (3 Males, 4 Females). Four of the participants are regular cyclists who cycle almost every day, and the other three participants cycle occasionally or rarely. Three participants describe themselves as confident cyclists, three participants describe themselves as confident cyclists but are less confident on busy roads. One participant describes them self as less confident on busy roads or in heavy traffic. Two participants are predominantly car drivers, one participant walks more than drives, one participant does not drive and would not choose to cycle in London, one participant cycles in London and the other two participants did not respond on their road user type/behaviour.

G.1.1.2 Car drivers

Eight participants took part in the focus group (4 Male, 4 Female). Six of the participants drive every day, one participant drives 5 to 6 times per week and one participant drives 2 to 3 times per week. All of the participants describe themselves as confident drivers, however the participants reported being less confident in situations such as narrow, country lanes, heavy traffic, on the motorway and in busy cities. One participant stated that they have become less confident with age. Three participants do not cycle, four participants cycle for leisure, and one participant occasionally cycles but always on cycle paths.

G.2 Experiences from the trial

G.2.1 LLCS with early release - Understanding

G.2.1.1 Cyclists

A number of focus group participants suggested that they did not initially notice the LLCS and found it difficult to interpret the layout until it had been navigated a number of times.

Some focus group participants suggested that on approaching the junction they generally used the main traffic lights and with increasing familiarity began to use the

LLCS. Several of the focus group participants suggested that they continued to use both the LLCS and main traffic lights for the duration of the trial.

Whilst the majority of focus group participants suggested that they initially found the layout confusing, they were all aware of the low level signals and their purpose. All focus group participants felt that the low level signals were clearly for cyclists due to the cycle symbol and therefore did not feel these would confuse either pedestrians or motorists.

Some participants suggested that because using the low level signals was a new concept for cyclists, a number continued to wait until the main lights were also green.

> *"[I] wasn't confident to go on the low level lights, [so] waited for the main lights to change too"*

G.2.1.2 Car drivers

Initially, on negotiating the layout for the first time, a limited number of focus group participants did not realise the low level signals provided a head start to cyclists and pulled away in their cars simultaneously with the cyclists, following the cyclists and cycle lights rather than watching the main lights. However, for the remainder of the trial the focus group participants suggested that they used the main lights as their guide with some using the low level signals as preparation time for the main lights.

The majority of focus group participants suggested the differentiation between the main traffic signals and the low level cycle symbols was sufficient to avoid any confusion between the lights. However a few focus group participants suggested that initially drivers may see the green light and go without adequately checking whether they apply to drivers or cyclists as the concept is unfamiliar. It was suggested that the low level signals could be angled towards the ground so they were less likely to be in the driver's sight line, reducing any confusion for drivers.

> *"Should have pedestrian and cyclist lights at different angles to avoid confusion"*

> *"…[the] first time [I] looked at [the] cyclist lights and then pulled away when cycle lights were green as they were in my eye line".*

> *"…saw the green in the corner of my eye and went"*

> *"Distracting to have the bike lights change first"*

All the focus group participants suggested that they found it immediately obvious what to do when approaching the traffic lights. Participants suggested the low level signals gave them a greater awareness and consideration towards surrounding cyclists.

> *"…make you more aware of cyclists [who could] suddenly appear"*

A small number of focus group participants suggested that the additional set of lights could be distracting for drivers. Others suggested that they were less aware of their surroundings as they were concentrating on all the lights, which were excessive.

> *"[there were] additional things to look at, [so I] was less aware of surroundings"*

G.2.2 Cycle reservoir - Understanding

G.2.2.1 Cyclists

Several focus group participants suggested that approaching the layout was confusing and initially felt it was difficult to understand what to do. One focus group participant did not use the cycle box throughout the trial due to their lack of understanding of its purpose.

G.2.2.2 Car drivers

The focus group participants indicated that they all immediately understood how to navigate the layout.

The focus group participants all interpreted that the cycle box was for cyclists only and suggested that all other vehicles should wait behind the first stop line. Some focus group participants had concerns that if drivers were unfamiliar with the layout then they may wait in the cycle box without realising its purpose.

A number of focus group participants had concerns that motorcyclists or scooters may also wait in the cycle box.

"…I think motorcyclists will think they can go in the box"

Some focus group participants suggested that during busy periods drivers may become stranded in the box by mistake if the traffic lights changed unexpectedly.

"If unfamiliar with the road layout, there wasn't anything to say you couldn't wait in the box"

G.2.3 Entering the Cycle Box

G.2.3.1 Cyclists

The focus group participants suggested that they liked the additional space the cycle box provided cyclists with.

Several focus group participants suggested that the facility was confusing with a number suggesting that cyclists who did not also drive may struggle to understand the layout.

"The layout could be confusing if you don't drive"

One focus group participant was unaware that the cycle box was for cyclists to wait in and spent the duration of the trial waiting behind the first start line with the traffic. The participant concerned interpreted that the purpose of the cycle box was to assist cyclists crossing the road.

"…cycle box was to help cyclists cross the road so didn't enter it".

"Assumed the cycle box was to assist cyclists crossing the road, never entered it…unfamiliar with cycling on the road".

The focus group participants generally all liked the cycle box, favouring the added space it provided to cyclists.

"Initially hard to know what to do"

"Impressed with the cycle box"

The majority of focus group participants suggested that the cycle box was clearly marked for cyclists and liked the additional space it provided for cyclists.

"Currently you are bunched in with traffic so this layout is good as it separates them".

The majority of focus group participants suggested that if they knew that there was a cycle box at the front of the traffic they would use it and would feel confident in travelling to the front of queuing traffic.

"Would be more likely to get to the front of the queue knowing there was a box there".

One focus group participant suggested that he would use the pavement if necessary to reach the cycle box to avoid overtaking traffic / to ensure he could get to the front of the queuing traffic and into the cycle box.

"Would hop onto the pavement if really busy to enter the cycle box"

G.2.4 Stopping at the Junction

G.2.4.1 Cyclists

Most focus group participants suggested that whilst waiting in the cycle box their location would vary depending on their desired destination. Some focus group participants suggested that they would be likely to wait on the side of the cycle box associated with where they were intending to travel. However, others suggested that they would wait on the left of the cycle box until the lights had changed and then would potentially move across the cycle box if turning right. The location of participants also varied depending on whether there were any vehicles waiting at the lights.

A small number of focus group participants suggested that the LLCS should be located in the direction of travel, however the majority felt they should be located on the same pole as the main lights.

"If turning right would wait on the right of the cycle box if there was a car behind, but if there were no cars would wait on the left and then move across".

"Stayed on the left of the box, knew I had extra time and then moved to the right on the green".

G.2.4.2 Car drivers

Focus group participants all agreed that the location of the traffic lights would not impact their choice on where to stop to wait for the traffic lights. Instead, participants suggested that the stop line would influence their stopping position.

One focus group participant stated that the layout may discourage drivers from creeping forward when the lights turn amber if they were held at the first stop line behind cyclists.

'Takes away drivers creeping forward on the line at the lights…better for cyclists"

G.2.5 Moving off through the Junction

G.2.5.1 Cyclists

Some focus group participants suggested that on approaching the junction they generally used the main traffic lights and when they became more familiar with the layout began to use the LLCS. Several of the focus group participants suggested that they continued to use both the LLCS and main traffic lights for the duration of the trial.

Some focus group participants suggested that using the LLCS was a new concept for cyclists and therefore a number continued to wait until the main lights were also green.

> *"[I] wasn't confident to go on the low level lights, [so] waited for the main lights to change too"*

G.2.6 Turning at the Junction

G.2.6.1 Cyclists

A limited number of the focus group participants criticised the location of the LLCS suggesting they were not positioned conveniently for turning right. These participants suggested that they wanted to look in the same direction as they were travelling in.

> *"[The] position of the lights was the wrong way around…wanted to look in the same direction as I was travelling in"*

Focus group participants suggested that the location of the low level lights was important to them, stating that only having the low level lights to the left could have easily been missed if a cyclist was distracted.

> *"Having the low level lights on the left you could easily be distracted and miss the 4 second head start".*

Some focus group participants suggested that the facility could be improved by having both the main lights and the LLCS on the same pole.

> *"Need to have the lights on the main pole as [it] was hard to see initially"*

In contrast, other focus group participants suggested that they preferred to have lights on both sides and the secondary lights as it was felt there would be less chance of getting the two sets of lights confused.

> *"Signals on both sides and in front would be good"*

Most focus group participants also suggested that on the Arm they initially used the main lights and then when pulling away they used the low level signals.

G.2.7 Traffic Signals

G.2.7.1 Cyclists

A number of focus group participants suggested that they would rather both the main lights and low level signals were located on the same pole as they felt that this would assist with increased awareness of the timings.

"Need to have lights on the same pole as was hard to see initially"

It was also suggested that the low level signals should be bigger and raised. There were concerns that this could cause confusion for drivers though and all agreed that using the cycle symbol was preferable.

G.2.7.2 Car drivers

Focus group participants had mixed views on the location of the main traffic lights, with contrasting views over whether traffic lights and LLCS should be located on the same pole. Some focus group participants found preferred to just watch one pole, whereas others had concerns that if the lights were too close they could be misinterpreted resulting in vehicles pulling away on the cycle signals.

Some focus group participants favoured the LLCS, suggesting that they gave drivers advanced warning of when the main lights were about to change.

"…advanced warning for the main lights to change"

Several focus group participants suggested that the location of the main lights and LLCS affected their experience, with some suggesting that the lights should be further away from each other and others suggesting that they preferred them to be on the same pole.

Two focus group participants suggested that they found it confusing having both the main lights and LLCS on the same pole.

The remainder of the focus group participants did not have this issue. Other participants suggested it was clearer to have the lights on the same pole and this assisted drivers as they just needed to observe one pole to understand the road system.

"Should look at the main light and below this should be the cyclist light"

"More obvious and clearer to have cycle lights and main lights on the same pole"

However, some focus group participants also suggested that they preferred the lights to be separated, with the approach favoured where the main lights were ahead and the LLCS separated.

"further away light were better as less inclined to marry the two up".

G.2.8 Design of junction approach

G.2.8.1 Cyclists

The focus group participants generally preferred the green shaded cycle box to having a cycle symbol on the tarmac. The less confident cyclists within the focus group suggested that they preferred the green shaded cycle box as it highlighted it from a distance however the more confident cyclists suggested that they found a symbol with no shading to be sufficient.

G.2.8.2 Car drivers

Most focus group participants suggested that they disliked Arm B as the secondary signals were too close together. Some focus group participants suggested that the traffic island made this approach too restrictive and were concerned that there could be issues with drivers overtaking cyclists where there was inadequate space.

"…too constrained"

Focus group participants also suggested that there were excessive lights and combined with the narrowed road this could cause conflict between vehicles and cyclists.

"…loads of lights combined with a narrow road way".

Some focus group participants were mildly nervous when turning right from Arm D, suggesting that they were concerned with oncoming traffic and were unsure of who would have priority. In addition, there was concern that if there were large numbers of cyclists they may not all have time to get across the road before the main lights changed for the oncoming traffic.

Focus group participants had differing opinions over the coloured tarmac of the cyclist box. A few participants suggested they disliked the green shaded cycle box, with one participant suggesting he found this harder to see and that red would be preferable. However, in contrast, other participants suggested the green increased visibility of the cycle box.

"Found green less clear than no paint…it should be red"

"Unsure why the box was green"

"Green stands out better than just a plain symbol"

G.2.9 Duration of early release

G.2.9.1 Cyclists

The focus group participants did not notice the difference in early release timings. A number of focus group participants suggested that this was due to the low numbers of cars.

The focus group participants had contrasting views over the amber light for cyclists. The majority suggested that the amber was unusually long[36], suggesting cyclists did not require such a long time to prepare to pull away and this may lead to cyclists not waiting for the green light. However, others suggested that they thought the Amber period for cyclists was appropriate.

"…with a car you need this time to get into gear but with a bike you don't need so long"

"Like the… amber time to prepare"

G.2.9.2 Car drivers

One focus group participant suggested that he used the LLCS head start to gauge when to prepare to pull away. He suggested that usually he would anticipate leaving the junction based on the oncoming traffic, however he began using the cyclist lights to provide him with this indication instead until he realised this was incorrect.

[36] In the trial, the duration of the Amber phase for the LLCS was 2 seconds before the Green and 3 seconds after the Green, which is the same as for standard traffic signals.

All focus group participants supported the four second head start afforded to cyclists. This was felt to be a sufficient amount of time, whilst the two second head start was considered by most of them to be too short.

Focus group participants suggested that the head start was particularly helpful to cyclists turning left. However there were concerns for those turning right as it was suggested that if there were large volumes of cyclists not all would be able to cross before the oncoming traffic's main lights.

Participants all preferred the four second head start for cyclists over the two seconds. Participants suggested that this amount of time allowed for a clear separation between the cyclists and the other traffic.

> *"…emphasized the consideration of cyclists and gives them a chance to get ahead safely"*

A limited number of focus group participants suggested that the number of seconds for the cyclists head start should be amended depending on the gradient of travel. It was noted during the trial that cyclists going uphill required a longer head start compared with downhill.

> *"Should be a different early timing for roads where cyclists are going uphill".*

G.3 Attitudes

G.3.1 Compliance with red light

G.3.1.1 Cyclists

The majority of focus group participants suggested that they do not 'jump the lights' when traffic lights are red, however two participants suggested that they do when they deem it safe they do so.

> *"…want to get there quickly so carry on but check sufficiently first",*

> *"It's a considered risk, usually late so jump the lights".*

Of the few focus group participants who stated that they do sometimes 'jump the lights', they suggested the facility would not alter their behaviour and if deemed safe they would continue to do so. It was also the opinion of the other participants that the facility would not change the mindset of cyclists jumping the lights.

G.3.2 Perceptions of safety

G.3.2.1 Cyclists

The majority of focus group participants suggested that they felt the facility would benefit cyclist safety.

Focus group participants all agreed that, in their view, the layout would improve safety for cyclists and agreed that it should make cycling easier for cyclists as there was potential for less conflict with the main traffic.

> *"…potential to save lives and encourage cycling"*

> *"Much more protection afforded, would be more confident on major routes"*

All focus group participants suggested that cyclists are the most vulnerable road users, especially when stopping or starting and therefore it was suggested that giving them priority to pull away would be beneficial.

"It gives extra time to cyclists and is therefore safer"

"Giving head start will give cyclists confidence"

Some focus group participants suggested that currently cyclists move off at random, whereas this facility would help to regulate their movement.

"…there would be signals for all road users which gives added confidence"

Some focus group participants also suggested that the layout would benefit road users as cyclists' actions would be less ambiguous.

"As a driver it is safer, cyclists are now visible and out of the way"

"Would feel more aware of cyclist's locations"

Most focus group participants suggested that the facility would aid cyclists turning left at the junction, indicating that, in their view, HGVs and buses don't currently see cyclists turning left, however this layout would allow cyclists to have pulled away from the junction prior to the vehicles moving off.

Focus group participants generally expressed favourable views of the combined LLCS and cycle reservoir suggesting it provided cyclists with increased space and time leading to a safer environment for cyclists.

All focus group participants suggested that they would be encouraged to travel to the front of queuing traffic and take advantage of the early release.

Whilst a number of the focus group participants were familiar with cycle boxes, they all agreed that the addition of LLCS provided cyclists with additional time and space to be protected from vehicles.

"…knew I had extra time and then moved over to the right of the cycle box"

Some cyclists expressed concern over priority when turning right, see Section G.3.4

G.3.2.2 Car drivers

All focus group participants were favourable of the cycle boxes as it was suggested this assisted with safety and helped drivers to know where to expect cyclists.

The majority of focus group participants suggested that the cycle box provided a safe area for cyclists and created a greater awareness amongst car drivers of their presence. However, a few had concerns that drivers may be less aware of approaching cyclists as they would expect them to already be in the cycle box area.

The general consensus from the focus group participants was that the layout contributed to cyclist's safety. Participants suggested that the early release would particularly assist with cyclists turning left which they felt was a common safety issue between cyclists and vehicles.

"Allowing cyclists to go through a dangerous junction first before cars would be great"

"…brilliant, takes account for the differentiations between the speed of the driver and the cyclist…gives the cyclist a chance if turning left to get around the corner"

"Cyclists are ahead so car will have seen cyclist so shouldn't turn left"

G.3.3 Willingness to cycle

G.3.3.1 Cyclists

All focus group participants were complementary of the design with one participant stating that he currently cycled on back roads but would consider cycling on main roads if they had LLCS at the junctions.

"Would use the main roads if this facility was available rather than choosing the quieter roads"

It was felt by some participants that for less confident cyclists, or for children, other cycling facilities would be required, such as segregated cycle lanes.

G.3.3.2 Car drivers

Whilst all focus group participants suggested that the layout would benefit cyclist safety, most of them suggested that the layout would not encourage them to cycle more. It was suggested that further improvements to cycle infrastructure were needed to encourage more cyclists in London.

All focus group participants suggested that they felt the layout would benefit cycling safety in London, however it was noted by many that more cycle lanes would also be required to complement the new layout. The focus group participants suggested that whilst the layout would benefit existing cyclists, they did not feel these types of junction would be sufficient to encourage them to cycle in London.

G.3.4 Concerns

G.3.4.1 Cyclists

Most focus group participants suggested that the layout would assist cyclists turning left but there was concern that cyclists turning right may assume priority to oncoming traffic. It was suggested that cyclists could be given a longer head start to assist all those turning right, however there were further concerns that drivers may become frustrated if held at traffic lights for too long.

There was concern that if there were high volumes of cyclists turning right, they may not all manage to get across the road before the main lights turned green in the opposite direction. Some focus group participants suggested that cyclists could assume priority to oncoming traffic or become stranded in the centre of the crossing.

"Really liked it…need to do something about turning right though".

"In London if the box was full might not be able to get across in time";

"Staggered lights made me feel I had priority to oncoming traffic".

Most focus group participants felt that the size of the cycle box was adequate, however there were concerns expressed by a few that a larger box would be required in London.

There were concerns that vehicle drivers may become frustrated by the facility if they were expected to wait for increasingly long periods at junctions. In addition, focus group

participants were concerned that the layout would require increased space and that for this reason the layout may not be feasible for London.

G.3.4.2 Car drivers

Focus group participants were generally favourable to the combined layout of cycle box road markings with associated low level signals.

There were concerns that drivers may become less aware of their surroundings as they may just expect cyclists to be located in the cycle box. A few focus group participants had concerns that the layout would make drivers less aware of cyclists approaching the cycle box. It was felt that drivers would be less likely to expect cyclists travelling down the carriageway and in their blind spots. Some admitted that it made them less likely to look out for cyclists in their mirror.

> *"… [I] wasn't looking whether they [cyclists] were coming up to the left or right of me"*

> *"[with this facility] the 'I didn't see you in my mirror' scenario disappears"*

> *"If cyclist is way ahead, it could reduce accidents but if they arrive late this could be an issue"*

> *"As a driver, you are usually glancing around at what is coming from behind. The box may make you less aware of cyclists around".*

A limited number of focus group participants suggested that they disliked cyclists approaching on their left and so often block cycle lanes to prevent them from passing. Some focus group participants suggested that cyclists would assume priority, which if the driver was unaware of their presence could be dangerous.

> *"I usually try to keep to the left of the kerb to stop cyclists coming past and then you don't have to overtake them".*

A limited number of focus group participants had concerns that during busy periods the cycle box would be too small to accommodate all cyclists. There were concerns that, particularly in London where there are high volumes of cyclists at certain times, they could spill over the cycle box and into the carriageway.

> *"Lots of cyclists may struggle to get into the box"*

Focus group participants had further concerns for other car drivers described by one person as 'amber gamblers', suggesting drivers who are used to driving through amber lights may be unaware of the early signals for cyclists.

> *"[those who go through the signals just before they go red]…may think there are no cars going through [the other signals] and don't realise there are cyclists going first"*

Furthermore, a limited number of focus group participants had concerns that the layout could see an increase in accidents due to the increase in cyclists pulling ahead which would then need to be overtaken by vehicles.

> *"…cyclists have to pull away in front of the car…lots more cyclists to over-take".*

There was a concluding consensus that whilst the layout would contribute to safety, further cycling safety infrastructure would be required in the form of cycle lanes.

> *"This is safer…[but] doesn't remove the hazard altogether"*

Focus group participants were concerned that the layout could frustrate drivers if they were unnecessarily delayed if the layout was located in areas of low volumes of cyclists.

Focus group participants had further concerns for accessing the cycle box. A number of focus group participants were also cyclists and had experienced this issue, especially once a queue of traffic had formed.

"As a cyclist, it is difficult to get [past traffic] to the cycle boxes"

G.3.5 Suggestions

G.3.5.1 Cyclists

Whilst all focus group participants suggested that the layout would improve cyclist safety, a number of participants highlighted that this facility needed to form part of wider cycling infrastructure improvements.

"Would only use it if there were decent cycle lanes leading to the cycle box"

It was stated that the facility should not be in isolation and therefore should form part of a larger improvement to cycling infrastructure.

Some focus group participants suggested that the LLCS should be larger and higher so they could be seen from a distance, however other participants were concerned this could cause confusion for motorists and cyclists.

Focus group participants all agreed that the facility should be implemented in accident black-spots with a number of them suggesting that the layout should form part of a wider cycling safety scheme and not be implemented in isolation.

A limited number of focus group participants suggested staggering the lights for longer to ensure cyclists crossed before the opposite flow of traffic pulled away.

Focus group participants were all in agreement that they liked the bike symbols for the LLCS and suggested that this should reduce any confusion with the main traffic lights.

Focus group participants generally felt the cycle box was an adequate size for cyclists.

"Nice big area for cyclists and motorists confidence".

However, it was felt that if the layout was implemented in London or in other urban areas with substantial cycling at peak periods then a larger reservoir may be required.

G.3.5.2 Car drivers

Focus group participants suggested that the layout required adequate education and awareness raising for both drivers and cyclists in how to navigate the layout safely.

Focus group participants suggested that it should be clearer on the approach to the junction whether there is a cycle box or if LLCS are present. Focus group participants felt it could be confusing for cyclists unless this was consistent.

"Could be confusing for cyclists if they are at some junctions and not others".

Drivers would need to be aware of cyclists approaching the cycle box. There were concerns that drivers may have a lack of awareness for approaching cyclists as drivers would only expect cyclists in the cycle box.

It was suggested that it would be important that cyclists moved over to the left once they had used their head start at the low level signals.

"once cyclists get away they should move to the left to allow drivers to pass".

G.3.6 Trial realism

G.3.6.1 Cyclists

Focus group participants suggested that the trial could be improved by having more traffic to increase its realism.

G.3.6.2 Car drivers

The trial was reported as being too controlled and artificial with focus group participants suggesting that they would have liked an increased number of cyclists to increase the realism and to experience the trial in an uncontrolled environment. Focus group participants suggested that participants should be free to navigate the layout as they would if it was implemented on actual roads.

In addition, it was suggested that the trial should be repeated at night time as there were concerns for the visibility of the cycle box without natural light.