

# Low Level Cycle Signals with different cycle reservoir depths – Appendices

## Track trial report

This document contains the appendices to accompany the report from the fourth sub-trial of a larger track trial investigating the reactions of road users to Low Level Cycle Signals (LLCS) with different cycle reservoir depths (Trial code: M24).

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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	M24 cycle trial	M24 car trial
RQ1 / RQ10 – Did cyclists / car drivers understand the LLCS and cycle reservoirs?	<p>[F1.a] – Most cyclists (97%) showed a good understanding of the cycle reservoir, although some (&lt;1%) thought it could be used by both motorcyclists as well as cyclists, whereas some (1%) said it could be used by cars in some instances. A few cyclists (1%) thought there was a different meaning between the painted and unpainted reservoirs. The size of the cycle reservoir did not affect participant perception of the purpose of the reservoir.</p> <p>[F1.b] – Similar to previous trials, most cyclists (96%) showed a good understanding of the LLCS, although a few cyclists (1%) confused the LLCS with Toucan crossings, saying they thought they were for cyclists or pedestrians crossing the road.</p>	<p>[F10.a] – Almost all car drivers (about 95%) understood the purpose of the cycle reservoir. Participants understood the different sized reservoirs equally well.</p> <p>[F10.b] – Similar to previous trials, three car drivers (less than 5%) thought the green unpainted cycle reservoirs had different meanings, with cars being able to enter the unpainted reservoir if there are no cyclists around.</p> <p>[F10.c] – Similar to previous trials, almost all car drivers (95%) understood the LLCS.</p>
RQ2 / RQ11 – What attitudes did cyclists / car drivers have towards the cycle reservoirs?	<p>[F2.a] – The results from the three different reservoir sizes strongly suggest that the size of the cycle reservoir should be based upon the volume of cyclists using the junction.</p> <p>[F2.b] – The majority of cyclists (76%) said that the size of the cycle reservoir was 'about right' but those who experienced the smaller (5m) reservoir were more likely to say it would be better if larger (26%) than were those who experienced a larger cycle reservoir (18% from the 7.5m groups and 10% from the 10m groups said it would be better if larger).</p> <p>[F2.c] – The main perceived benefits of the cycle reservoir were that it gives cyclists more space away from vehicles and</p>	<p>[F11.a] – The majority of car drivers thought that the size of the cycle reservoir they experienced was 'about right' (84%, 81%, 64% for the 5m, 7.5m and 10m reservoirs respectively). Those who experienced the larger reservoir (10m) were the most likely to say it would be better if smaller (about 20%), although they only experienced the junction either with one cyclist in front or no cyclists.</p> <p>[F11.b] – Common comments from car drivers relating to the size of the cycle reservoir were that it should be based on the location and volume of cyclists using the junction and that there is a need to strike a balance</p>

Question	M24 cycle trial	M24 car trial
	<p>also is a well-defined area.</p> <p>[F2.d] – 60% of cyclists who put forward suggestions for improvements (15 cyclists) suggested that cycle reservoirs should be painted as this makes them more obvious to all road users.</p>	<p>between space for cyclists and motor vehicles.</p> <p>[F11.c] – The participants who experienced the larger reservoirs (7.5m and 10m) were slightly more likely to say the junction was 'safer' or 'much safer' than an ordinary junction than those who experienced the 5m reservoir (70% compared with 64%).</p>
<p>RQ3 / RQ12 – What attitudes did cyclists / car drivers have towards the LLCS?</p>	<p>[F3.a] – Between 70% and 83% of cyclists were positive about the LLCS; those who experienced the 10m reservoir were more likely to be positive than those who experienced the 5m and 7.5m reservoirs. Less than 10% were negative about the LLCS.</p> <p>[F3.b] – The proportion of cyclists who said that it would be better if the LLCS were higher increased with group size. Up to 49% in the largest group gave this response compared to 20% in the previous trials which consisted of individual trials.</p> <p>[F3.c] – Similar to previous trials, the majority of the cyclists said that the angle of the LLCS was 'About right' (81%) and that the location of the LLCS was 'about right' (64%).</p>	<p>[F12.a] – The attitudes of the car drivers to LLCS were similar to previous trials, with the majority of car drivers saying that: the location of the LLCS was 'about right' (75%); the height of the LLCS was 'about right' (between 75% and 85%); and the angle of the LLCS was 'about right' (over 70%). For each of these, the size of the reservoir did not have an effect.</p> <p>[F12.b] – As in previous trials over 90% of car drivers said that cyclists on the road would benefit from the LLCS, with a slight increase in this response as the size of the cycle reservoir increased (90% for the 5m reservoir and 100% for the 10m reservoir).</p> <p>[F12.c] – Similar to previous trials, about 95% of car drivers were either positive or neutral about the LLCS; this was the case for all cycle reservoir depths.</p>
<p>RQ4 / RQ13 – What information did cyclists / car drivers use at the junction??</p>	<p>[F4.a] – 56% of the cyclists said that they noticed the LLCS on their first run through the junction and almost all of the others noticed it on their second run or after a few times. Cyclists who experienced the 5m reservoir were less likely to notice the LLCS on their first run.</p> <p>[F4.b] – The volume of cyclists had more of an effect than the depth of the reservoir on how difficult it was to see the LLCS</p>	<p>[F13.a] – For the most part the reservoir depth did not affect what car drivers looked at.</p>



Question	M24 cycle trial	M24 car trial
	<p>whilst waiting at the junction. Cyclists in the large group were more likely to find it difficult or impossible to see the LLCS. 50% of cyclists said that there were times when it was difficult or impossible to see the LLCS whilst waiting at the junction.</p> <p>[F4.c] – When asked how often they found it difficult or impossible to see the LLCS, about 40% of the large group and 30% of the small group said ‘sometimes’. This was more likely to be the case as the reservoir size increased. The most common reason given for not being able to see the LLCS was that they were obscured by other cyclists (65%). Over 75% of cyclists in the large group who experienced the 5m reservoir gave this response.</p> <p>[F4.d] – Of the cyclists who said there were times when it was difficult or impossible to see the LLCS, 38% said that this affected how they went through the junction. Of these, over 40% said that they followed the cyclists in front, whereas a quarter said that they tried to reposition themselves so that they could see the LLCS.</p> <p>[F4.e] – More cyclists said that they had difficulties seeing the LLCS when they were only present on the nearside (Arm D) than when they were present on both sides of the road (Arm B); this was 55% compared with nearly 65% for the small group and 35% compared with about 45% for the large group.</p> <p>[F4.f] – Cyclists who reported having difficulties seeing the LLCS in the small groups, were more likely to say they looked at the secondary signals, whereas those in the large groups were more likely to say they looked at the actions of other cyclists. Group size and size of the cycle reservoir both</p>	



Question	M24 cycle trial	M24 car trial
	contributed to this.	
RQ5 – Did the LLCS and cycle reservoirs affect whether cyclists stopped at a red light?	[F5.a] – There were very high levels of compliance with the red signal and that there were no differences between the different reservoir depths and group sizes.	
RQ6 / RQ14 – How did the different cycle reservoir depths affect where cyclists / car drivers waited?	<p>[F6.a] – For the small group (eight cyclists) the average number of cyclists who stopped before the first stop line was 1.5 for the 10m reservoir. The 7.5m and 10m reservoirs were typically sufficiently large enough to hold all eight cyclists.</p> <p>[F6.b] – For the large group, the average occupancy was 8.0 cyclists for the 5m reservoir and 13.0 for the 7.5m reservoir. The 10m reservoir was typically sufficiently large enough to hold all 16 cyclists.</p> <p>[F6.c] – Cyclists did not encroach substantially into the space between the second stop line and the pedestrian studs and this did not vary by reservoir depth or group size.</p> <p>[F6.d] – Cyclists waiting to go straight on predominantly waited at the front left of the cycle reservoir. With larger groups, the additional cyclists stayed towards the rear of the reservoir instead of filtering towards the front. Cyclists tended to wait on the right hand side when waiting to turn right. There was little difference between Arm B and Arm D, suggesting that the island with the additional LLCS did not have a large effect on</p>	<p>[F14.a] – In the majority of observations (&gt;96%), cars stopped before the reservoir entrance. The trials with the deeper cycle reservoirs were associated with a small but statistically significant increase in encroachment, from about 1.5% for the 5m reservoir up to between 3 and 4% for the deeper reservoirs.</p> <p>[F14.b] – The majority of encroachment was only up to 1.25m past the first stop line. The 10m reservoir had slightly higher encroachment compared to the 5m reservoir when there was no cyclist present (0.9% compared to 0.0%), which although only a small difference was indicative of greater encroachment in the 10m scenario.</p> <p>[F14.c] – Over half of the car drivers stopped more than 2.5m before the first stop line for the 7.5m and 10m reservoir depths. This supports the anecdotal evidence from the previous trial that some car drivers stopped quite far back from the stop line, possibly in order to</p>

Question	M24 cycle trial	M24 car trial
	<p>stopping position.</p> <p>[F6.e] – Over half (56%) of those who said that the LLCS affected where they stopped said that they tried to position themselves so that they could see the LLCS.</p>	<p>see the main signals that were located on the separate poles at the first stop line.</p> <p>[F14.d] – In the questionnaire, the majority of car drivers (over 80%) said that they 'never' waited in the cycle reservoir and this did not vary by the depth of the reservoir.</p>
<p>RQ7 / RQ15 – Did the LLCS and cycle reservoirs affect how cyclists / car drivers moved off as the signals changed to green?</p>	<p>[F7.a] – On average for both the small groups and large groups the first cyclist started moving around 0.5 seconds before the LLCS turned to green. On average for the small group, the last cyclist started moving about 2.5 seconds after the first cyclist and for the large group this was about 4 seconds.</p> <p>[F7.b] – It was only meaningful to consider the gap between the last cyclist and the controlled car for one approach (Arm B). On this approach, for scenarios with an early release of 3, 4 or 5 seconds and a small group of cyclists in front, the average Entry Time of the controlled car was comparable to previous trials (i.e. less than 7 seconds). This suggested that the car was not delayed from entering the junction by the cyclists in these scenarios.</p> <p>[F7.c] – On Arm B for the 2-second early release with a small group and the 5-second early release with a large group, the average Entry Time of the controlled car was about 7.5 seconds, suggesting that typically the car had just caught up with the last cyclist when entering the junction.</p> <p>[F7.d] – On Arm B for other early release scenarios with a large group of cyclists in front, the average Entry Time of the controlled car was greater than 7.5 seconds. This suggested that typically the car was delayed from entering the junction by</p>	<p>[F15.a] – When the reservoirs were 7.5m or 10m, the car drivers were more likely to start moving on the LLCS early release, compared to the 5m reservoir. Specifically for the 5m reservoir this was between 0% and 2% of observations, but for the 7.5m and 10m reservoirs this rose to between 4% and 10% of the observations when there was an early release of 3 or more seconds.</p> <p>[F15.b] – The average Reaction Times for the car drivers were typically around half a second faster in the trials with the deeper reservoirs, compared to the trial with the 5m reservoir.</p> <p>[F15.c] – In the questionnaire when asked whether during normal driving they would ever start moving on the LLCS early release, more car drivers answered either 'Yes' or 'It Depends' as the size of the reservoir increased; this was 3%, 14% and 24% for the 5m, 7.5m and 10m reservoirs, respectively. Reasons for doing so included: not concentrating; being distracted by the LLCS; if they were not aware of the early release; if there were no cyclists around; in anticipation of the main signals.</p> <p>[F15.d] – The average Entry Time was highest in the</p>

Question	M24 cycle trial	M24 car trial
	the last cyclist in these scenarios.	<p>scenario with no early release and a cyclist in front, suggesting that the car driver often had to wait for the cyclist before entering the junction. For the scenarios with no early release and no cyclist present, the average Entry Time increased by about 0.2 seconds for each additional 2.5m of reservoir.</p> <p>[F15.e] – For the trials with an early release, the 7.5m reservoir resulted in a small increase of about 0.1 seconds to the average Entry Time, whereas the 10m reservoir resulted in an increase of about 0.6 seconds, compared against the 5m reservoir.</p> <p>[F15.f] – An alternative measure relative to the Entry Time of the controlled cyclists suggested that the 7.5m reservoir gave an additional time advantage to the cyclist of 0.6 seconds, whereas the 10m gave an additional time advantage to the cyclist of 0.8 seconds, both compared against the 5m reservoir. However, this measure was subject to variability in the Entry Times of the controlled cyclists.</p>
RQ8 – Did the LLCS and cycle reservoirs affect whether right-turning cyclists turned in front of	<p>[F8.a] – For each of the 3-second, 4-second and 5-second early release scenarios, in over three-quarters of right-turning observations, at least one cyclist turned right in front of the oncoming car.</p> <p>[F8.b] – The larger the early release, the higher the average number of cyclists who turned right ahead of the oncoming car.</p> <p>- For the small group of eight cyclists, this ranged from 1.3 with the 2-second early release up to 5.6 with the 5-second early release.</p>	

Question	M24 cycle trial	M24 car trial
oncoming cars?	<p>- For the large group of 16 cyclists, this ranged from 1.6 with the 2-second early release up to 8.6 with the 5-second early release.</p> <p>[F8.c] – The deeper the cycle reservoir, the higher the average number of cyclists who turned right ahead of the oncoming car.</p> <p>- For the small group of eight cyclists, this was on average 1.9, 2.5 and 3.1 in the 5m, 7.5m and 10m scenarios, respectively.</p> <p>- For the large group of 16 cyclists, this was on average 3.2, 5.5 and 5.0, respectively.</p> <p>[F8.d] – The proportion of participants who said they turned right in front of the car either 'Every time' or 'Sometimes' was:</p> <p>- For the small groups, 58%, 71% and 90% for the 5m, 7.5m and 10m trials, respectively.</p> <p>- For the large groups, 46%, 67% and 66% for the 5m, 7.5m and 10m trials, respectively.</p> <p>[F8.e] – Of the cyclists who said they turned right in front of the car either every time or sometimes:</p> <p>- 30 to 60% said "I could see that the car had not started or it was moving slowly";</p> <p>- 20 to 40% said "I could see from the LLCS I had enough time to turn in front of the car";</p> <p>- 15 to 25% said "I could see that other cyclists were turning in front of the car";</p> <p>- 5 to 15% said "I expected the car to wait for me".</p> <p>[F8.f] – Of those who said they 'turned in front of the car every time', 4% gave comments suggesting they were confused over who had priority, whereas this proportion was 5% for those who said they 'turned in front of the car sometimes'. Some said</p>	

Question	M24 cycle trial	M24 car trial
	<p>they thought the LLCS gave them priority over oncoming vehicles, interpreting it as acting like a filter arrow.</p> <p>[F8.g] – The proportion of participants who said “I could see from the LLCS that I had enough time to turn in front of the car” was higher for the deeper cycle reservoirs. This might be explained by the car on the opposing approach being set back further from the junction, resulting in a larger gap in which more cyclists could turn.</p>	
RQ9 – What did the cyclists / car drivers think about the effect on safety of the LLCS and cycle reservoirs?	<p>[F9.a] – 80% of cyclists considered the junction to be either be ‘safer’ or ‘much safer’ to use compared to an ordinary junction with traffic signals (compared with around 90% in previous trials).</p> <p>[F9.b] – Around 5% in most scenarios said the junction was more unsafe or much more unsafe. Of these the main concern was about turning right across oncoming traffic when there was an early release.</p>	

## Appendix B Further details on methodology

### B.1 Sample size

Table B-1 shows the sample size collected for the cycle trial. There was a target of 20 observations for each manoeuvre. Cyclists were released up to the junction on a red signal so that all cyclists would stop at the junction. Over 20 observations were collected for each scenario, although instances where not all the cyclists stopped at the junction were filtered out. In the large group on the first morning of the trial (5m reservoir), there were several instances of some cyclists not reaching the signals before they changed to green. An adjustment to the signal timings was made to the signal timings at lunchtime on the first day to prevent this from happening. The relatively lower sample size for the large group on the 5m reservoir is not an issue, because there is still a reasonable sample size when pooled across all early release scenarios.

**Table B-1 – Cycle trial: collected sample size**

				No early release	With early release					Total
Reservoir depth	Group size	Arm	Turn	0 secs	2 secs	3 secs	4 secs	5 secs		
5m reservoir	8 cyclists	A	Straight	23	21	21	22	19	106	
		B	Straight	20	13	14	13	13	73	
		D	Straight	18	19	20	16	19	92	
			Right	21	19	20	18	19	97	
		Total		82	72	75	69	70	368	
	16 cyclists	A	Straight	15	12	11	15	13	66	
		B	Straight	12	8	7	6	9	42	
		D	Straight	13	11	14	10	13	61	
			Right	13	16	16	14	15	74	
		Total		53	47	48	45	50	243	
7.5m reservoir	8 cyclists	A	Straight	23	23	19	16	15	96	
		B	Straight	27	26	20	19	21	113	
		D	Straight	26	26	20	21	19	112	
			Right	27	26	21	21	19	114	
		Total		103	101	80	77	74	435	
	16 cyclists	A	Straight	19	17	15	16	15	82	
		B	Straight	25	21	22	15	20	103	
		D	Straight	16	13	18	13	21	81	
			Right	19	14	17	10	19	79	
		Total		79	65	72	54	75	345	
10m reservoir	8 cyclists	A	Straight	32	14	26	21	26	119	
		B	Straight	35	21	26	20	26	128	
		D	Straight	33	17	26	17	24	117	
			Right	36	16	26	19	26	123	
		Total		136	68	104	77	102	487	
	16 cyclists	A	Straight	24	19	15	21	18	97	
		B	Straight	26	24	21	23	22	116	
		D	Straight	27	23	20	23	21	114	
			Right	24	21	19	24	22	110	
Total		101	87	75	91	83	437			

Table B-2 shows the sample size collected for the car trial. There was a target of 25 observations for each manoeuvre. The sample size for the 5m reservoir car trial can be found in the appendices of the M19 report.

**Table B-2 – Car trial: collected sample size**

Reservoir depth	Vehicles	Arm/Turn		No early release	With early release				
					2 secs	3 secs	4 secs	5 secs	All early release scenarios
7.5m reservoir	Participant car driver, no cyclist	A	Right	95	48	47	47	46	188
		B	Left	46	23	22	23	24	92
			Straight	50	25	24	25	23	97
		C	Left	47	24	22	24	24	94
			Right	48	24	25	24	24	97
		D	Straight	48	24	24	23	24	95
			Right	48	24	24	25	23	96
		Total		382	192	188	191	188	759
	Participant car driver, cyclist in-front	A	Right	79	47	47	48	48	190
		B	Left	38	23	23	20	22	88
			Straight	42	25	24	27	22	98
		C	Left	42	25	24	25	24	98
			Right	38	23	24	23	23	93
		D	Straight	40	24	25	22	24	95
			Right	40	23	23	24	24	94
		Total		319	190	190	189	187	756
10m reservoir	Participant car driver, no cyclist	A	Right	88	40	32	47	46	165
		B	Left	43	18	15	23	24	80
			Straight	44	22	16	25	24	87
		C	Left	60	20	16	23	24	83
			Right	28	20	16	25	23	84
		D	Straight	44	21	17	24	24	86
			Right	43	19	15	24	24	82
		Total		350	160	127	191	189	667
	Participant car driver, cyclist in-front	A	Right	96	45	48	31	47	171
		B	Left	43	24	24	15	24	87
			Straight	43	23	24	16	24	87
		C	Left	51	29	24	16	23	92
			Right	44	19	24	16	24	83
		D	Straight	52	23	25	17	26	91
			Right	42	24	23	15	22	84
		Total		371	187	192	126	190	695



## B.2 Routes

Figure B-1 shows the routes followed by participant car drivers in the M24 Trial. Route 5 was not used in the trial due to the U-turn required at Arm B.

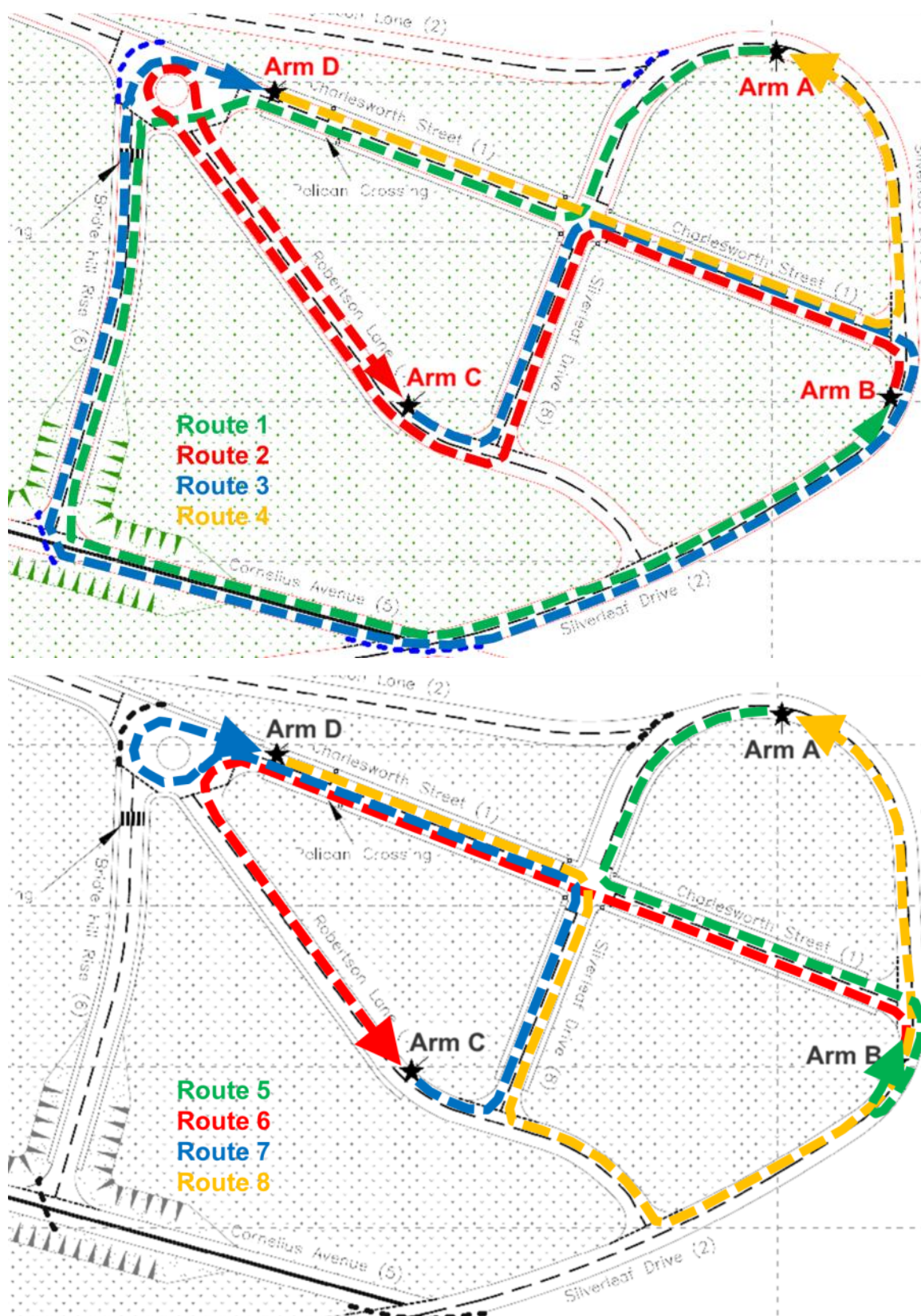
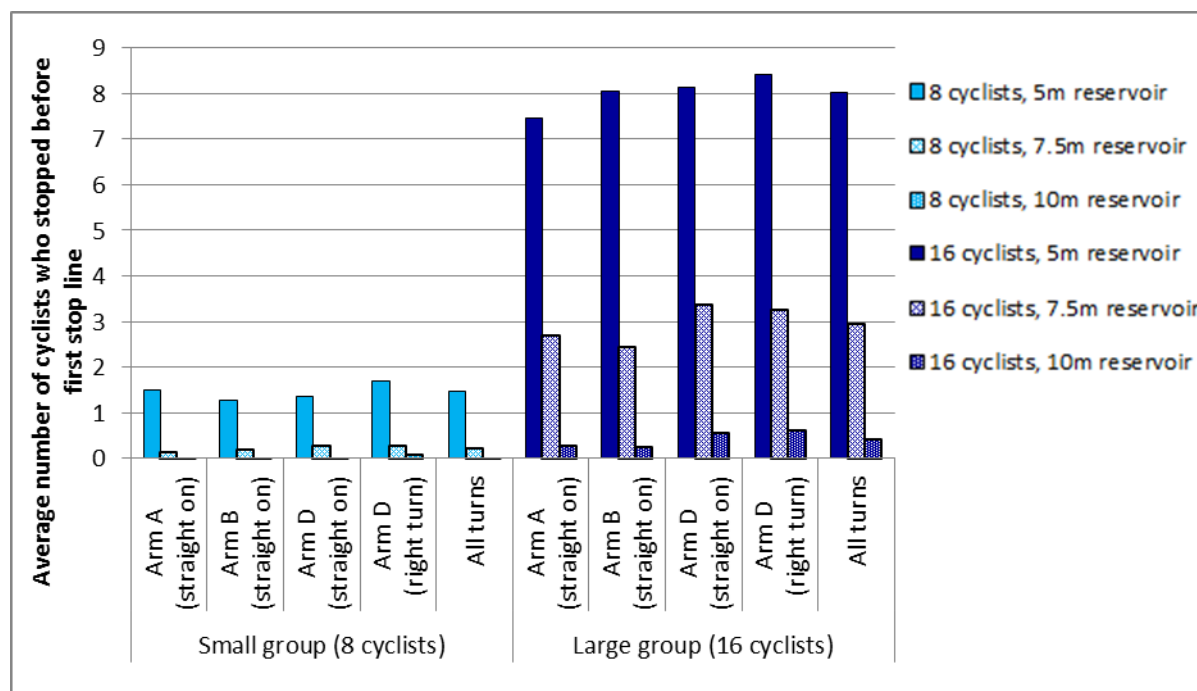


Figure B-1 – Car trial: routes used by car drivers

## Appendix C Further analysis of video data

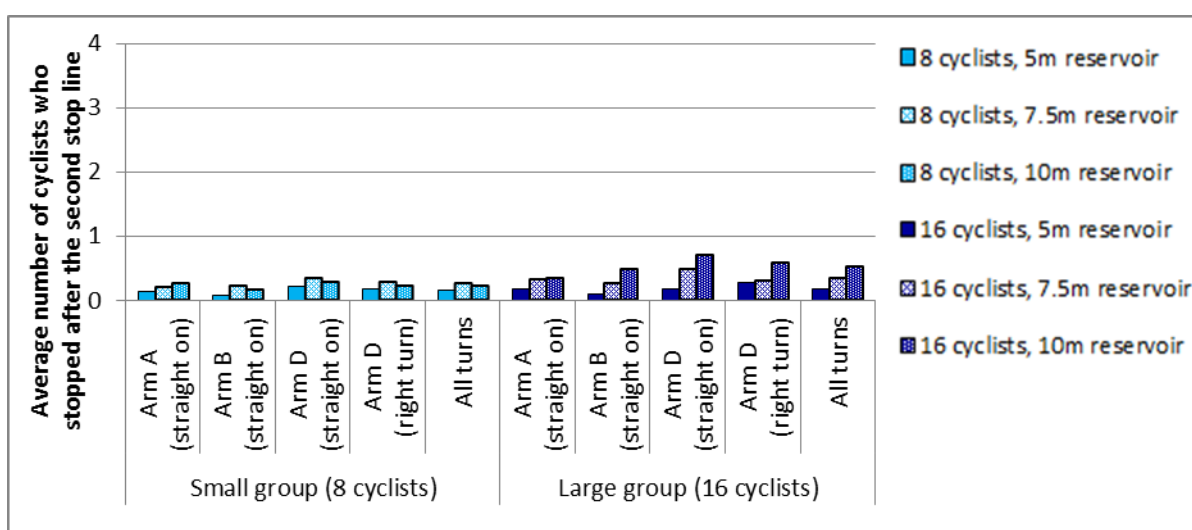
### C.1 Longitudinal stopping position (cycle trial)

Section 3.6.1.1 of the main report summarises the longitudinal stopping position in the cycle trial. Figure C-1 shows the average number of cyclists who stopped before the cycle reservoir for the two group sizes and three reservoir depths, broken down by approach arm and turn.



**Figure C-1 – Cycle trial: Average number of cyclists stopping before the cycle reservoir, by group size, reservoir depth, approach arm and turn (video data)**

Figure C-2 shows the average number of cyclists stopping with their front wheel after the cycle reservoir (i.e. the second stop line) for each approach arm and turn.



**Figure C-2 – Cycle trial: Average number of cyclists stopping after the cycle reservoir by arm and turn (video data)**

## C.2 Longitudinal and lateral stopping position (cycle trial)

Section 3.6.1.2 of the main report presented two sets of heat maps for the average number of cyclists stopping in each zone for cyclists waiting to go straight on and waiting to turn right. Figure C-3, Figure C-4 and Figure C-5 present the equivalent results for cyclists waiting to go straight on from Arms A, B and D, respectively.

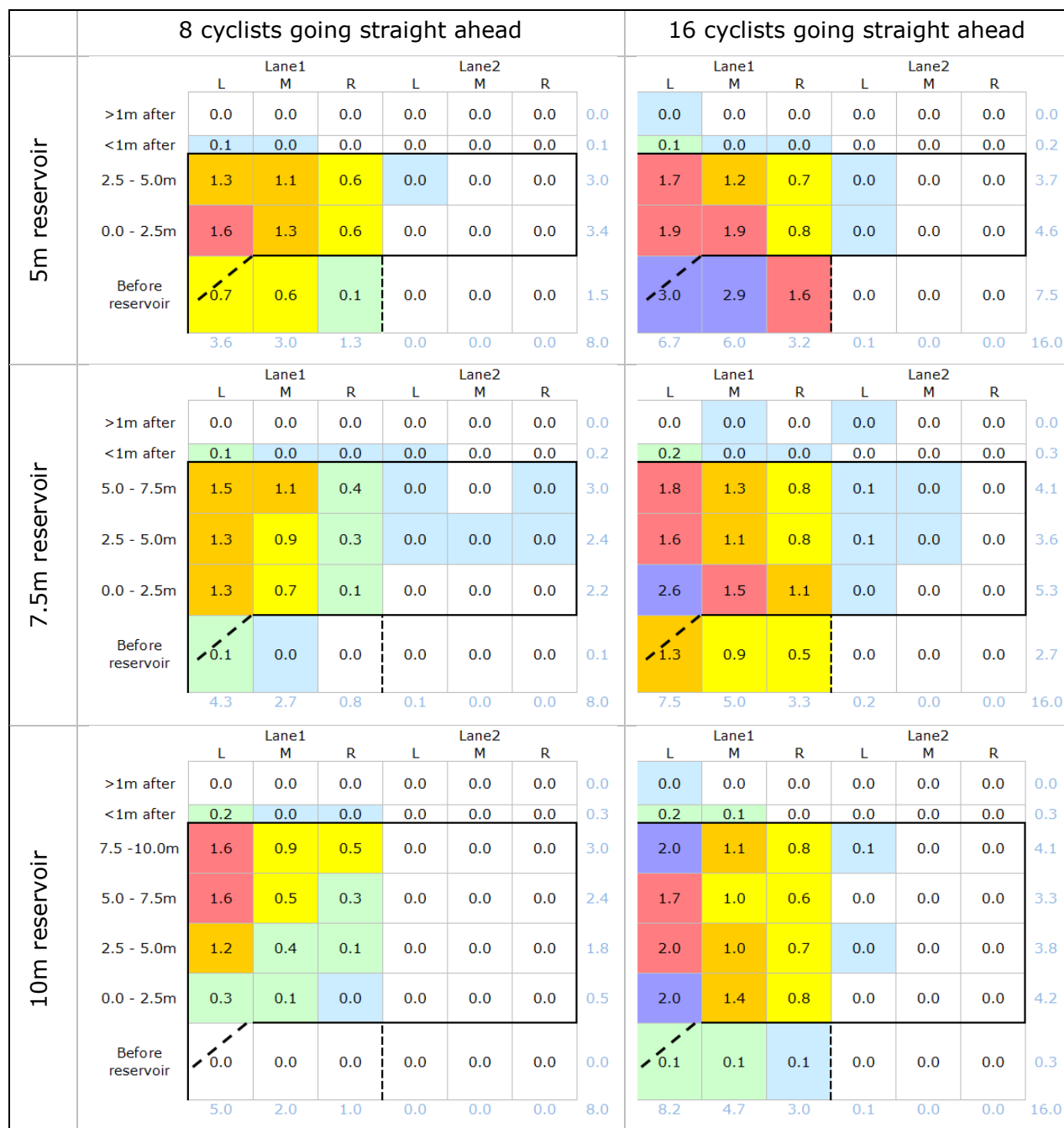


Figure C-3 – Cycle trial: Arm A straight on stopping positions (video data)

	8 cyclists going straight ahead					16 cyclists going straight ahead				
5m reservoir		L	M	R			L	M	R	
	>1m after	0.0	0.0	0.0	0.0	>1m after	0.0	0.0	0.0	0.0
	<1m after	0.0	0.0	0.0	0.1	<1m after	0.1	0.0	0.0	0.1
	2.5 - 5.0m	1.3	1.0	0.7	3.0	2.5 - 5.0m	1.4	1.2	0.7	3.2
	0.0 - 2.5m	1.8	1.2	0.6	3.6	0.0 - 2.5m	2.0	1.7	0.8	4.5
	Before reservoir	0.8	0.5	0.1	1.3	Before reservoir	3.5	3.6	1.1	8.2
		3.9	2.7	1.4	8.0		7.0	6.4	2.6	16.0
7.5m reservoir		L	M	R			L	M	R	
	>1m after	0.0	0.0	0.0	0.0	>1m after	0.0	0.0	0.0	0.0
	<1m after	0.2	0.0	0.0	0.2	<1m after	0.2	0.0	0.0	0.2
	5.0 - 7.5m	1.3	1.0	0.6	2.9	5.0 - 7.5m	1.4	1.3	1.0	3.7
	2.5 - 5.0m	1.2	0.8	0.5	2.5	2.5 - 5.0m	1.3	1.3	1.0	3.6
	0.0 - 2.5m	1.4	0.6	0.2	2.2	0.0 - 2.5m	2.5	1.8	1.6	6.0
	Before reservoir	0.1	0.1	0.0	0.2	Before reservoir	1.3	0.8	0.4	2.4
		4.1	2.5	1.3	8.0		6.7	5.3	4.1	16.0
10m reservoir		L	M	R			L	M	R	
	>1m after	0.0	0.0	0.0	0.0	>1m after	0.0	0.0	0.0	0.0
	<1m after	0.1	0.0	0.0	0.1	<1m after	0.2	0.2	0.1	0.5
	7.5 - 10.0m	1.6	0.9	0.6	3.0	7.5 - 10.0m	1.9	1.1	1.1	4.1
	5.0 - 7.5m	1.3	0.8	0.4	2.5	5.0 - 7.5m	1.5	1.0	1.0	3.5
	2.5 - 5.0m	1.1	0.4	0.2	1.7	2.5 - 5.0m	1.6	1.3	0.9	3.8
	0.0 - 2.5m	0.4	0.1	0.0	0.5	0.0 - 2.5m	1.8	1.2	0.8	3.8
	Before reservoir	0.1	0.0	0.0	0.1	Before reservoir	0.2	0.1	0.0	0.3
		4.6	2.2	1.2	8.0		7.2	4.8	4.0	16.0

Figure C-4 – Cycle trial: Arm B straight on stopping positions (video data)

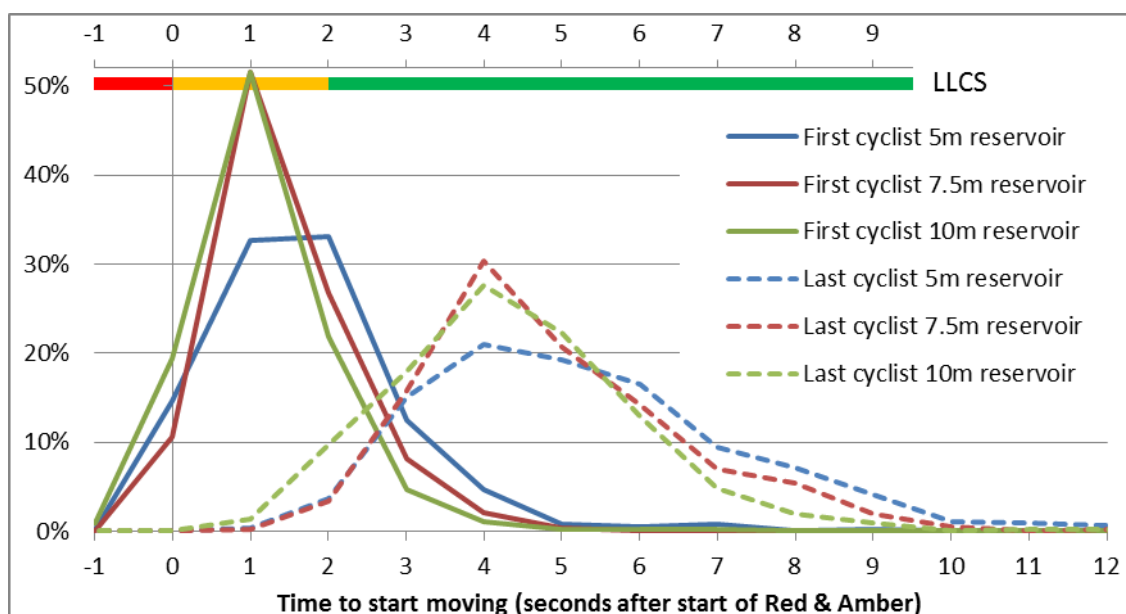
	8 cyclists going straight ahead				16 cyclists going straight ahead			
5m reservoir		L	M	R		L	M	R
	>1m after	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	<1m after	0.1	0.1	0.0	0.2	0.1	0.0	0.0
	2.5 - 5.0m	0.9	0.9	0.7	2.5	1.1	1.3	1.0
	0.0 - 2.5m	1.8	1.3	0.8	3.9	1.8	1.5	1.0
	Before reservoir	0.9	0.4	0.1	1.4	3.3	3.1	1.7
		3.7	2.7	1.6	8.0	6.3	6.0	3.7
7.5m reservoir		L	M	R		L	M	R
	>1m after	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	<1m after	0.2	0.1	0.1	0.3	0.3	0.1	0.1
	5.0 - 7.5m	1.0	0.8	0.6	2.3	0.9	1.2	1.0
	2.5 - 5.0m	1.1	0.8	0.4	2.3	1.3	1.0	1.2
	0.0 - 2.5m	1.6	0.8	0.3	2.7	2.3	1.4	2.0
	Before reservoir	0.3	0.0	0.0	0.3	1.8	0.9	0.6
		4.2	2.5	1.3	8.0	6.6	4.5	4.9
10m reservoir		L	M	R		L	M	R
	>1m after	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	<1m after	0.2	0.1	0.0	0.3	0.4	0.1	0.2
	7.5 - 10.0m	0.9	1.0	0.6	2.5	0.9	0.9	1.2
	5.0 - 7.5m	1.0	0.9	0.5	2.4	1.0	1.0	1.4
	2.5 - 5.0m	1.0	0.6	0.2	1.9	1.1	1.2	1.4
	0.0 - 2.5m	0.6	0.2	0.1	0.9	1.5	1.4	1.6
	Before reservoir	0.0	0.0	0.0	0.0	0.4	0.1	0.1
		3.7	2.9	1.5	8.0	5.3	4.8	5.9

Figure C-5 – Cycle trial: Arm D straight on stopping positions (video data)

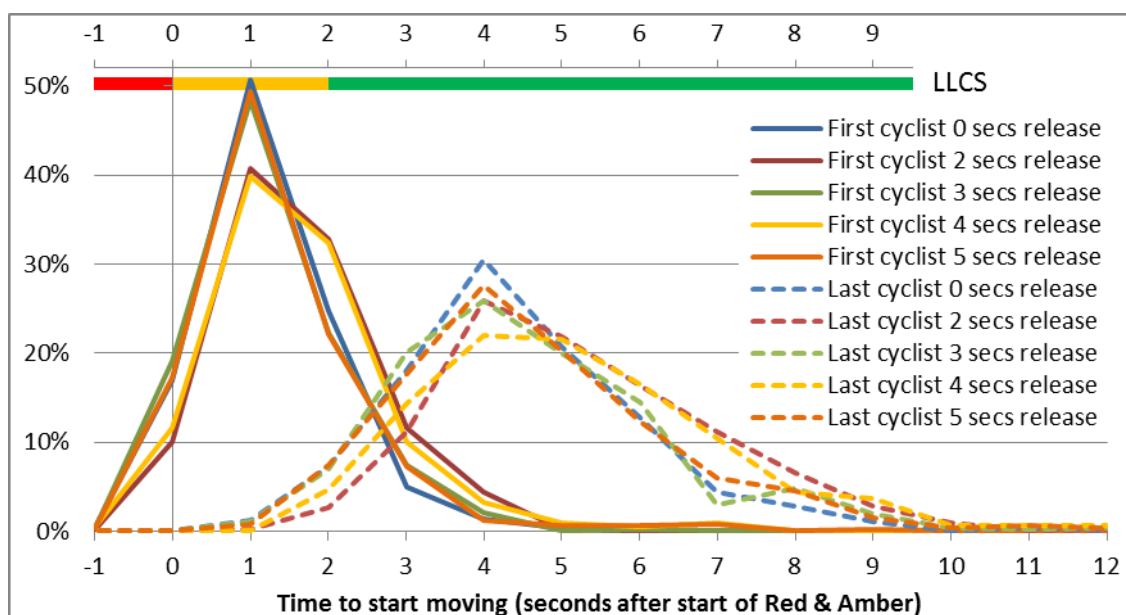


### C.3 Reaction Time (cycle trial)

The following charts show the Reaction Time for the first and last cyclist in each group. There are charts split by reservoir length and early release scenario. These are relative to the LLCS changing to Red and Amber.



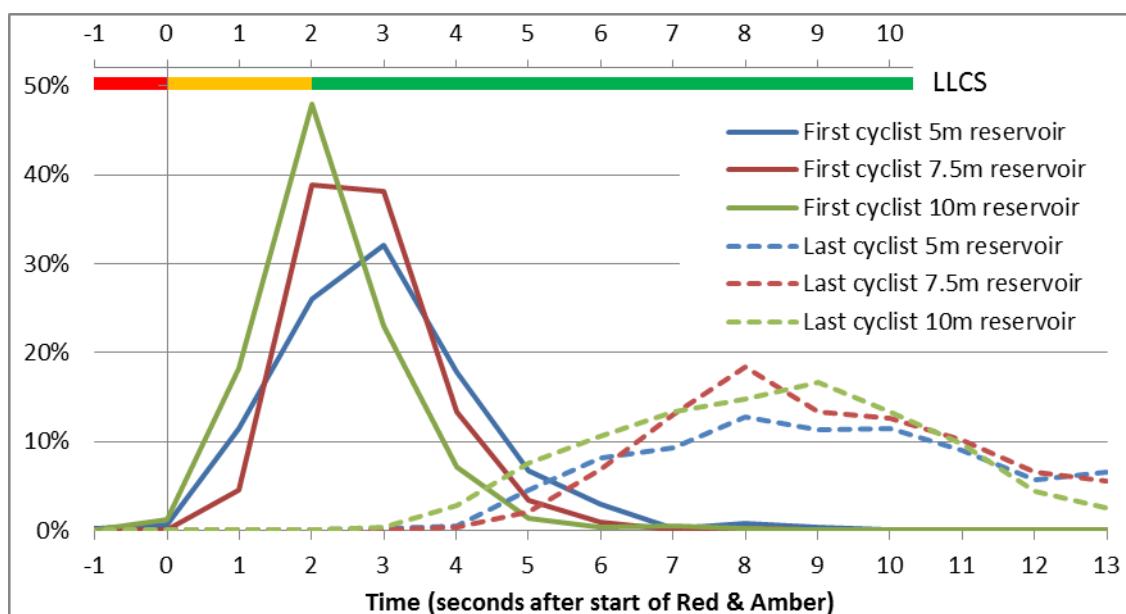
**Figure C-6 – Cycle trial: Reaction Time by reservoir length, relative to the LLCS (video data)**



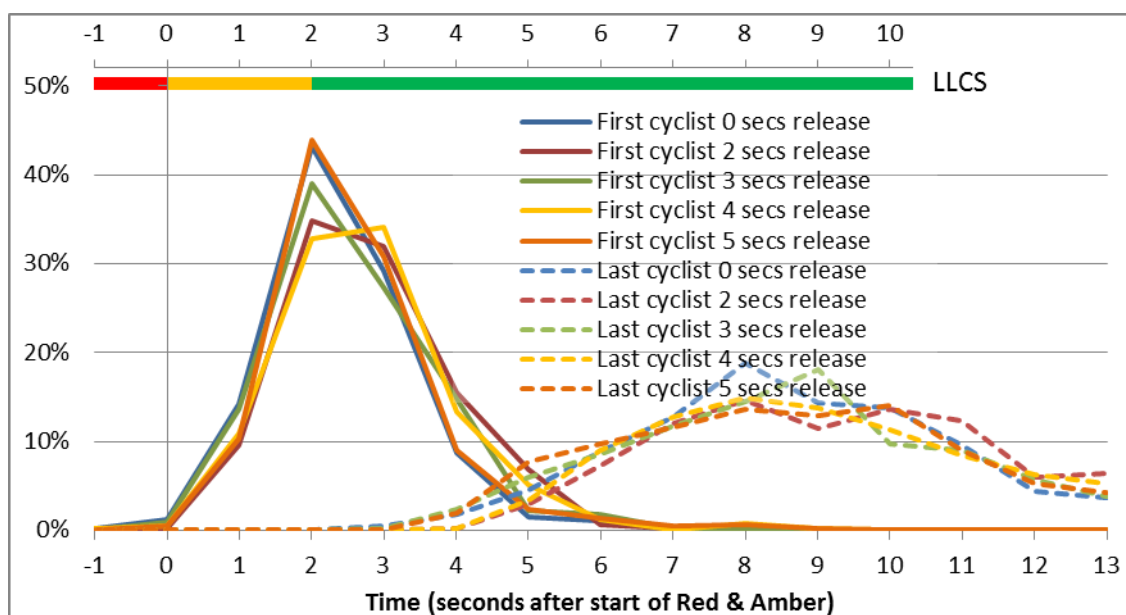
**Figure C-7 – Cycle trial: Reaction Time by early release scenario, relative to the LLCS (video data)**

### C.4 Entry Time (cycle trial)

The following charts show the Entry Time for the first and last cyclist in each group. There are charts split by reservoir length and early release scenario and group size. These are relative to the LLCS changing to Red and Amber.



**Figure C-8 – Cycle trial: Entry Time by reservoir length, relative to the LLCS (video data)**



**Figure C-9 – Cycle trial: Entry Time by early release scenario, relative to the LLCS (video data)**

## C.5 Right-turning behaviour (cycle trial)

Section 3.8 of the main report summarised the right turning behaviour of cyclists in front of the oncoming car. Further analysis is presented below.

### C.5.1 Sample bias

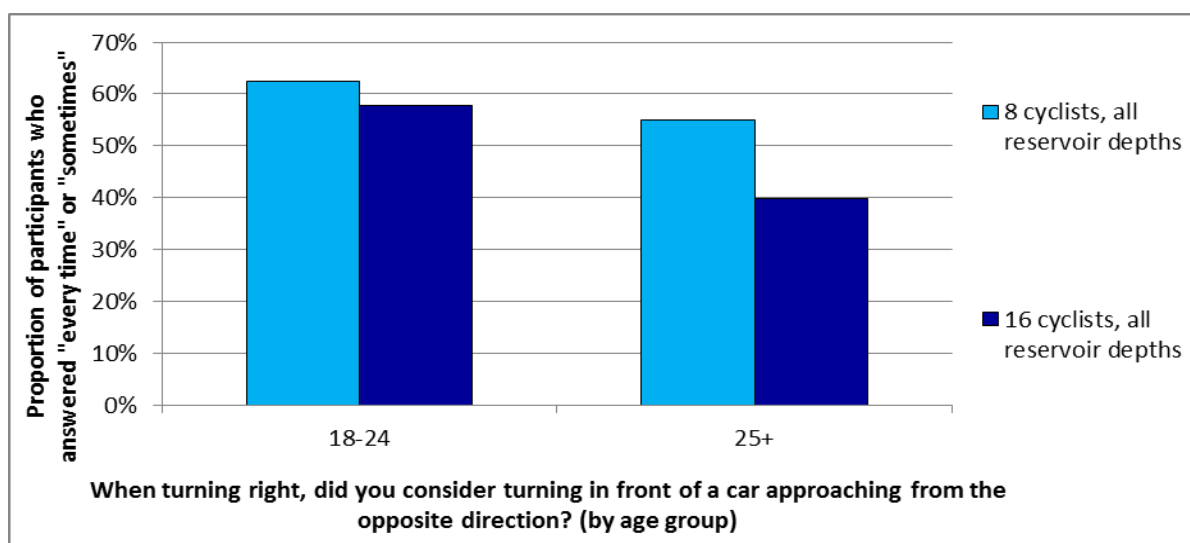
Each participant was assigned to be in a group of either eight or 16 cyclists and they stayed in the same group for the duration of the trial. As such, it was important to record the characteristics of each group to assess for any sample biases. All participants completed a questionnaire of some type, either 'short', 'medium' or 'long'. All types of questionnaire recorded characteristics such as age, gender and experience of cycling.



The 'medium' and 'long' questionnaires also included questions on their experiences from the trial.

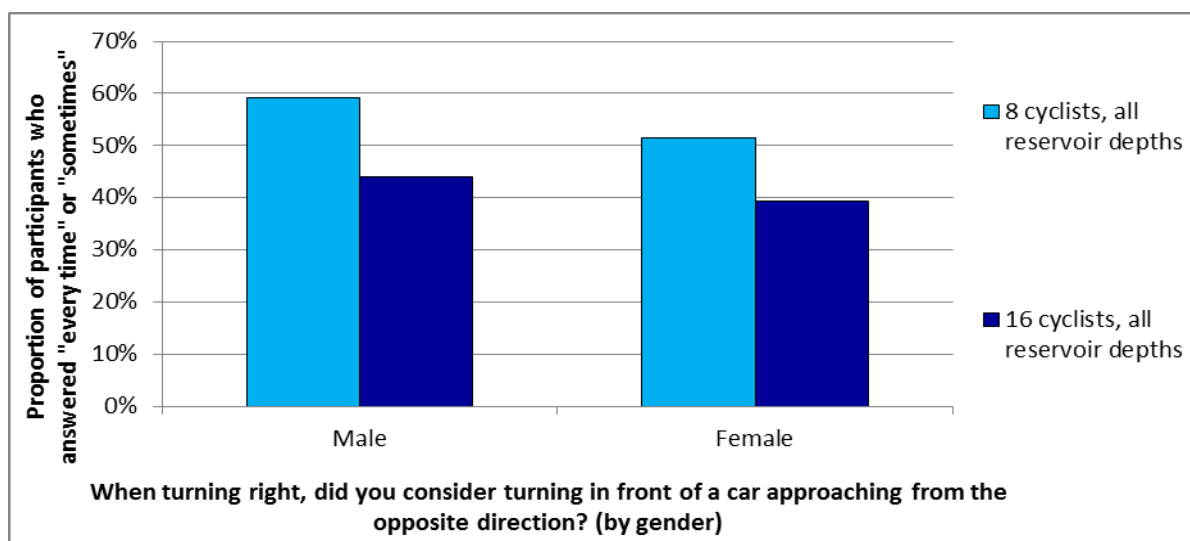
In the 'medium' and 'long' questionnaires, cyclists were asked, "When turning right, did you consider turning in front of the car approaching from the opposite direction?" and were asked to pick one of four responses: 'Turned in front of the car every time', 'Turned in front of the car sometimes', 'Considered, but did not turn in front of the car', 'Did not consider turning in front of the car'. The responses to this question are assessed here for sample bias.

Figure C-10 shows the proportion of cyclists who said they turned right in front of the car either 'every time' or 'sometimes', split into two age categories of '18-24' and '25 or over'. This shows that younger cyclists were more likely to turn in front of the car.



**Figure C-10 – Cycle trial: cyclists who said they turned right in front of the car 'every time' or 'sometimes', by age and group size (questionnaire)**

Figure C-10 shows the proportion of cyclists who said they turned right in front of the car either 'every time' or 'sometimes', split by gender. This shows that male cyclists were more likely to turn in front of the car.



**Figure C-11 – Cycle trial: cyclists who said they turned right in front of the car 'every time' or 'sometimes', by gender and group size (questionnaire)**

Table C-1 lists the groups with a large proportion of younger participants and also those with an uneven gender split. The group identifier gives the day of the trial (1-20), the time they took part (1 and 2 = AM; 3 and 4 = PM) and the colour of their bib (red, green or blue). Each group experienced early release scenarios of either {0, 2 and 4} or {0, 3 and 5}. The thresholds used were the proportion aged 18-24 being at least 30% and at least 25% of each gender. There were 99 groups in total. The 23 groups below have been filtered from the analysis of right-turning behaviour to enable fair relative comparisons between the scenarios for early release and reservoir depth.

**Table C-1 – Cycle trial: groups removed from right-turning analysis due to sample bias (video data)**

Group size	Reservoir depth (m)	Early releases experienced	Group	Proportion Age 18-24 (>30% highlighted)	Proportion male (<25% or >75% highlighted)
8	5	0, 2 and 4 secs	Day 1__2G	33%	17%
8	5	0, 2 and 4 secs	Day 3__1G	0%	88%
8	5	0, 3 and 5 secs	Day 1__3R	38%	63%
8	5	0, 3 and 5 secs	Day 1__4R	50%	25%
8	5	0, 3 and 5 secs	Day 4__2G	20%	20%
8	7.5	0, 2 and 4 secs	Day 8__1B	0%	83%
8	7.5	0, 2 and 4 secs	Day 9__3B	43%	86%
8	7.5	0, 3 and 5 secs	Day 10__1B	13%	100%
8	7.5	0, 3 and 5 secs	Day 8__3R	38%	88%
8	7.5	0, 3 and 5 secs	Day 8__4B	0%	100%
8	10	0, 2 and 4 secs	Day 15__2G	0%	88%
8	10	0, 2 and 4 secs	Day 17__1R	13%	88%
8	10	0, 2 and 4 secs	Day 18__1R	50%	75%
8	10	0, 3 and 5 secs	Day 16__1B	0%	86%
8	10	0, 3 and 5 secs	Day 16__1G	13%	100%
8	10	0, 3 and 5 secs	Day 16__1R	13%	100%
8	10	0, 3 and 5 secs	Day 19__1B	14%	86%
16	5	0, 2 and 4 secs	Day 1__2B	46%	69%
16	5	0, 2 and 4 secs	Day 2__2B	0%	13%
16	5	0, 2 and 4 secs	Day 2__2R	33%	40%
16	7.5	0, 3 and 5 secs	Day 11__1R	36%	79%
16	7.5	0, 3 and 5 secs	Day 11__2B	13%	81%
16	10	0, 3 and 5 secs	Day 20__2R	31%	44%

### C.5.2 Sample size

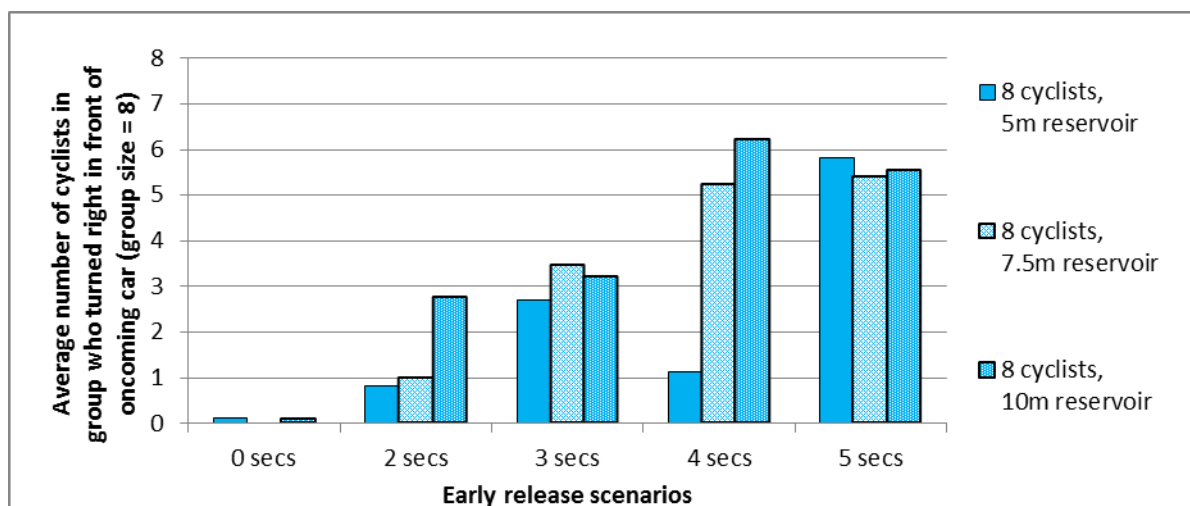
Table C-2 shows the sample size and proportion of observations where at least one cyclist turned right in front of the oncoming car, by group size, early release and cycle reservoir.

**Table C-2 – Cycle trial: sample size and proportion of observations where at least one cyclist turned right in front of the oncoming car, by group size, early release and cycle reservoir (video data)**

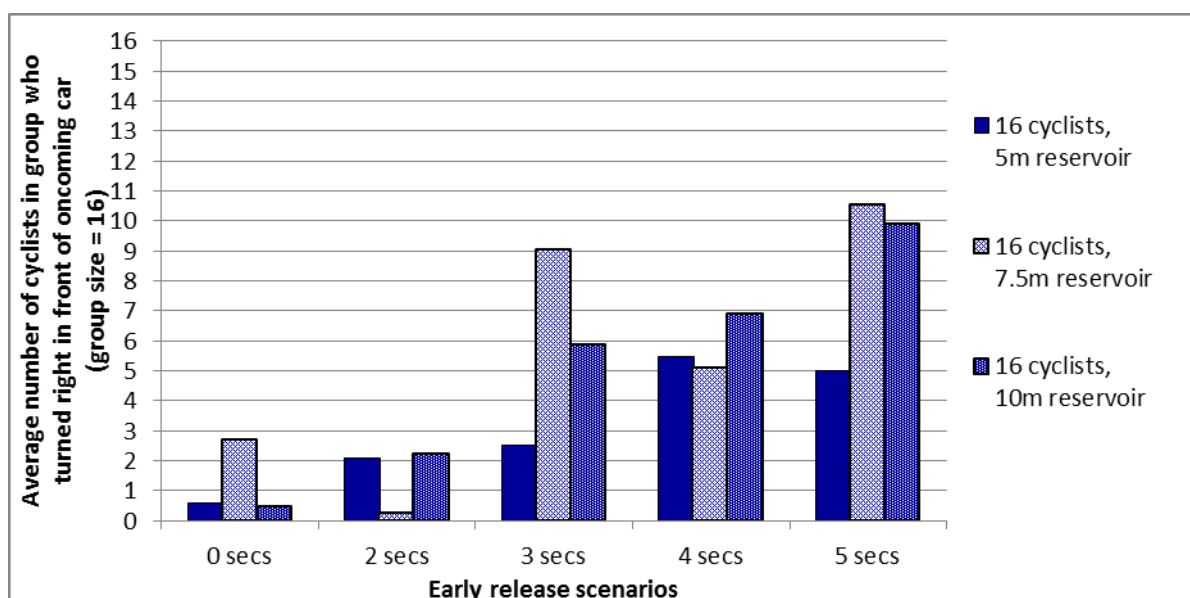
Group size	Early release scenario	Cycle reservoir scenario	Number of observations where cyclist turned right in front of car	Sample Size	% of observations where cyclist turned right in front of car	Number of observations where cyclist turned right in front of car	Sample Size	% of observations where cyclist turned right in front of car
8 cyclists	0 secs	5m	2	15	13%	4	55	7%
		7.5m	0	19	0%			
		10m	2	21	10%			
	2 secs	5m	3	16	19%	18	51	35%
		7.5m	9	23	39%			
		10m	6	12	50%			
	3 secs	5m	10	13	77%	31	41	76%
		7.5m	10	13	77%			
		10m	11	15	73%			
	4 secs	5m	6	14	43%	29	38	76%
		7.5m	14	14	100%			
		10m	9	10	90%			
	5 secs	5m	12	12	100%	38	40	95%
		7.5m	12	13	92%			
		10m	14	15	93%			
16 cyclists	0 secs	5m	3	12	25%	16	49	33%
		7.5m	7	15	47%			
		10m	6	22	27%			
	2 secs	5m	6	10	60%	21	45	47%
		7.5m	2	14	14%			
		10m	13	21	62%			
	3 secs	5m	10	16	63%	37	45	82%
		7.5m	13	13	100%			
		10m	14	16	88%			
	4 secs	5m	8	11	73%	37	45	82%
		7.5m	8	10	80%			
		10m	21	24	88%			
	5 secs	5m	11	15	73%	41	48	85%
		7.5m	14	14	100%			
		10m	16	19	84%			

### C.5.3 Average number of cyclists who turned right in front of the oncoming car

Section 3.8.2 of the main report analysed the average number of cyclists who turned in front of the car for the different early release scenarios and the different reservoir depths. Figure C-12 and Figure C-13 show the same data, but for each combination of early release and reservoir depth scenario.



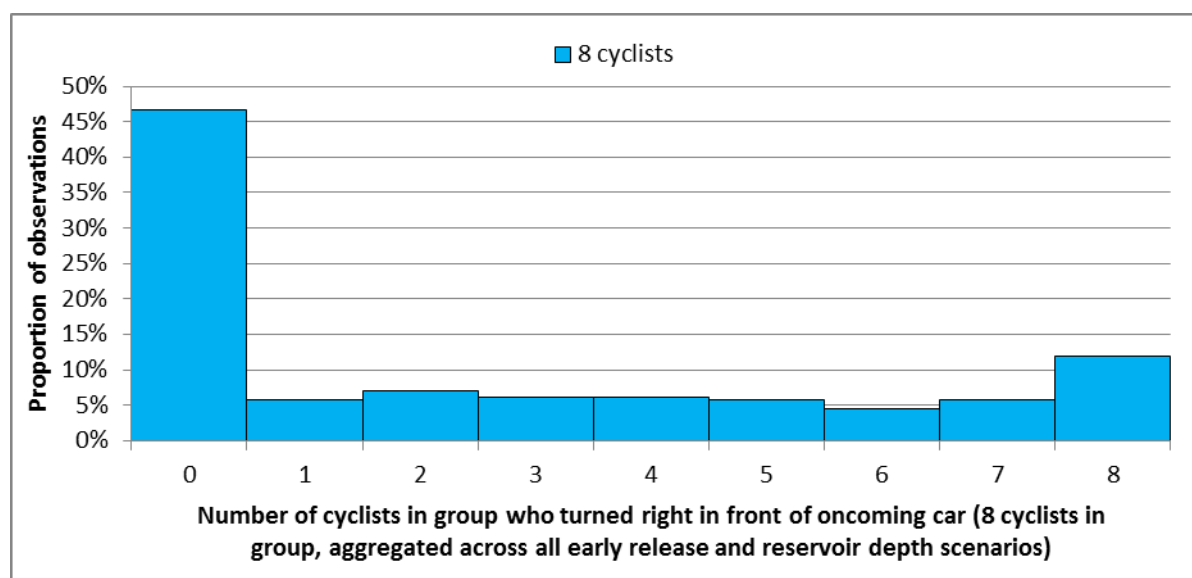
**Figure C-12 – Cycle trial: average number of cyclists who turned right in front of the oncoming car, group size = 8, by early release and cycle reservoir (video data)**



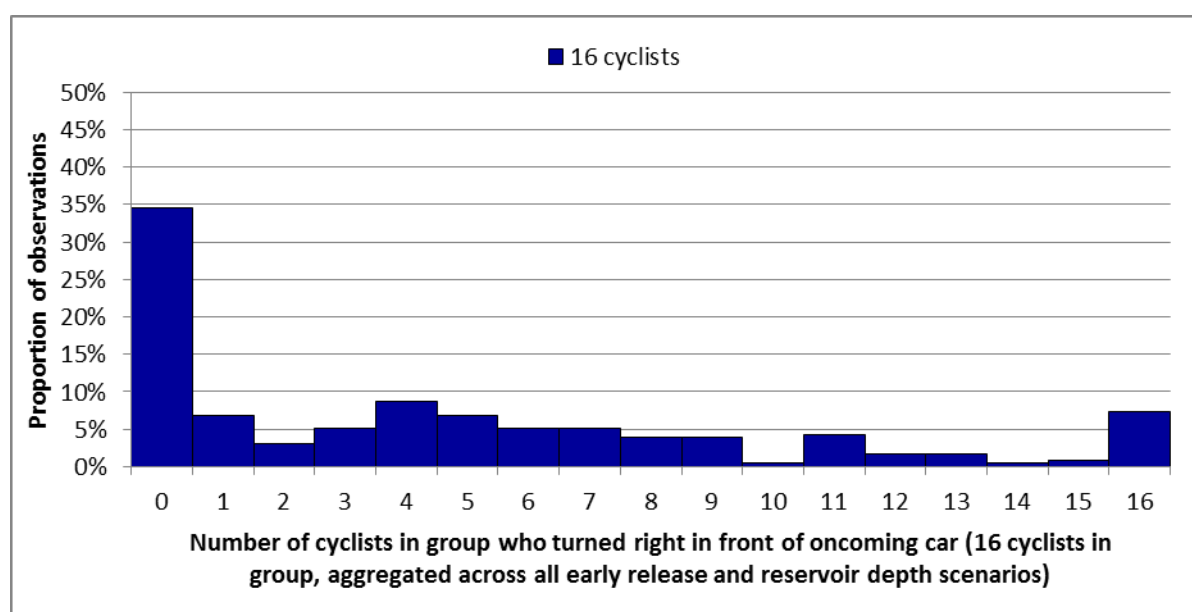
**Figure C-13 – Cycle trial: average number of cyclists who turned right in front of the oncoming car, group size = 16, by early release and cycle reservoir (video data)**

#### C.5.4 Distribution

Figure C-14 and Figure C-15 show the distribution of how many cyclists turned right in front of the oncoming car for the small group and large group, respectively.



**Figure C-14 – Cycle trial: distribution of the number of cyclists who turned right in front of the oncoming car, group size = 8 (video data)**

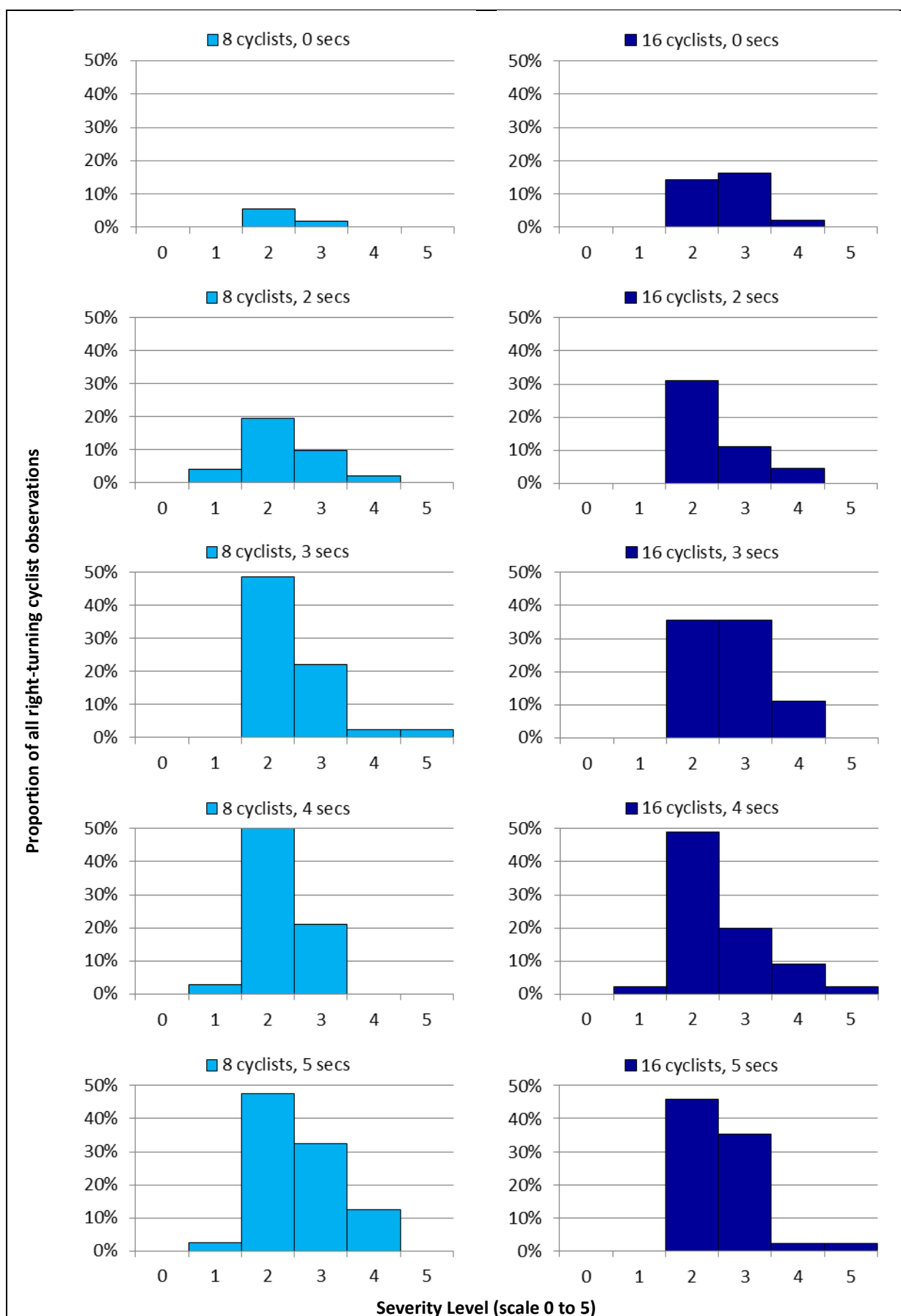


**Figure C-15 – Cycle trial: distribution of the number of cyclists who turned right in front of the oncoming car, group size = 16 (video data)**

### C.5.5 Severity Level classification

For the remainder of this sub-section, “last cyclist” refers to the last cyclist who turned in right front of the car. To gain a better understanding of how dangerous these manoeuvres may have been, each observation was categorised depending on how severely the car was forced to modify their behaviour relative to the last cyclist (0 to 5, where 5 was the most severe). See Section 3.7.1.1 of the M18 report for the definition of the Severity Levels. The cars were controlled by TRL staff, who were instructed to move off as normal but be prepared to stop as the safety of the participants was paramount.

Figure C-16 shows the distribution of Severity Level for the interaction between the car driver and the last cyclist, broken down by group size and early release scenario.

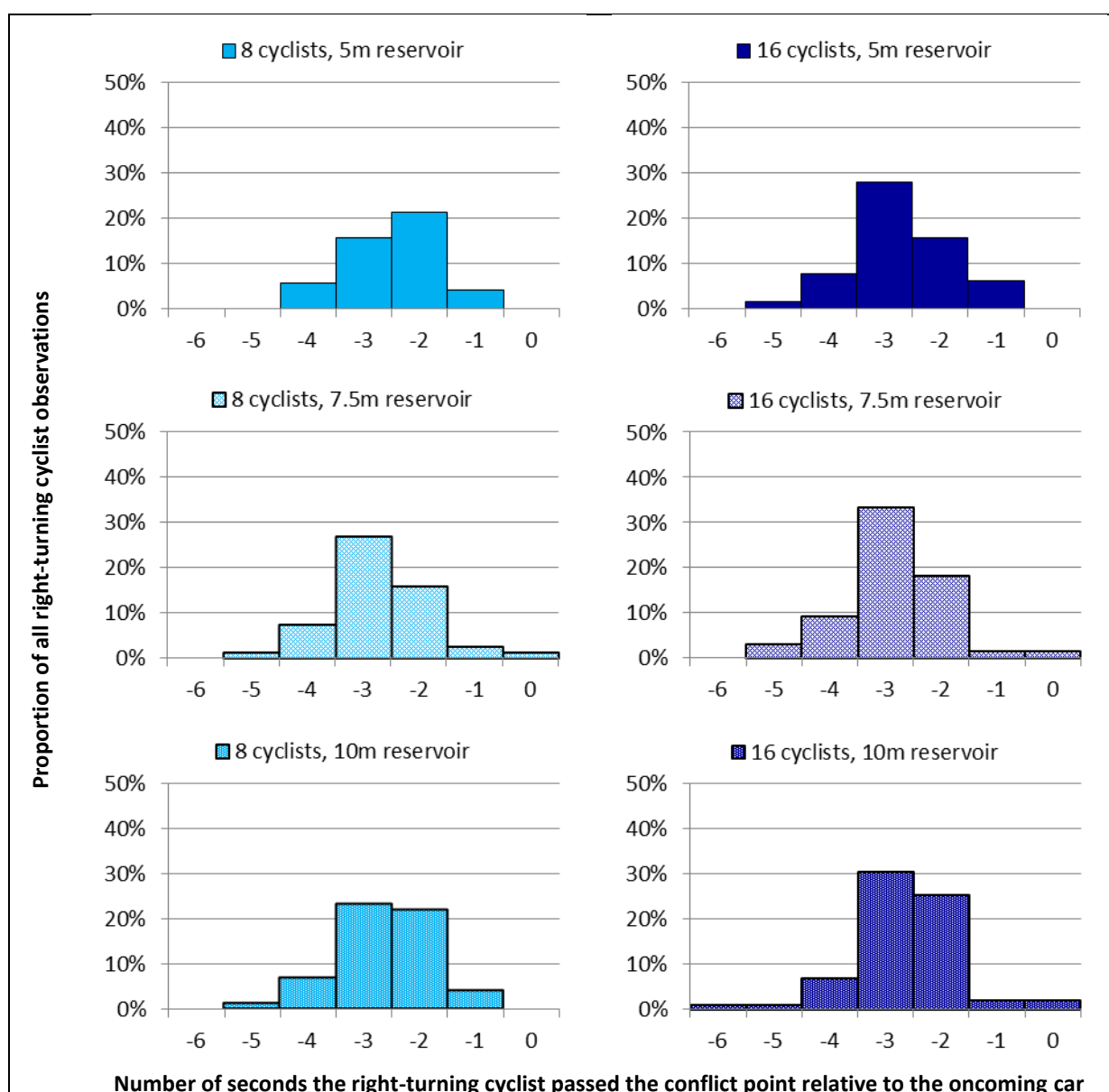


**Figure C-16 – Cycle trial: Severity Level of right-turning interaction (video data)**

Most manoeuvres were categorised as Severity Level 2, where the oncoming car (from Arm B) moved off normally, but regulated acceleration to allow cycle to complete turn. There were a small proportion of observations where the car was forced to slow down, but was able to do so safely (Severity Level 4) and also where the car had to stop suddenly (Severity Level 5).

### C.5.6 Interval between last cycle and car reaching the conflict point

The conflict point was defined as described in Section 3.7.1.2 of the M18 report. Figure C-17 shows the time elapsed between when the last cycle and car passed through the same point. The longer this interval, the safer it should be for the cyclist. For most observations there was at least a 2-second interval.

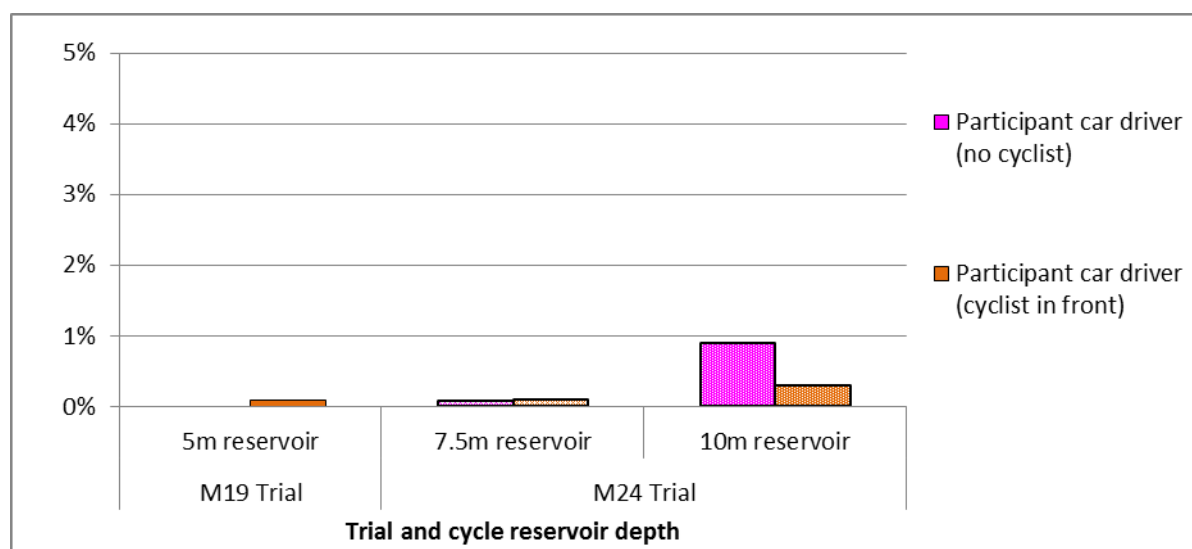


**Figure C-17 – Cycle trial: interval between last cycle and car reaching the conflict point, by group size and cycle reservoir (video data)**



## C.6 Longitudinal stopping position within reservoir (car trial)

Section 4.5.1.1 of the main report analysed the distribution of cars stopping within the reservoir. Figure C-18 shows the proportion of observations where the car stopped more than 1.25m past the first stop line.



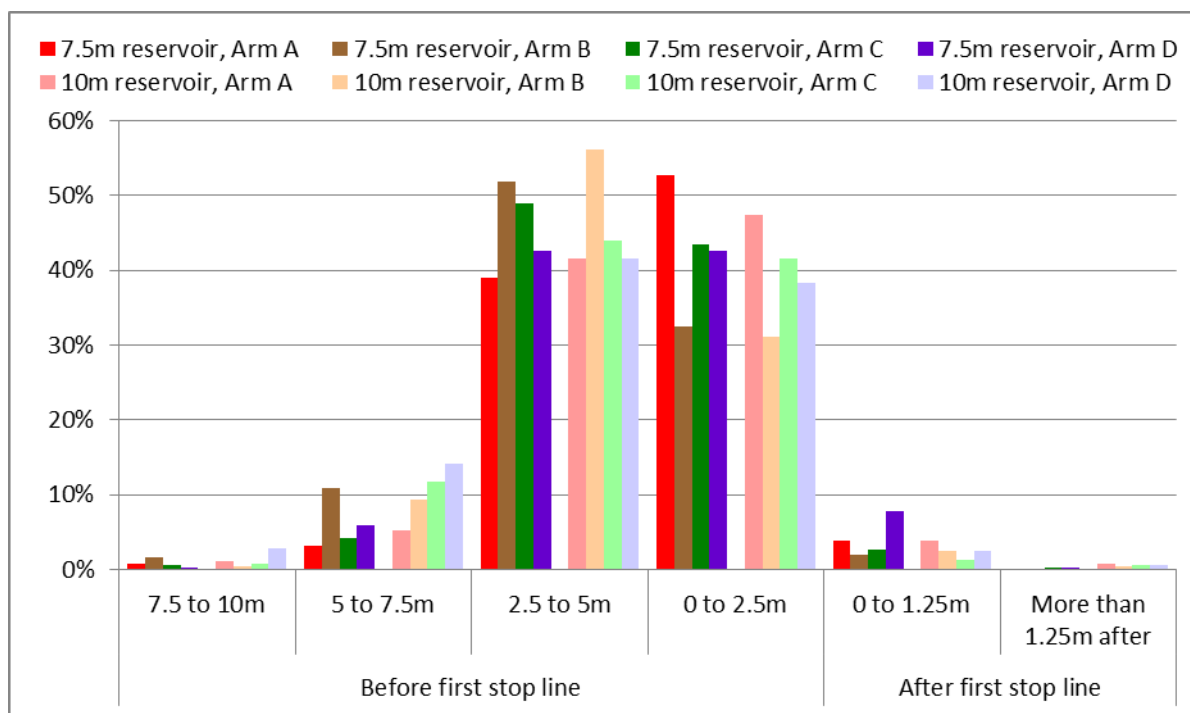
**Figure C-18 – Car trial: proportion of observations where the car stopped more than 1.25m within the cycle reservoir, by reservoir depth (video data)**

Of those observations where the car driver stopped past the first stop line, the majority were only up to 1.25m past the first stop line. In the scenarios with no controlled cyclists, the proportion of car drivers who stopped more than 1.25 metres past the reservoir was 0.0%, 0.1% and 0.9% for the 5m, 7.5m and 10m reservoirs, respectively. In the scenario with one controlled cyclist in front, these proportions were 0.1%, 0.1% and 0.3%, respectively. Of these the only statistically significant difference<sup>1</sup> was in the scenario with controlled cyclists from 0.0% for the 5m reservoir to 0.9% for the 10m reservoir. Although only a small change, this was an indicative effect that suggests that car drivers were more likely to encroach deep into the reservoir in the 10m scenario.

## C.7 Longitudinal stopping position before reservoir (car trial)

Section 4.5.1.2 of the main report analysed the distribution of cars stopping before the reservoir in the 7.5m and 10m scenarios. Figure C-19 breaks this analysis down by approach arm.

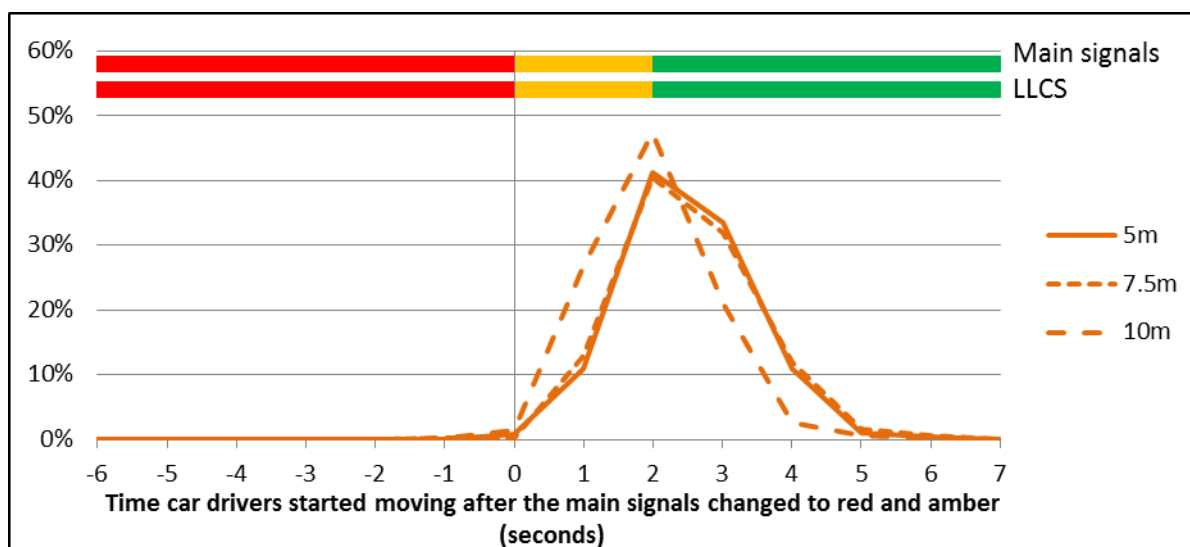
<sup>1</sup>  $P < 0.01$



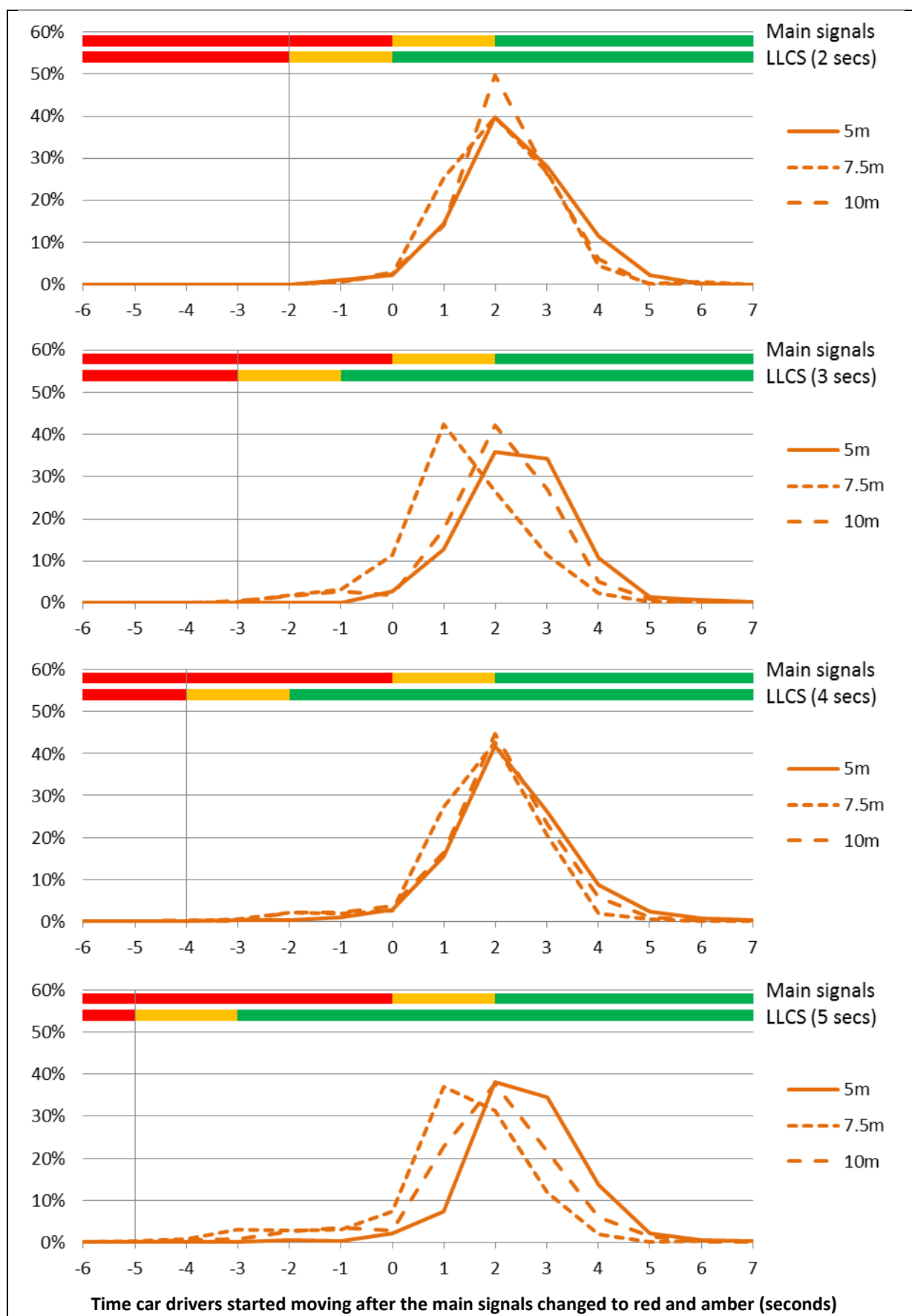
**Figure C-19 – Car trial: precise stopping positions before reservoir in 7.5m and 10m reservoir scenarios, by approach arm (video data)**

### C.8 Reaction Time (car trial)

Section 4.6.1.1 of the main report analysed the Reaction Time of the car drivers, both the proportion who started moving before the main signals changed and also the average Reaction Time. Figure C-20 shows the distribution of Reaction Time for the car drivers for the different reservoir depths in the trial with no early release. Figure C-21 shows the equivalent graphs for the different early release scenarios.



**Figure C-20 – Car trial: Reaction Time of car drivers relative to the main signals changing to red and amber, no early release (video data)**



**Figure C-21 – Car trial: Reaction Time of car drivers relative to the main signals changing to red and amber, with early release (video data)**

## Appendix D Further analysis of questionnaire data (Cycle trial)

### D.1 Introduction

This appendix contains further analysis of the questionnaires from the cycle trial. Graphs are broken down by the six groups across the three different reservoir depths and the two different group sizes.

Throughout this appendix participants from the previous trials will be referred to by the trial they participated in (see trial codes in Table D-1), followed by the road user type, for example 'M14 Cyclists'.

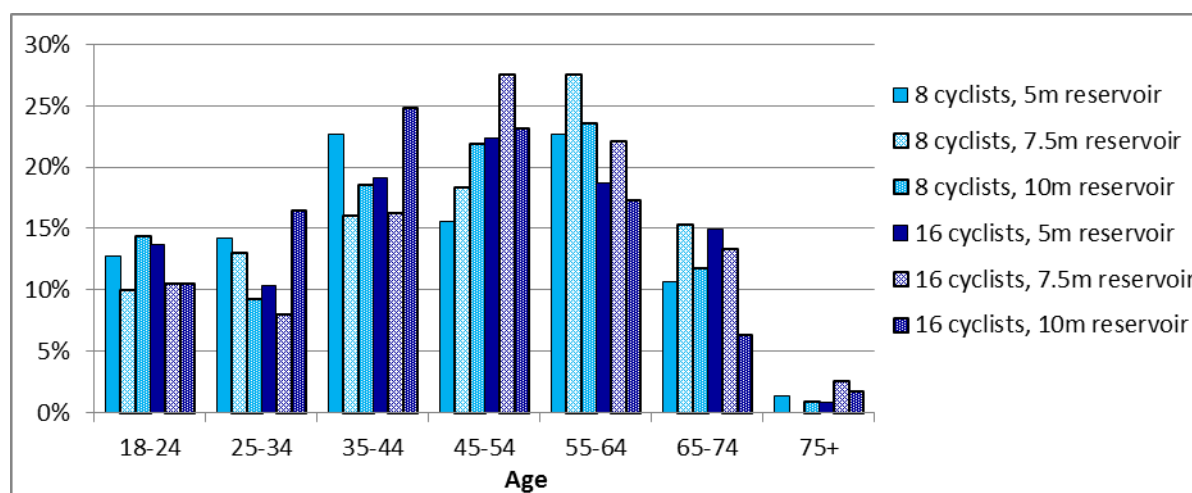
**Table D-1 – Trial codes**

Trial code	Location of signals	Early release	Reservoir depth
M14	Same poles	0 secs	5m
M18	Same poles	2,3,4,5 secs	5m
M19a	Separate poles	0 secs	5m
M19b	Separate poles	2,3,4,5 secs	5m
M24	Separate poles	0,2,3,4,5 secs	5m, 7.5m and 10m

#### D.1.1 Participant characteristics

##### D.1.1.1 Age characteristics

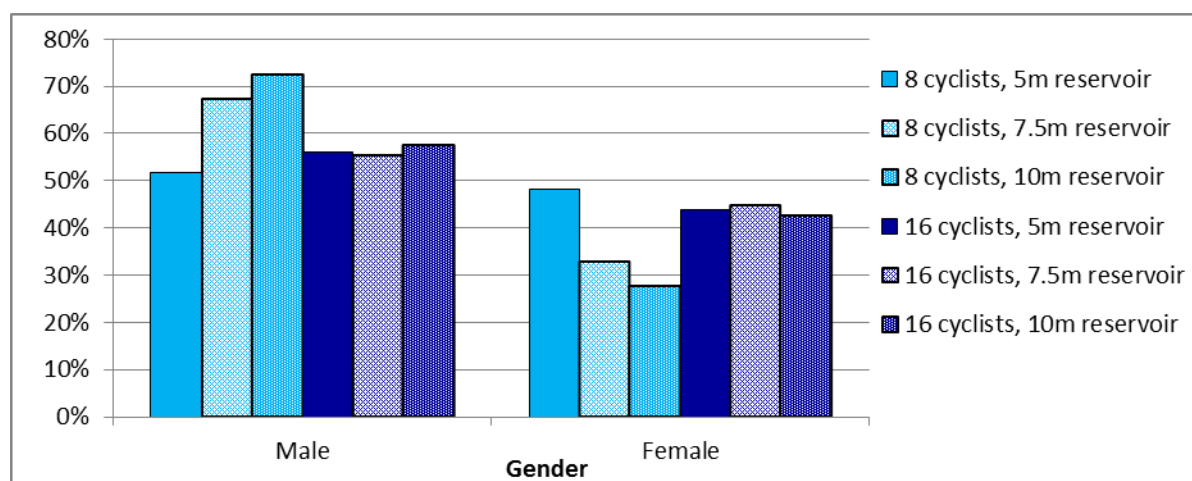
Most cyclists (63%) were aged between 35 and 64. The age distribution was broadly similar across the six groups, see Figure D-1. The range of ages was similar to the previous cycle trials.



**Figure D-1 – Cycle trial: age characteristics (questionnaire)**

##### D.1.1.2 Gender characteristics

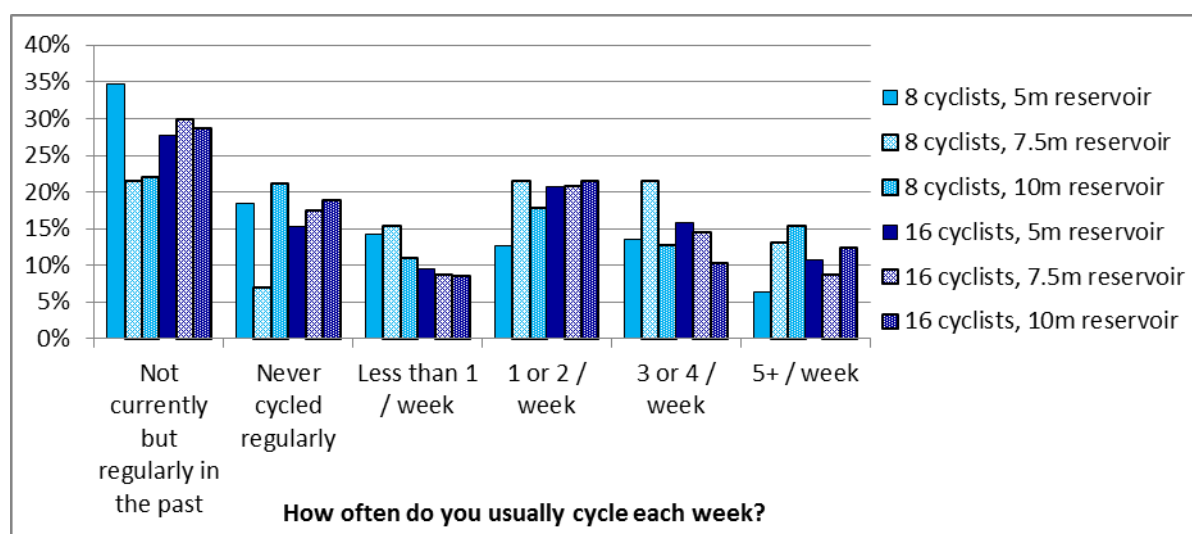
Most cyclists (59%) were male. The gender of the cyclists was broadly similar across the six groups, except there were more male cyclists within the 7.5m and 10m reservoir groups with 8 cyclists (see Figure D-2). The gender split is broadly similar to the previous cycle trials.



**Figure D-2 – Cycle trial: gender characteristics (questionnaire)**

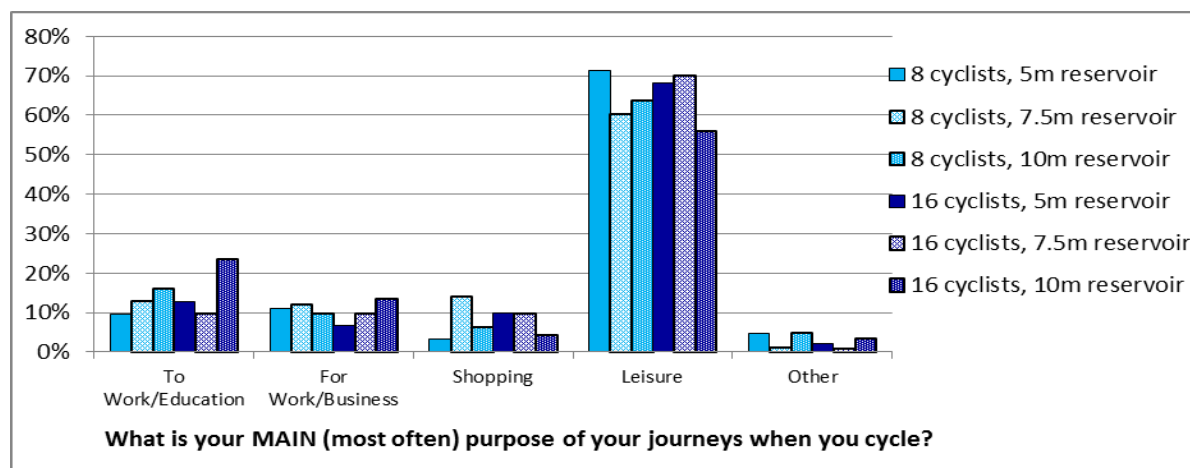
#### *D.1.1.3 Typical cycle journeys*

On average, 45% of cyclists usually cycled at least once a week (shown in Figure D-3). The level of experience across the six groups was relatively similar, although there were more 'not currently but regularly in the past' cyclists within the 5m reservoir with 8 cyclists group and there were less 'never cycled regularly' cyclists within the 7.5m reservoir with 8 cyclists group.



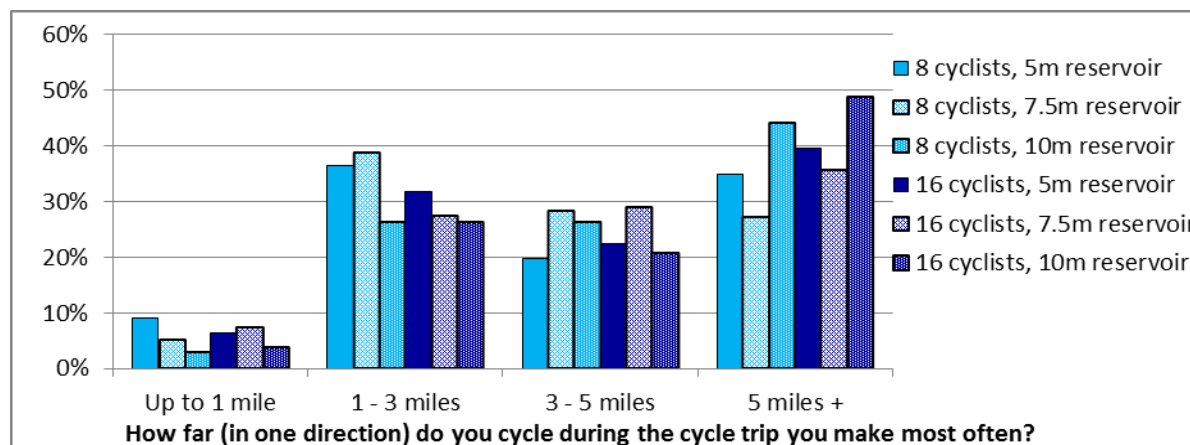
**Figure D-3 – Cycle trial: typical cycling frequency (questionnaire)**

For those cyclist participants who said they currently cycle, the large majority (65%) said that the main (most often) purpose of their cycle journeys was for leisure, which was the same in the previous trials; Figure D-4 shows this. The cycling journey purposes of the cyclists were broadly similar across the six groups.



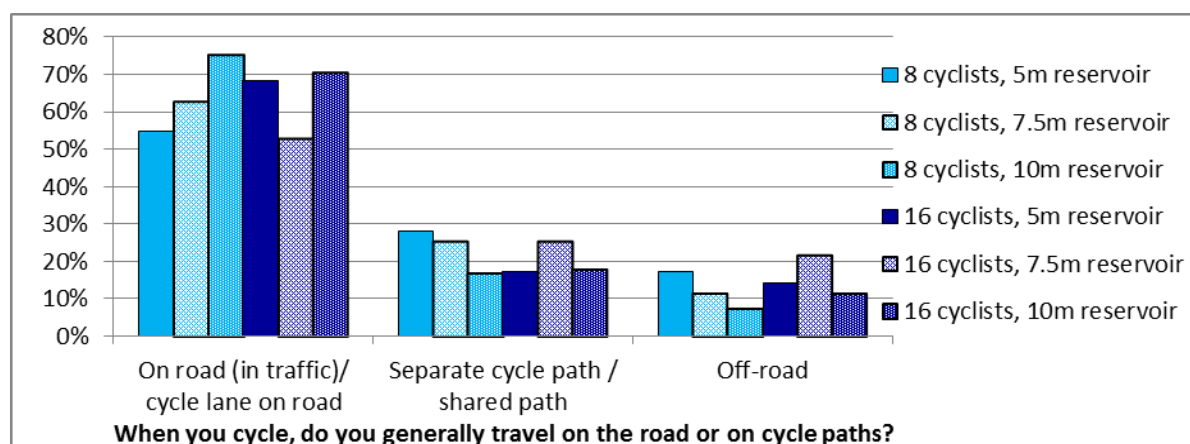
**Figure D-4 – Cycle trial: typical cycling journey purpose (questionnaire)**

For those cyclist participants who said they currently cycle, the majority (38%) said that the most frequent cycle journeys they make are five or more miles long. The cycle journey lengths of the cyclists were broadly similar across the six groups. Results are shown in Figure D-5.



**Figure D-5 – Cycle trial: typical cycling journey distances (questionnaire)**

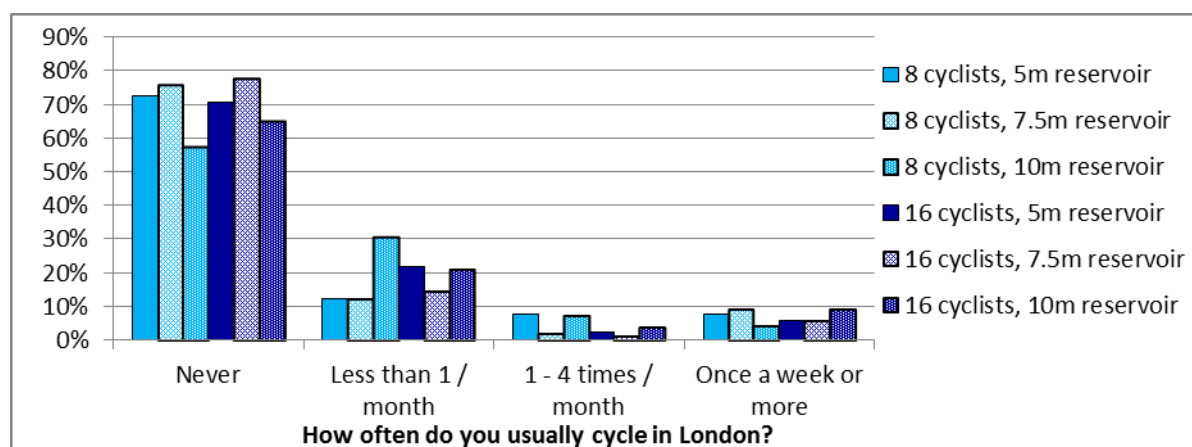
For those participant cyclists who said they currently cycle, 64% said that they usually cycle on roads (in traffic) / cycle lane on road, which was broadly similar to previous trials (see Figure D-6). The types of cycle routes used by cyclists were broadly similar across the six groups.



**Figure D-6 – Cycle trial: cycling on road, cycle paths, off road (questionnaire)**



The participant sample consisted largely of residents of the Wokingham/Bracknell area and as such only a small proportion (7% on average) of cyclists said that they cycle once a week or more in London, shown in Figure D-7. This was broadly similar across the six groups.

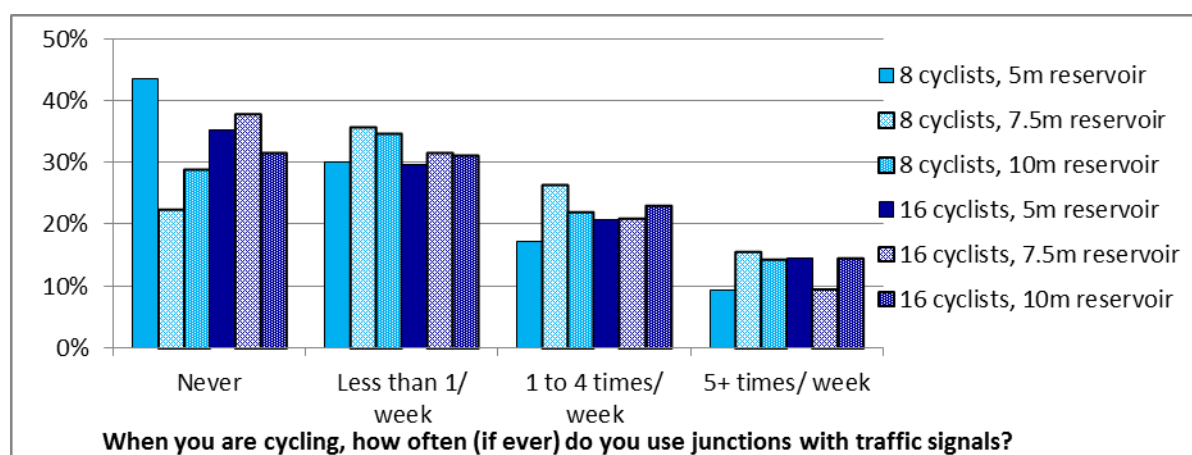


**Figure D-7 – Cycle trial: experience cycling in London (questionnaire)**

### ***D.1.2 Experience of traffic signal junctions***

#### ***D.1.2.1 Junctions with traffic signals***

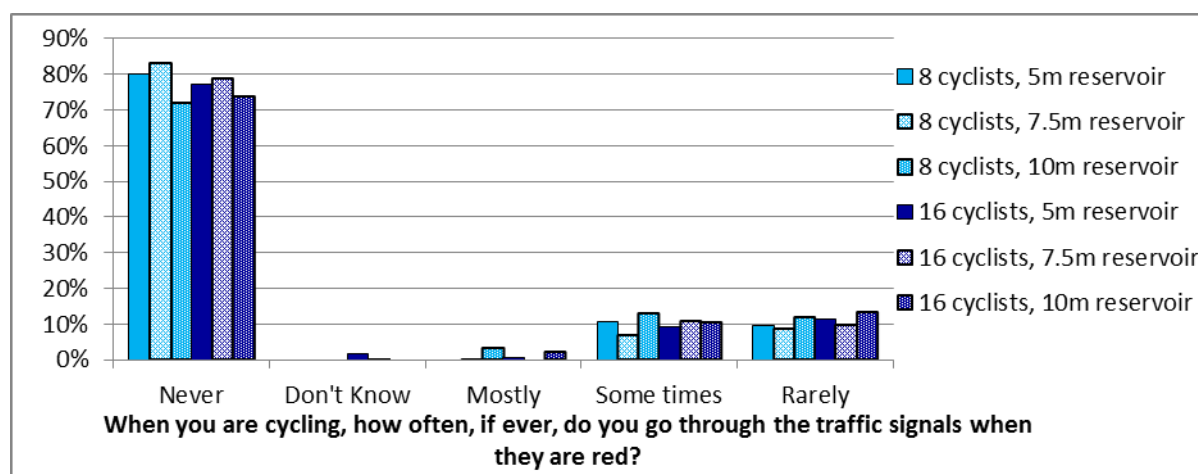
Cyclists were asked how often they use junctions with traffic signals when they are cycling. One third (33%) of cyclists said that they 'never' use junctions with traffic signals whilst cycling and one third (32%) said that they do so less than once per week. Results are shown in Figure D-8. There was a similar level of usage across most of the groups however there were more cyclists within the 5m reservoir with 8 cyclists group who said they 'never' did. This suggests that there was a higher proportion of inexperienced cyclists in the 5m reservoir 8 cyclists group.



**Figure D-8 – Cycle trial: experience of using junctions with traffic signals (questionnaire)**

The cyclists who said that they used junctions with traffic signals were asked how often, if ever, they go through traffic signals when they are red. The large majority (78%) said they 'never' do this (see Figure D-9). There was little noticeable difference between the six groups.



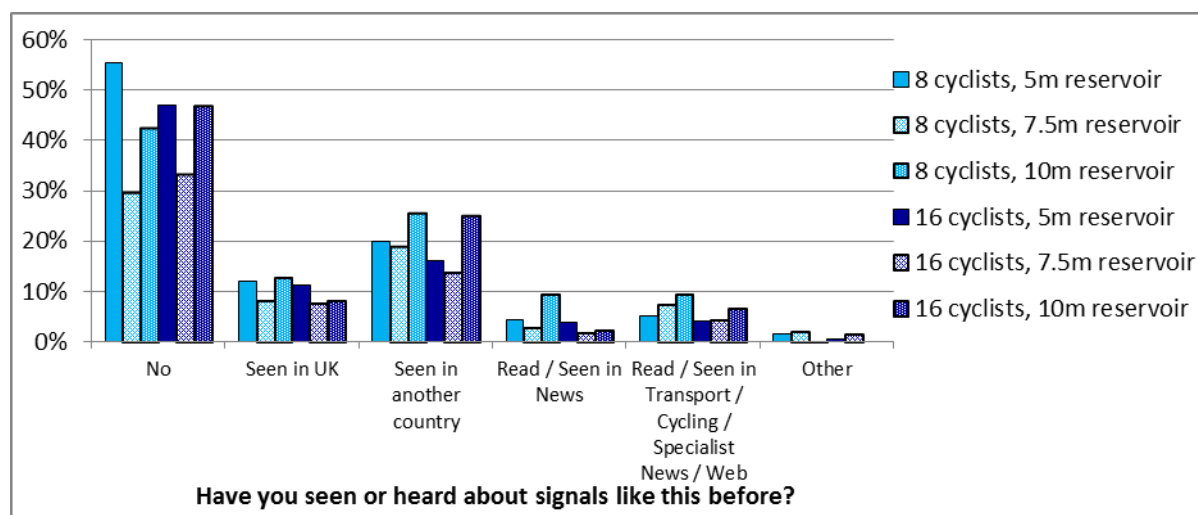


**Figure D-9 – Cycle trial: compliance with red signals (questionnaire)**

The cyclists who said that they used junctions with traffic signals and would go through a red traffic signal were asked under what circumstances they would go through a traffic signal showing red or red and amber. The most common reasons given for going through a red signal were 'when there was no traffic', 'when turning left', 'when the signals have not detected me', 'when can see the signals are about to change to green' and 'when it's not safe to stop'. The most common reasons for going through a red and amber signal were 'when there is no traffic', 'when turning left', 'when can see the signals are about to change to green' and 'when going straight on to get ahead of traffic'.

#### D.1.2.2 Low Level Cycle Signals

When asked whether they had "seen or heard about signals like this before", responses varied slightly across the six groups with more cyclists within the 5m reservoir with 8 cyclists group having not seen the LLCS before, see Figure D-10.

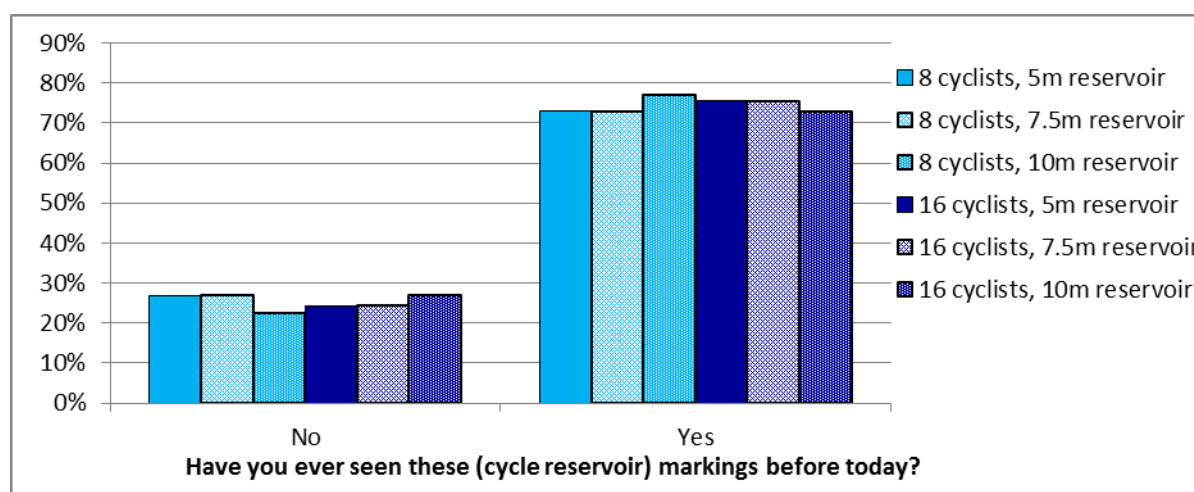


**Figure D-10 – Cycle trial: previous experience of LLCS (questionnaire)**

#### D.1.2.3 Cycle reservoirs

Figure D-11 shows the proportion of cyclists who had previously seen cycle reservoirs before. Similar to previous trials, between 20 and 30% of participants had not seen cycle

reservoirs before. This may be because the participant sample consisted largely of residents of the Wokingham/Bracknell area, where few junctions have ASLs.



**Figure D-11 – Cycle trial: previous experience of cycle reservoirs (questionnaire)**

**Experience of cycle reservoirs is also covered in Section 3.1.1 in the main report.**

## D.2 Experiences from the trial

### D.2.1 Cycle reservoirs

#### D.2.1.1 Noticing the cycle reservoir

In the M24 Trial, participants either experienced a 5m, a 7.5m or a 10m cycle reservoir before the junction. Participants were asked whether they noticed the cycle reservoir when they first approached it.

The large majority (over 90%) of cyclists across all six groups said that they noticed the cycle reservoir on their first approach.

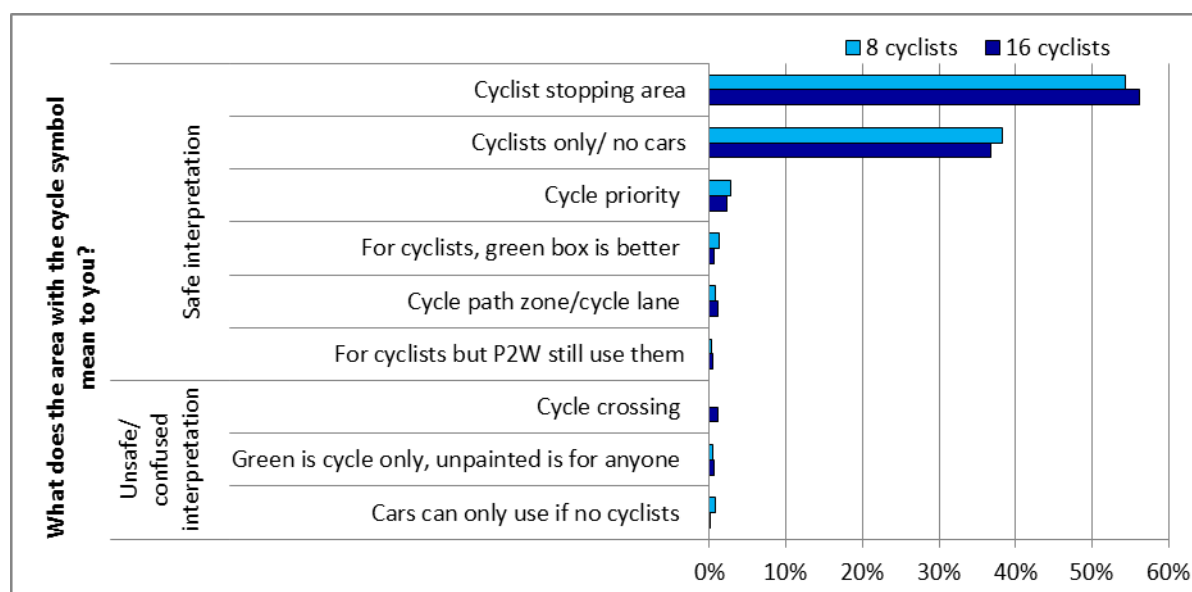
#### D.2.1.2 Understanding of the cycle reservoirs

About 55% of cyclists specifically mentioned that the cycle reservoir was for 'cycles only' and a large proportion of the those who did not specify it was for 'cycles only' suggested that the area was 'reserved' for cyclists. See Figure D-12.

Around 3% of cyclists suggested that the cycle reservoir gave cyclists priority, with two cyclists saying they had right of way:

*"Give way to cyclists. Cyclists' right of way." (10m reservoir, 16 cyclists)*

*"Cyclists can wait here for the lights and have right of way." (5m reservoir, 8 cyclists)*



**Figure D-12 – Cycle trial: understanding of cycle reservoirs (questionnaire)**

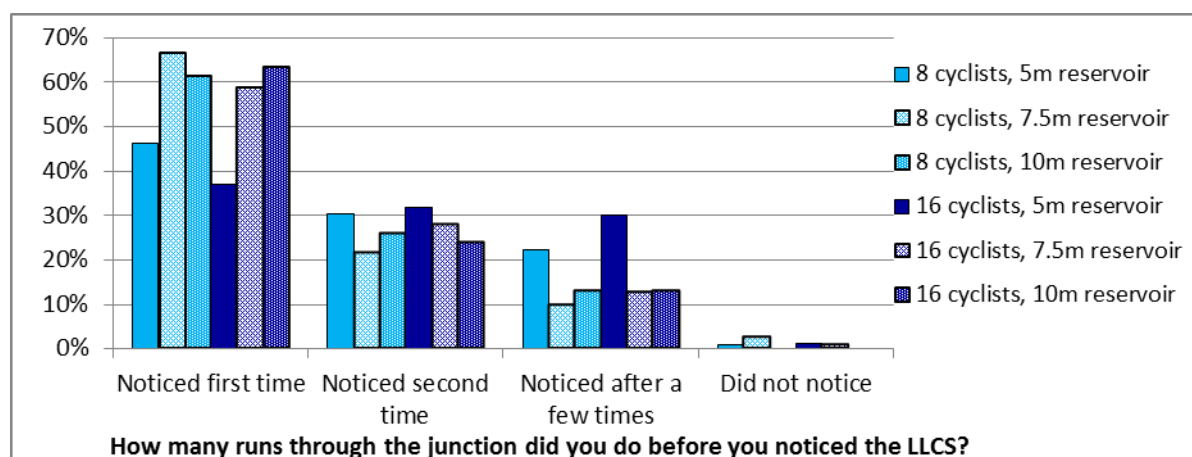
About 2% of participants had either an unsafe or confused interpretation of the purpose of the cycle reservoir. The most common of these were that the cycle reservoir represented a cycle path/lane or a cycle crossing.

**Understanding of cycle reservoirs is also covered in Section 3.1.1 in the main report.**

## D.2.2 Low Level Cycle Signals

### D.2.2.1 Noticing the Low Level Cycle Signals

Most participants noticed the LLCS on either their first or second pass through the junction, as shown in Figure D-13.

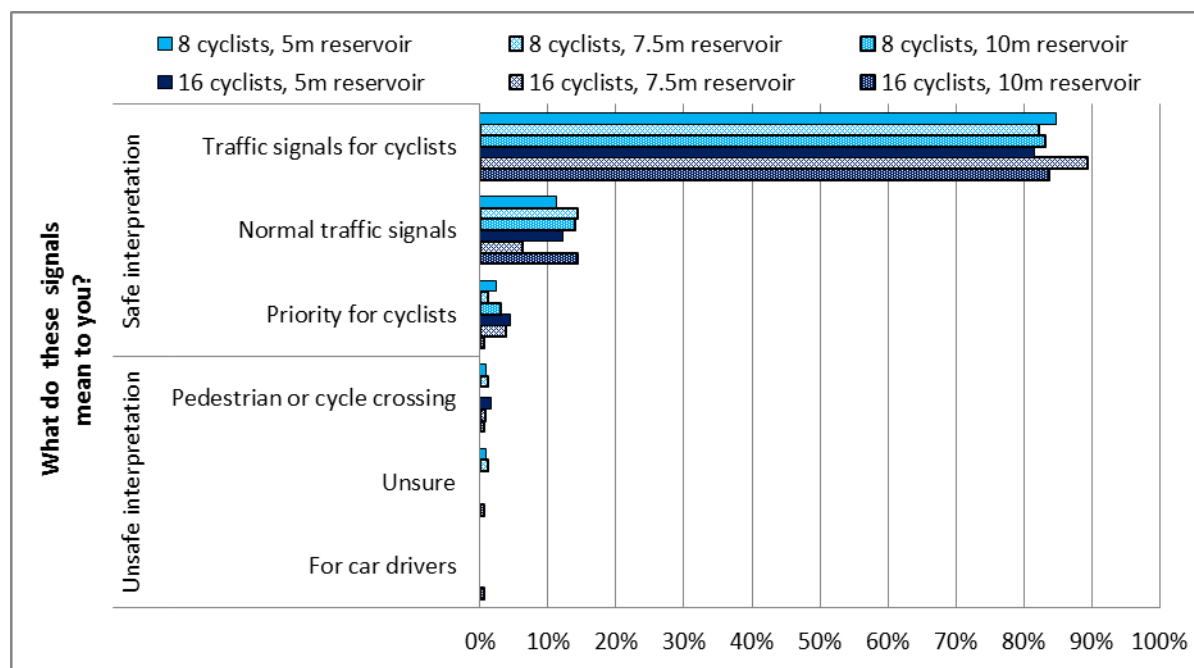


**Figure D-13 – Cycle trial: how many runs before cyclists noticed the LLCS (questionnaire)**

**Noticing the LLCS is also covered in Section 3.4.1 in the main report.**

### D.2.2.2 Understanding of the Low Level Cycle Signals

Cyclists were shown photos of LLCS and asked, "What do these signals mean to you?"; results are shown in Figure D-14.



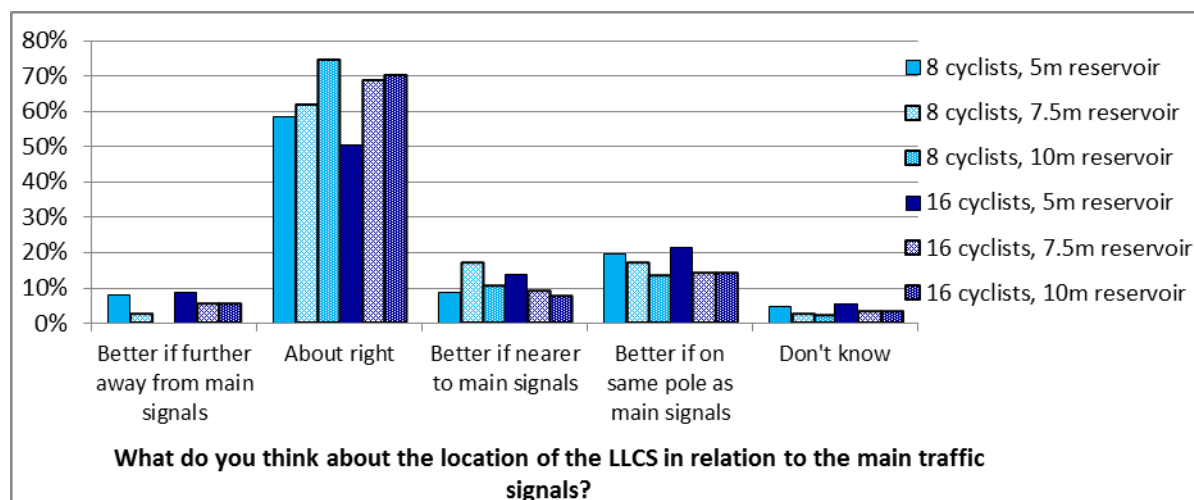
**Figure D-14 – Cycle trial: understanding of the LLCS (questionnaire)**

**Understanding of the LLCS is also covered in Section 3.1.2 in the main report.**

### D.2.3 Location of the LLCS and main signals

Participants were asked what they thought about the location of the LLCS in relation to the main signals; Figure D-15 shows the results.

When comparing the six groups, those using the 10m reservoir were more likely to say 'about right', while those using the 5m reservoir were more likely to say 'better if on the same pole'.



**Figure D-15 – Cycle trial: views on the location of the LLCS (questionnaire)**

Within the open-ended responses, various comments were made regarding the location of the LLCS. Some cyclists wanted the LLCS to be on the same pole so that cyclists are aware of what the main traffic is doing, and other cyclists wanted this so that car drivers are aware of what cyclists were doing. There were also a few responses which suggested that the location of the LLCS would be good for cyclists but perhaps not so good for car drivers who would not be aware of them. Some cyclists said that it would be less confusing if the LLCS were on the same pole as they would know where to look / only need to look in one place or because it is more normal / natural to look there for signals.

Some cyclists said they would like the LLCS to be nearer to the main signals, while others would like them to be further away. Generally the reasons given for this were: less confusion / easier to see / only having to look in one place / reassuring.

A number of cyclists said that it was difficult to see the LLCS when positioned at the junction to turn right. It was suggested by a few cyclists that it would help to either have the LLCS higher up or repeated on a traffic pole further ahead.

*"They are to the left. So when the ASL was full it was hard to see. Particular problem if turning right as then the angle/height could difficult." ('Better if on same pole as main signals', 7.5m reservoir, 8 cyclists)*

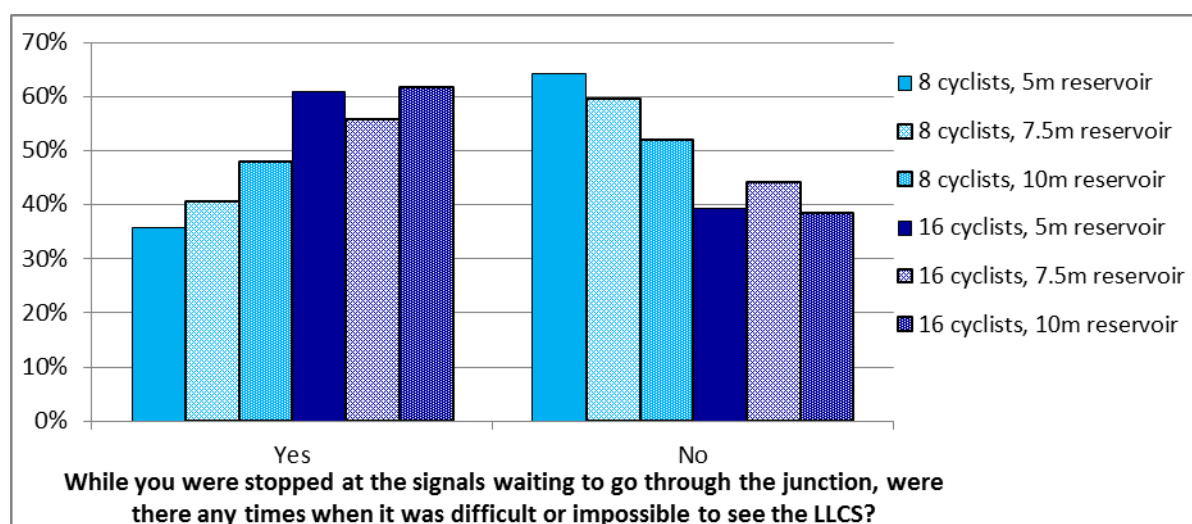
Some cyclists could not see the LLCS, because they were behind others in the group and therefore just relied on following others through the junction.

*"It was ok when following others but could not see them behind cyclists in front." ('Don't know', 5m reservoir, 16 cyclists)*

**Views on the location of the LLCS is also covered in Section 3.3.4 in the main report.**

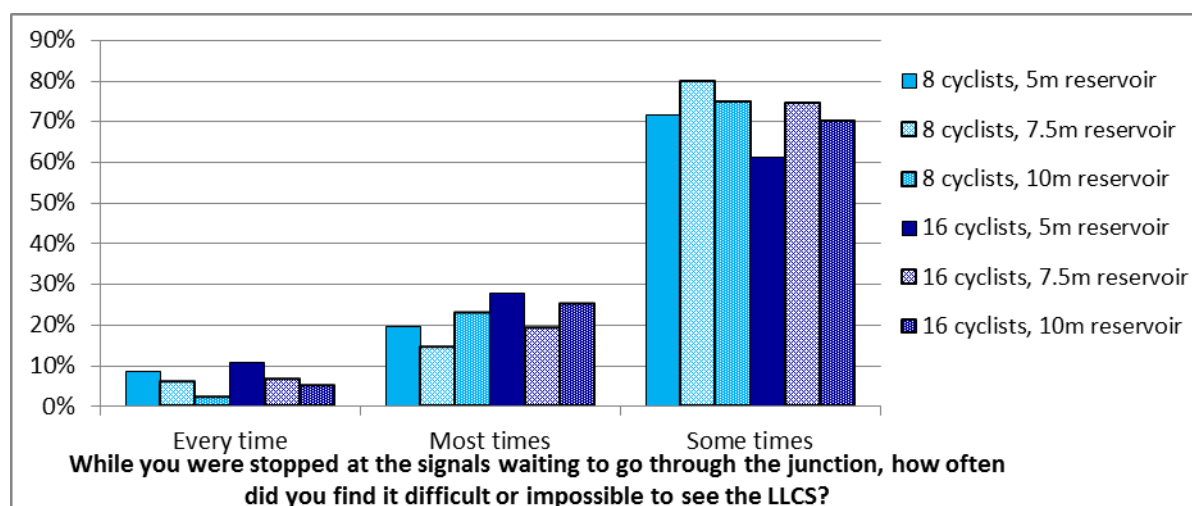
#### D.2.4 Difficulties seeing the LLCS

Participants were asked whether there were any times when it was difficult or impossible to see the LLCS whilst waiting at the junction and if so how often this happened, see Figure D-16 and Figure D-17 respectively.



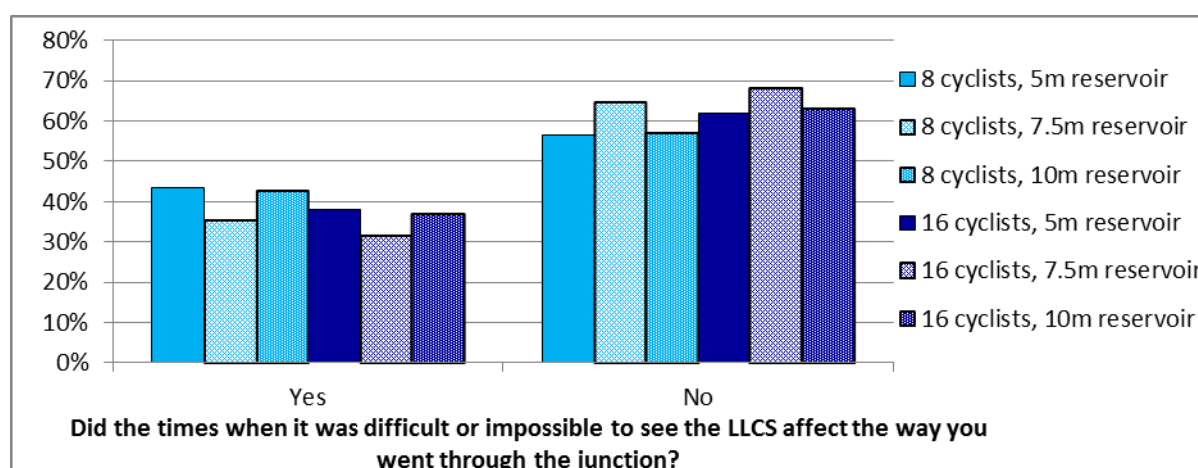
**Figure D-16 – Cycle trial: difficulties for cyclists in seeing the LLCS (questionnaire)**





**Figure D-17 – Cycle trial: of those who had difficulties seeing the LLCS, how often this happened (questionnaire)**

Participants were asked whether or not being able to see the LLCS affected how they went through the junction. As shown in Figure D-18, typically about 60% of cyclists said 'No, it did not affect how they went through the junction'.



**Figure D-18 – Cycle trial: did any difficulties in seeing the LLCS affect how cyclists went through the junction (questionnaire)**

Based on the open-ended responses, most participants who answered 'yes' said that not being able to see the LLCS meant they were 'delayed in setting off' or that it made them go through the junction 'more slowly':

*"This made me start off much slower." (5m reservoir, 16 cyclists)*

*"Watched main light opposite, so didn't benefit from the early release for cyclists." (10m reservoir, 16 cyclists)*

Some cyclists said that they used the main traffic lights when they could not see the LLCS, and this meant they would 'position themselves on the left' when turning right:

*"If turning right I stayed on the left because of the box being full & the car." (5m reservoir, 16 cyclists)*

Some cyclists said they looked around more, because they were more cautious when they could not see the LLCS.

*"Only if turning right-more of a need to watch if the main lights had changed."*

Other participants who could not see the LLCS would 'pay less attention', and just rely on following other cyclists.

*"Stop making a decision for yourself and just follow what everyone else does, including not noticing on-coming cars when turning right." (10m reservoir, 16 cyclists)*

*"Followed the herd." (5m reservoir, 16 cyclists)*

*"Followed the crowd, but checked the signals whilst going past." (7.5m reservoir, 16 cyclists)*

This meant that sometimes participants would follow the group and not use their own judgement, particularly when turning right.

*"Because I was following other cyclists, I tended to pay less attention to other traffic with the result that I failed to give way to traffic when I should have done." (7.5m reservoir, 16 cyclists)*

Two cyclists who could not see the LLCS were confused why they were going when the main lights were still red:

*"I was confused why they started cycling when the main lights were on red" (7.5m reservoir, 8 cyclists)*

Some participants were less confident / more hesitant when going through the junction. This could have been because they were relying on others in front when proceeding:

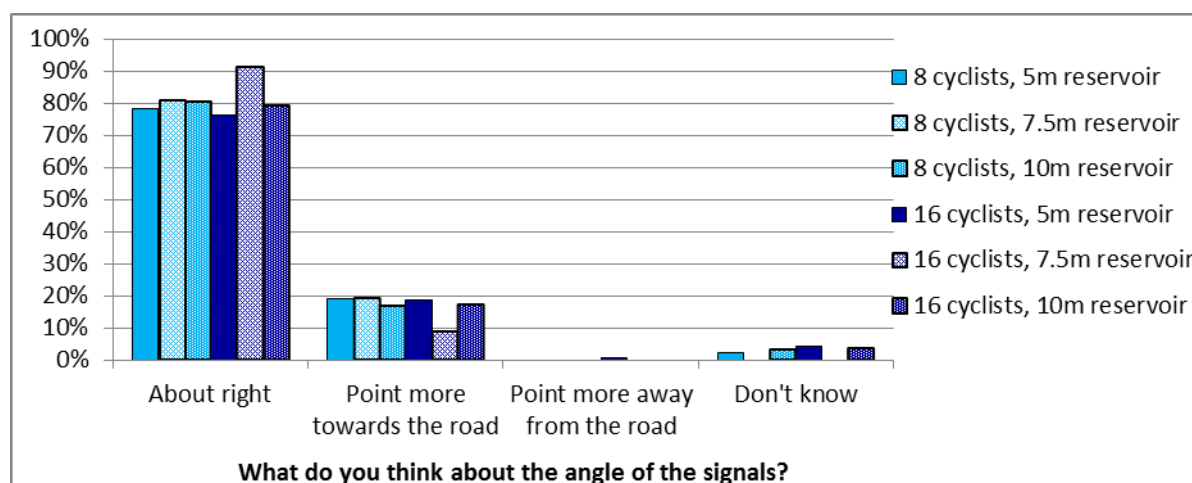
*"Anxious in case leaders jump lights." (10m reservoir, 8 cyclists)*

*"Bit unsure until I had seen lights for myself so went cautiously." (10m reservoir, 16 cyclists)*

**Difficulties seeing the LLCS is also covered in Section 3.4.2 in the main report.**

### D.2.5 Height and angle of the LLCS

Figure D-19 shows the responses from cyclists when asked about the angle of the LLCS.



**Figure D-19 – Cycle trial: views on the angle of the LLCS (questionnaire)**

**Height and angle of the LLCS is also covered in Section 3.3.3 in the main report.**

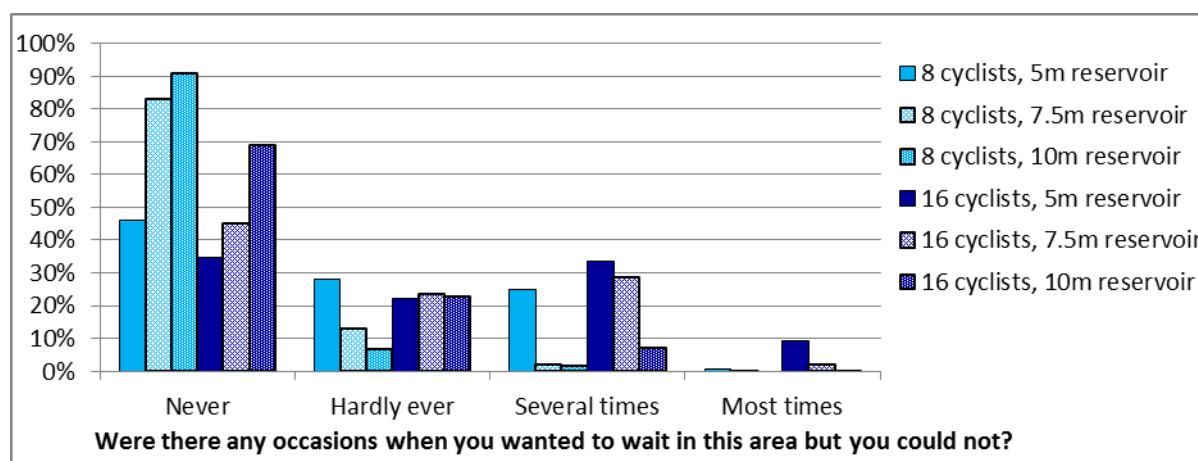


### D.2.6 Size of the cycle reservoir

**Size of the reservoir is covered in Section 3.2.1 in the main report.**

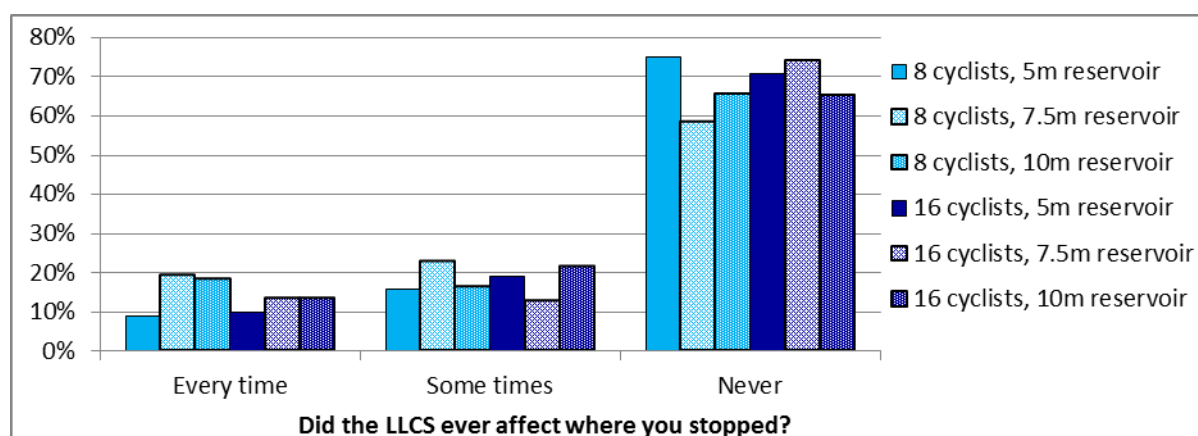
### D.2.7 Stopping position

Figure D-20 shows how often cyclists said they were not able to stop in the cycle reservoir.



**Figure D-20 – Cycle trial: how often cyclists were unable to stop in the cycle reservoir (questionnaire)**

Cyclists were asked whether the LLCS affected where they stopped, see Figure D-21. Pooled across all trials, about 70% of cyclists said that the LLCS 'never' affected where they stopped, which is similar to both the M14 and M19 Trials.



**Figure D-21 – Cycle trial: effect of LLCS on stopping position (questionnaire)**

Based on the responses given to the open-ended question, many participants who said 'Never' suggested that their decision on where to stop was determined by other factors, with many responses relating to the group size or the reservoir size.

Some participants said that the volume of cyclists would affect where in the cycle reservoir they stopped rather than the LLCS.

*"The low level signals didn't affect where I stopped so much as the volume of cyclists at the junction." ('Never', 7.5m reservoir, 16 cyclists)*

Some participants said that it was their own position within the group which determined where in the cycle reservoir they stopped rather than the LLCS.

*"I was able to see them whenever in the box but I did sit towards the front of the group most of the time."* ('Never', 7.5m reservoir, 8 cyclists)

*"As I was mainly at the back, you seem to miss them."* ('Never', 5m reservoir, 16 cyclists)

Some participants suggested that the size of the cycle reservoir determined where in the cycle reservoir they stopped rather than the LLCS.

*"Had to stop outside the box as I was at the back of the group."* ('Never', 5m reservoir, 16 cyclists)

*"No, too many bikes could not get in"* ('Never', 5m reservoir, 16 cyclists)

*"I was always aiming to stop in the area. I was less bothered about seeing the lights as I was in a group."* ('Never', 10m reservoir, 16 cyclists)

Of those who said 'Every time' or 'Sometimes', some participants said that others in the group obscured their vision of the LLCS, which would affect where in the cycle reservoir they stopped.

*"As my view was blocked, I moved so that I could see the signal."* ('Sometimes', 5m reservoir, 16 cyclists)

Three cyclists commented that the LLCS prompted them to stop in the cycle reservoir rather than wait at the vehicle stop line using the main signals.

*"Without the low level signals I would have expected to stop at the main lights."*

One cyclist commented:

*"Initially I was drawn to stop closer to them so I could see them but then as the routes were repeated, I knew when and what to expect, so started moving away."*

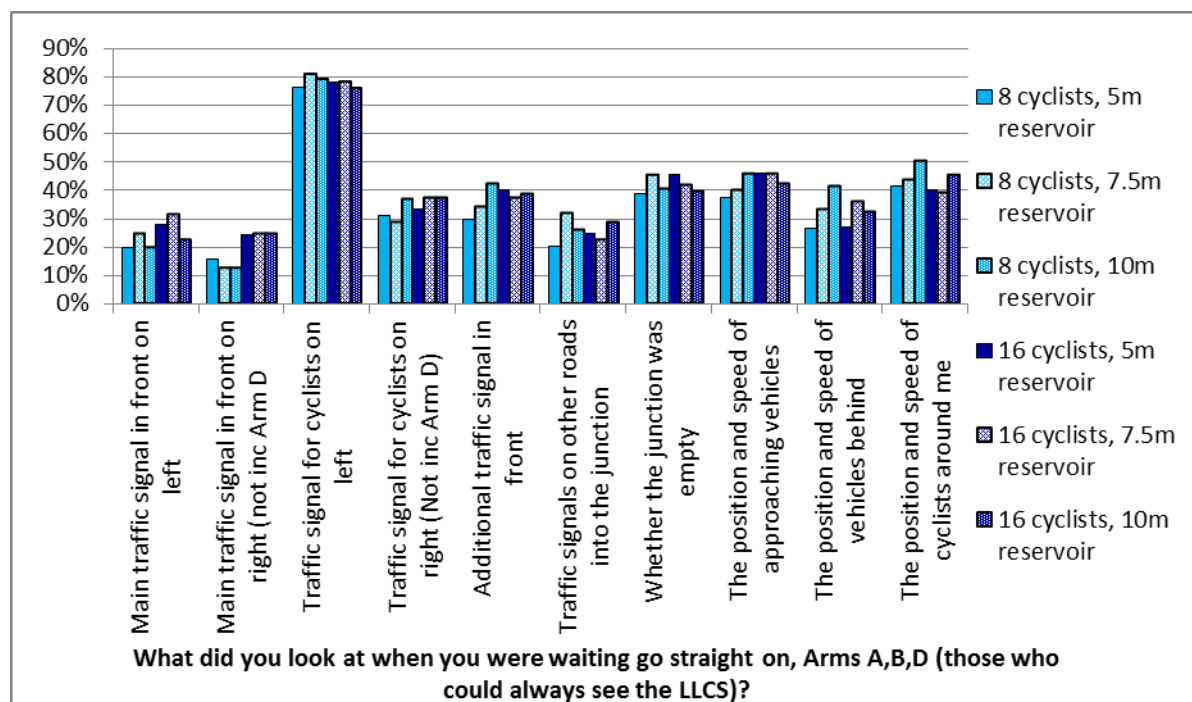
**The stopping position of cyclists is covered in greater detail in Section 3.6 in the main report.**

#### **D.2.8 What participants said they looked at**

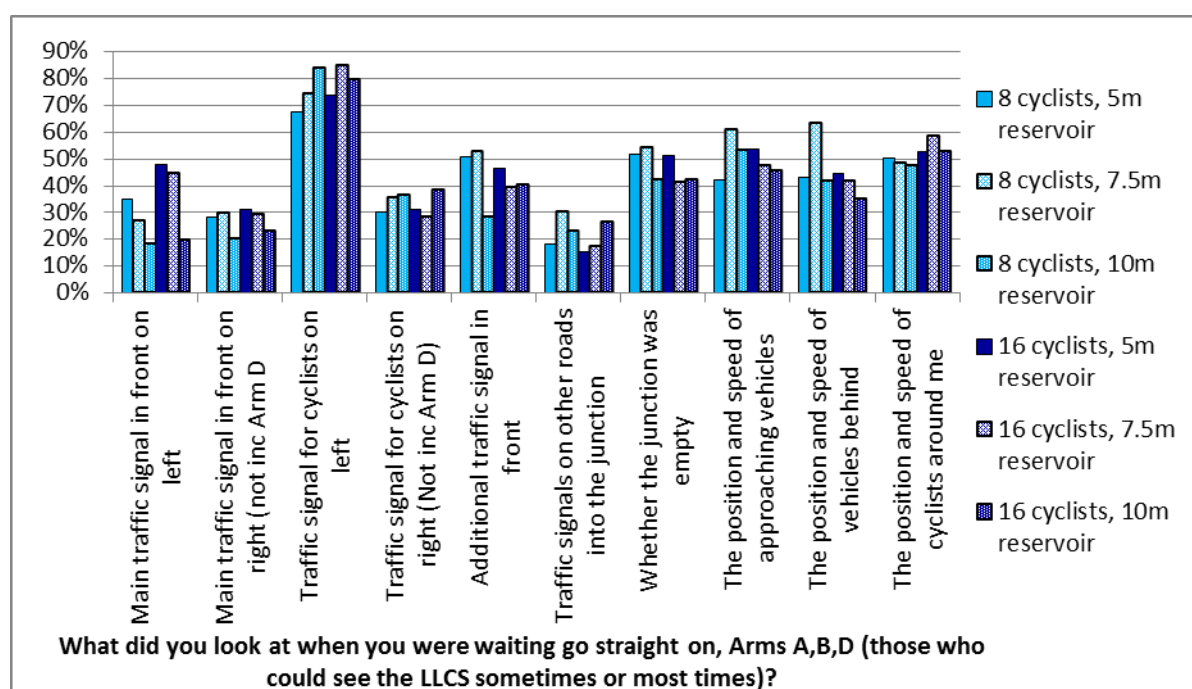
At Arm A, B and D some cyclists were asked what they looked at when they were approaching the junction and when they were setting off to go straight on. On Arm D they were also asked what they looked at when turning right. Cyclists were also asked for each junction if they were ever unable to see the signals, those that could always see the signals have been compared to those that could see the signals most times or sometimes. There were only few participants who could never see the signals, as such these have been filtered out here.

Results have been combined for all straight on movements and split by those who could always see the LLCS (Figure D-22) and those who could see the LLCS either sometimes or most times (Figure D-23). Similarly results are presented for right-turners from Arm D in Figure D-24 and Figure D-25, respectively.

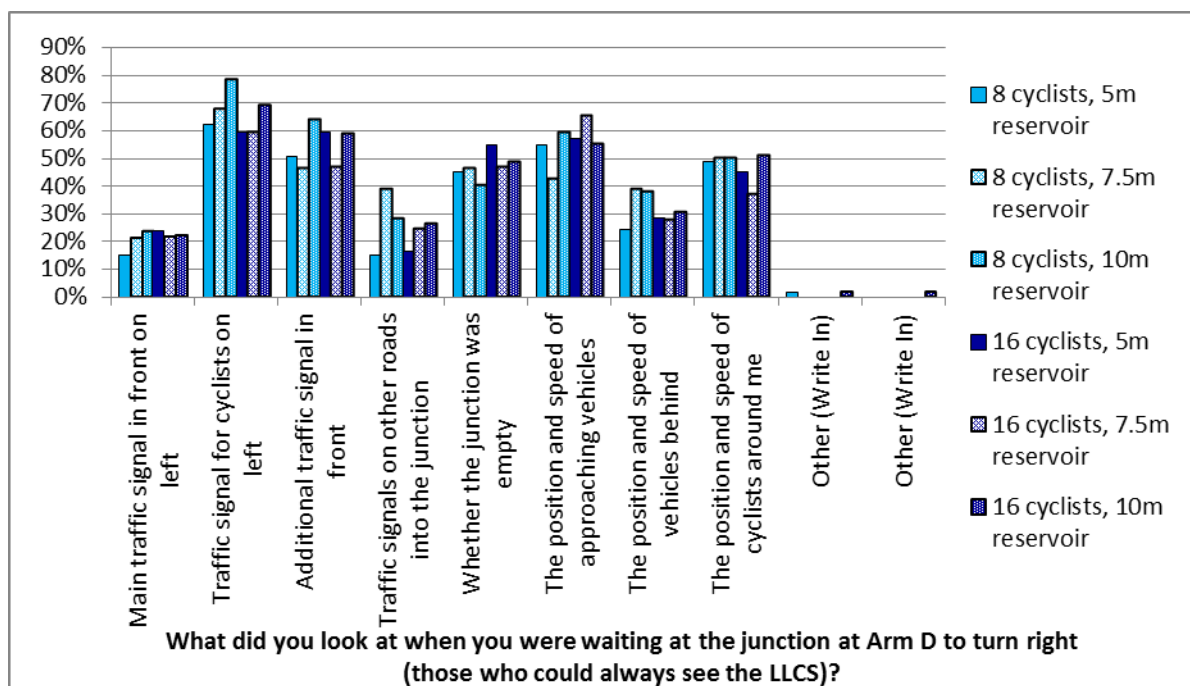
As may be expected, those who could see the LLCS either 'sometimes' or 'most times' typically used other visual cues more than those who could see the LLCS 'always'.



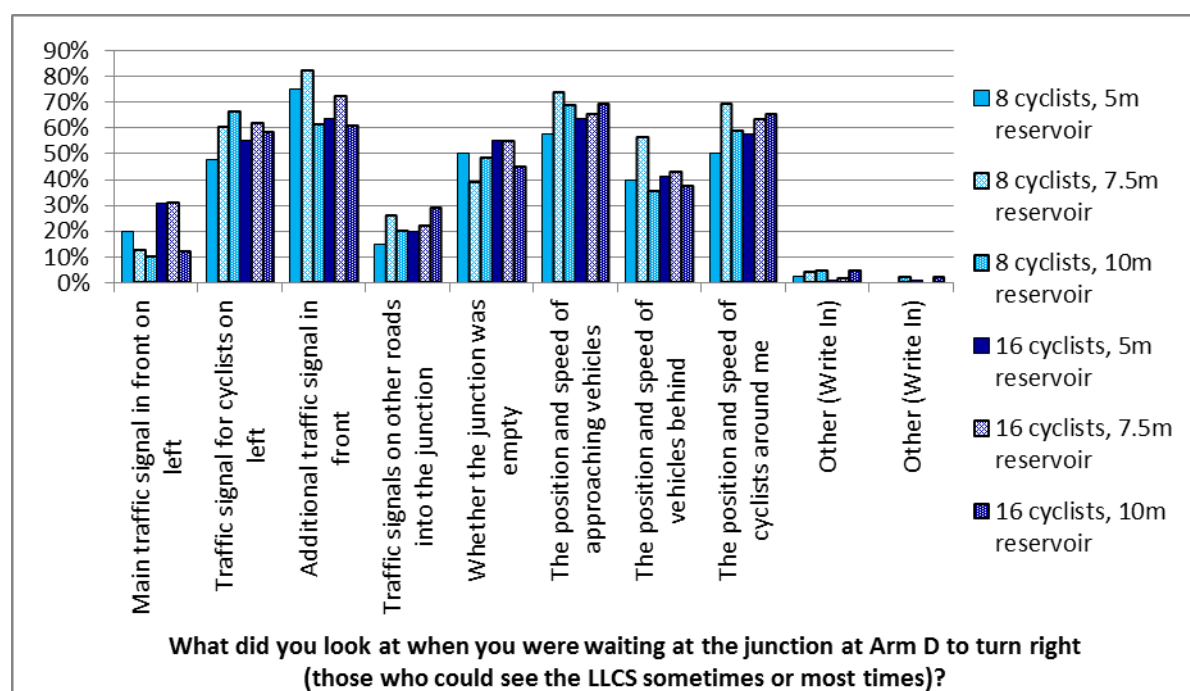
**Figure D-22 – Cycle trial: what cyclists looked at when going straight on, of those who could always see the LLCS (questionnaire)**



**Figure D-23 – Cycle trial: what cyclists looked at when going straight on, of those who could see the LLCS most times or sometimes (questionnaire)**

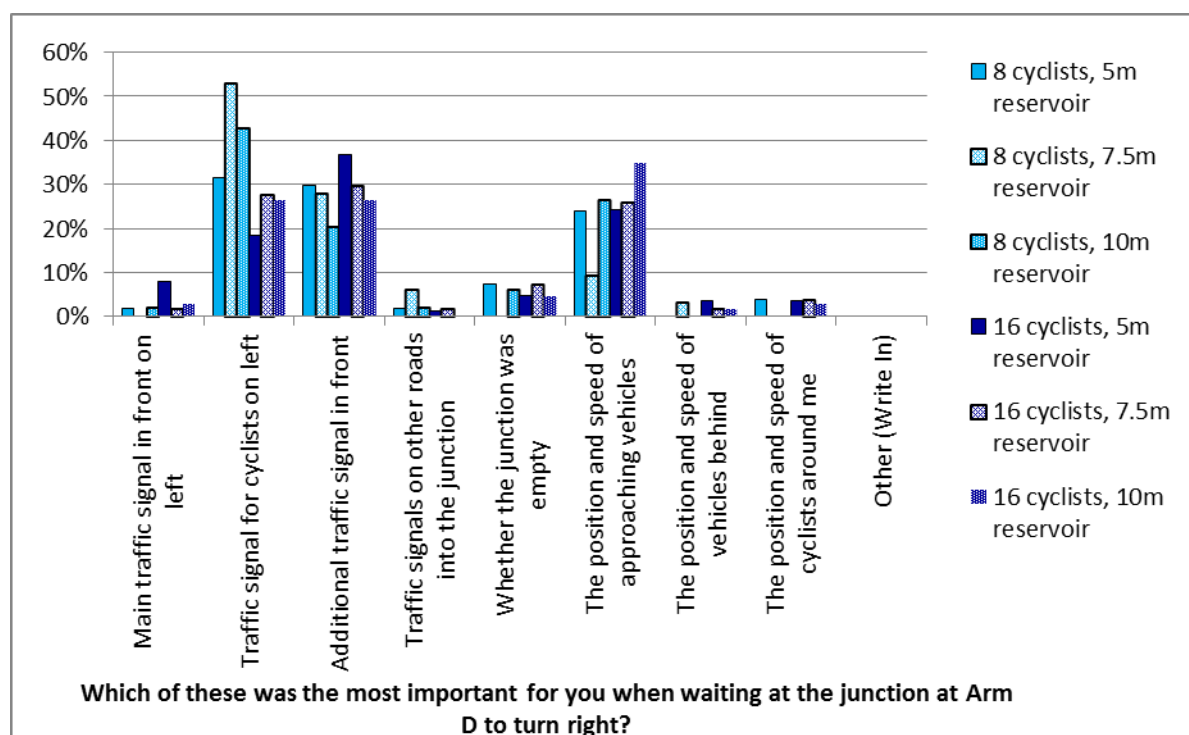


**Figure D-24 – Cycle trial: what cyclists looked at when turning right, of those who could always see the LLCS (questionnaire)**



**Figure D-25 – Cycle trial: what cyclists looked at when turning right, of those who could see the LLCS most times or sometimes (questionnaire)**

Cyclists were also asked of all the visual cues they looked at, which one was the most important to them; Figure D-26 shows this for the cyclists when waiting to turn right at Arm D.



**Figure D-26 – Cycle trial: which cues were most important when turning right at Arm D (questionnaire)**

**What they looked at is also covered in Sections 3.4.3 and 3.4.4 in the main report.**

### ***D.2.9 Right turn in front of oncoming car***

Cyclists were asked whether they considered turning in front of the car approaching from the opposite direction when turning right, and were asked to pick one of four responses. Table D-2 shows the frequency of responses split across the various group sizes and reservoir depths.

**Table D-2 – Cycle trial: cyclists considering and turning in front of the car, by group size and depth of cycle reservoir (questionnaire)**

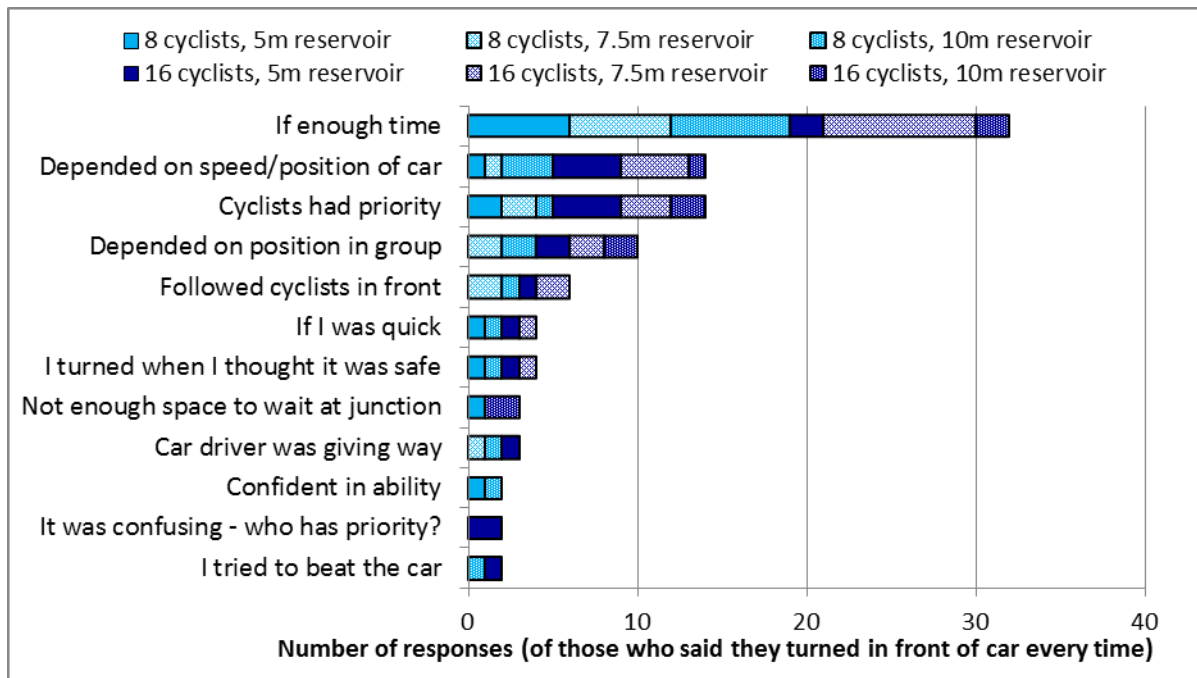
Group size	Cycle reservoir depths	"Turned in front of the car every time"	"Turned in front of the car sometimes"	"Considered, but did not turn in front of car"	"Did not consider turning in front of car"	Sample size
8 cyclists	5m	16	56	21	31	124
	7.5m	12	46	12	12	82
	10m	14	77	7	3	101
16 cyclists	5m	17	67	36	60	180
	7.5m	26	65	17	28	136
	10m	9	118	27	39	193

Cyclists were then asked to explain their answer; these open-ended responses were classified and are discussed below in turn for each of the four responses.

Cyclists were also asked a multiple choice question on factors that affected their decision; this is analysed in Section 3.8.3.1 of the main report.

### D.2.9.1 Turned in front of car every time

Figure D-27 shows the classified responses to the open-ended question for those who said they turned right in front of the car every time.



**Figure D-27 – Cycle trial: explanations of their decision, for cyclists who said they turned right in front of the car every time (questionnaire)**

The main responses given by cyclists who turned ahead of the car every time was that they felt they had enough time or space, or that there was enough of a delay or gap between them and the oncoming car. These cyclists used the additional priority consciously, i.e. when they saw that they had more time, they made a judgement that they could turn across the path of the car safely. Some participants suggested that they would turn ahead of the car specifically because they had extra time from an early release.

*"Advance warning green light (cycle) gave me enough time."*

*"There seemed to be enough time to go first."*

*"I felt as I had a few seconds gap I was able to turn in front of car."*

*"Had plenty of time to turn before car, because the group was small."*

A number of participants believed that the green light on the LLCS suggests / implies that cyclists have priority, which is a potential safety concern:

*"You assume the green cycle light gives you right of way."*

*"Since we had green light assumed it was safe to go and that car was on red."*

*"Signal (cyclist) seemed to give priority to cyclists."*

*"Cycle signals lull you into thinking the on-coming car will stop-but then you remember it won't"*

*"The green cyclist filter led me to believe it was safe to turn right."*

The other common responses included:



- *Depended on position in group* – with those nearer the front of the group more likely to turn as they had more time to do so.
- *Followed cyclists in front* – this is a potential safety concern with some cyclists not using their own judgement and instead just followed other cyclists ahead.

*"Followed other cyclists and assumed OK to proceed."*

*"I realise I should have waited but I guess I was a bit of a sheep following the others in front."*

*"There was a group mentality to stay together."*

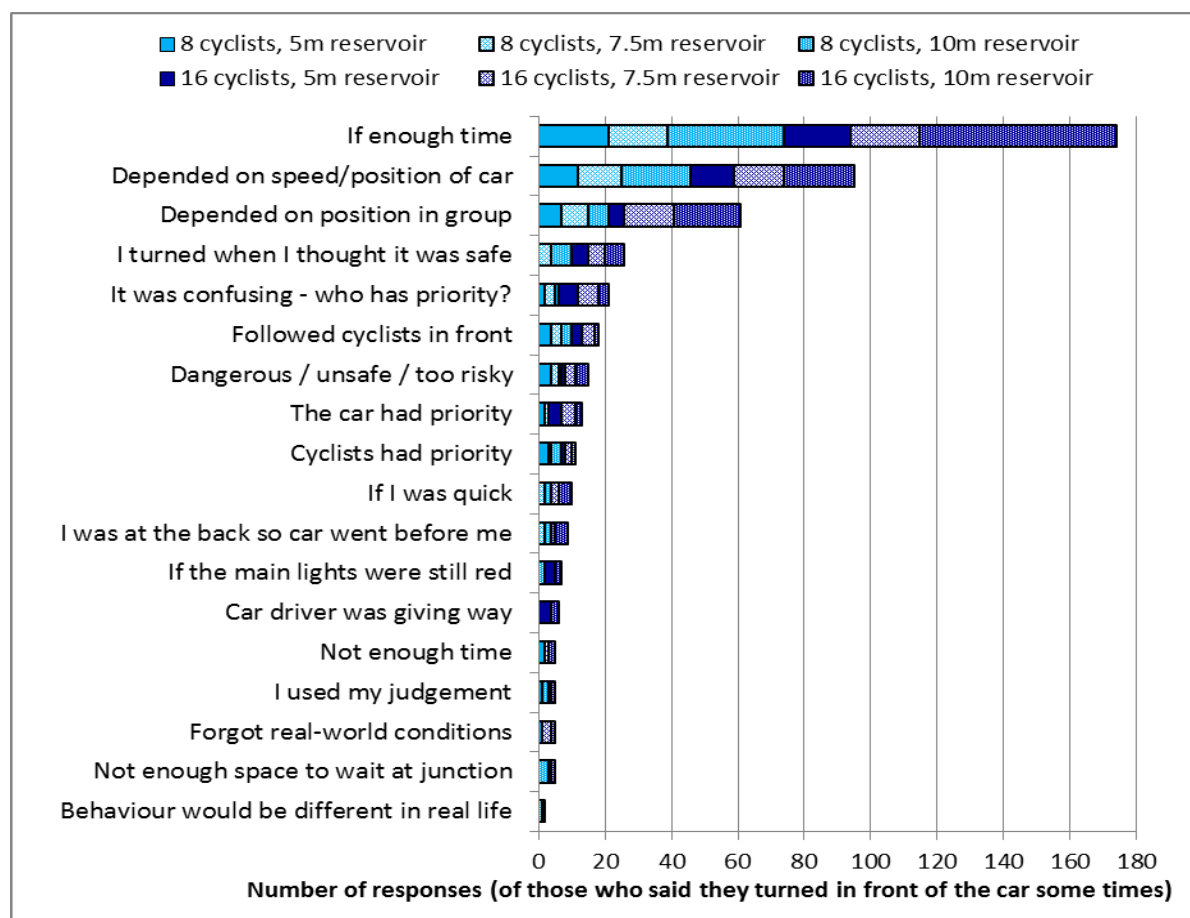
Some provided the response *"Not enough space at junction to wait safely / feel vulnerable there"*, which suggested that some participants felt inclined to turn ahead of the traffic, because they didn't want to stop in the middle of the junction between two streams of traffic.

*"Like to go ahead of the car if possible-feel very vulnerable if stuck in the middle with cars passing both sides."*

*"Otherwise with lots of cars I would get stranded between 2 streams of traffic."*

#### D.2.9.2 Turned in front of car sometimes

Figure D-28 shows the classified responses to the open-ended question for those who said they turned right in front of the car sometimes.



**Figure D-28 – Cycle trial: explanations of their decision, for cyclists who said they turned right in front of the car sometimes (questionnaire)**



The main response given by cyclists who said they turned ahead of the car sometimes was that they felt they had enough time or space, or that there was enough of a delay or gap between them and the oncoming car. In general, many participants seemed to be very aware of both the LLCS and when the main traffic signals turned to green and used this to judge if they had enough time to cross ahead of the car.

The other common responses to this question included:

- *Depended on speed / position of car* – as before, with the decision based on how quickly the car was moving and how far away it was.
- *Depended on position in group* – as before, with those nearer the front of the group more likely to turn as they had more time to do so.

*"If I was one of the first cyclists then I had time. If I was to the back of the group, I crossed in front of the car a couple of times when I should've stopped."*

- *I turned when I thought it was safe* – participants making a judgement call.
- *It was confusing – who has priority?* – as discussed previously, this confusion over who has priority at a right-turn junction is a potential safety concern

*"This was confusing as I assumed the bike light meant I could go first like a filter but there wasn't enough time before the car went. Had to stop suddenly."*

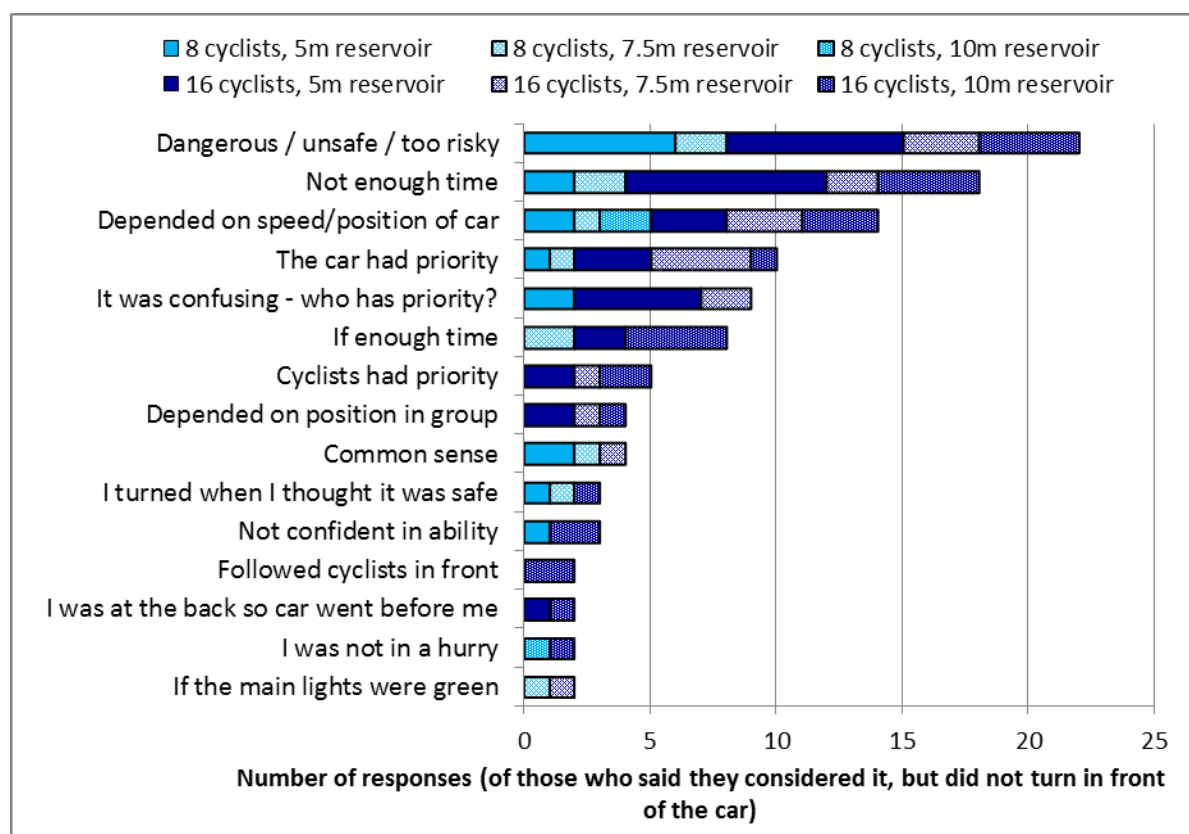
*"This was confusing because the cycle signal said it was safe to turn right and yet, I noticed that a car was approaching. Reality - I would have stopped for the car."*

- *Cyclists had priority* – as discussed previously, this seemed to be a fairly common misconception and a potential safety concern.
- *Followed cyclists in front* – as discussed previously, this is a potential safety concern as some participants did not use their own judgement to turn and would just follow cyclists ahead of them.

With regards to trial realism, a minority (3) of participants stated that they turned in front of the car sometimes and implied that they did not take it seriously. One said *"it was a bit of a game to beat the cars"* and two admitted to playing 'chicken' with the car.

#### *D.2.9.3 Considered but did not turn in front of car*

Figure D-29 shows the classified responses to the open-ended question for those who said they considered but did not turn in front of car.



**Figure D-29 – Cycle trial: explanations of their decision, for cyclists who said they considered but did not turn in front of car (questionnaire)**

The main response given by cyclists who said they considered but did not turn ahead of the car was that they felt it was too dangerous, unsafe or risky.

*"Too risky, car had a green light too."*

*"Too risky, did not want to take the chance."*

*"Didn't want to get run over."*

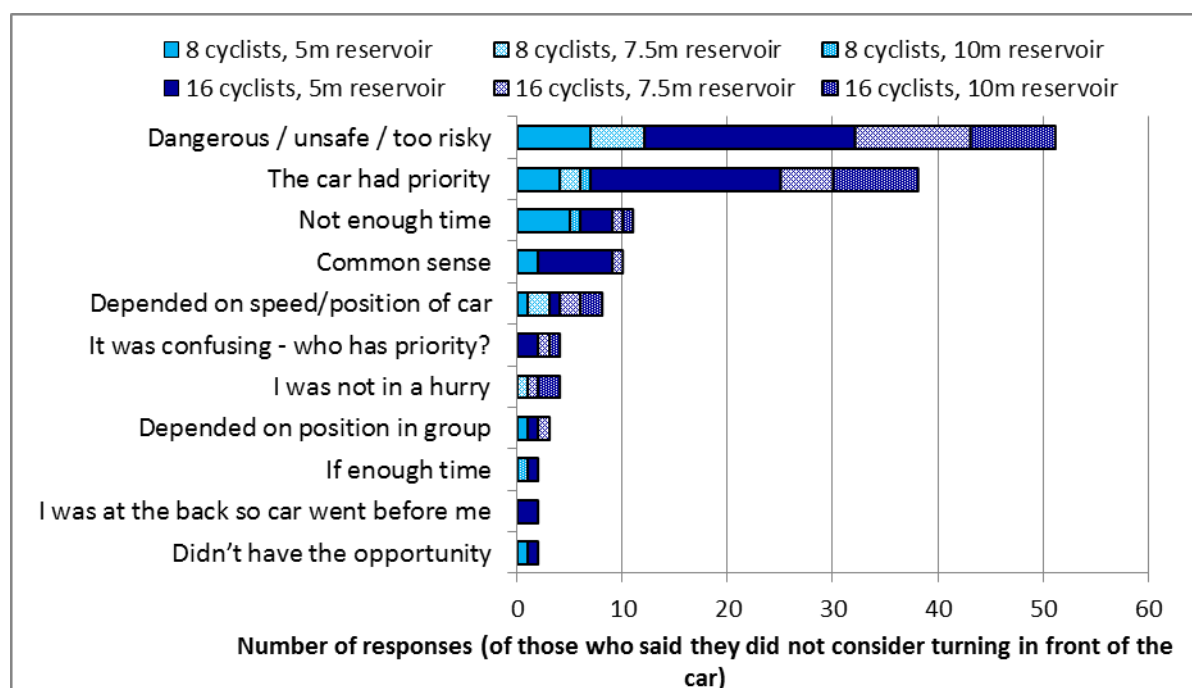
*"Dangerous to wait in middle of road with cars/traffic either side, but not as dangerous as turning into the path of an oncoming vehicle."*

The other common responses given in response to this question included:

- *Not enough time / Depended on speed and position of car* – Some participants said that they did not have enough time to get through the junction, whereas others suggested it was dependent on how quickly the car was moving and how far away it was.
- *The car had priority* – understanding the priority rules.
- *If was confusing – who had priority?* – as discussed previously, some participants were confused over the priority rules at the right turn.

#### D.2.9.4 Did not consider turning in front of car

Figure D-30 shows the classified responses to the open-ended question for those who said they did not consider turning in front of car.



**Figure D-30 – Cycle trial: explanations of their decision, for cyclists who said they did not consider turning in front of car (questionnaire)**

The main response given by cyclists who did not consider turning ahead of the car was that they felt it was too dangerous, unsafe or risky.

*"Wouldn't feel safe turning right. A few people did and it looked dangerous."*

*"It felt very unsafe as I did not know if I could turn before the car or not."*

*"I felt it was not safe to turn right in front of oncoming traffic."*

*"Bit dangerous to turn in front of cars and not sure if bikes had right of way so stayed put until car went."*

Another common response was that they understood that the car 'had priority'.

Other responses given in response to this question included:

- *Not enough time*
- *Common sense* – a similar response to both the 'dangerous/unsafe' and 'car had priority' categories
- *Depended on speed / position of car* – a fairly even split from across the various groups suggested it was dependent on how quickly the car was moving and how far away it was.
- *If was confusing – who had priority?* – as discussed previously, some participants were confused over the priority rules at the right turn:

*"This is actually where advance cycle time is dangerous, several in group either crossed in front of car (thinking they had right of way) or tried to race the car & beat it."*

**Right turn in front of oncoming car is also covered in Section 3.8.3 in the main report.**

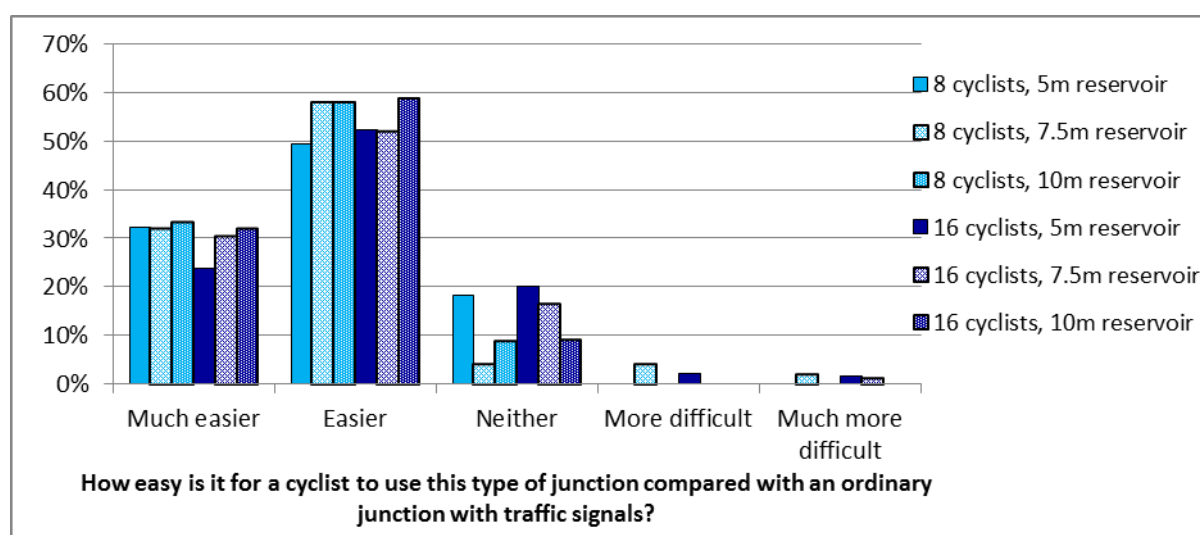
## D.3 Attitudes

### D.3.1 Comparisons with an 'ordinary' junction

Participants were asked questions around how the trial junction compared with an 'ordinary' signal junction, regarding ease of use, safety and whether they would be more likely to cycle if more junctions were like this. The participant sample consisted largely of residents of the Wokingham/Bracknell area, where only few junctions have ASLs. As such, many participants were not familiar with ASLs and interpreted an 'ordinary' signal junction to be one without an ASL.

#### D.3.1.1 Ease of use compared with an ordinary junction

Figure D-31 shows how easy cyclists felt it was to use the trial junction compared with an ordinary junction with traffic signals.



**Figure D-31 – Cycle trial: how easy it was to use the junction compared with an ordinary junction (questionnaire)**

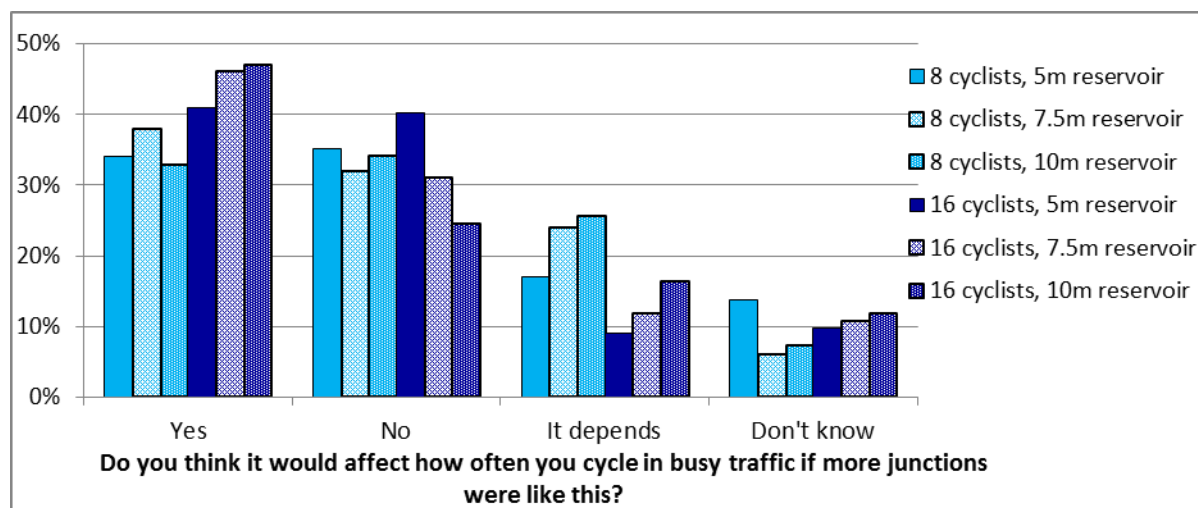
**Ease of use compared with an ordinary junction is also covered in Section 3.9.2 in the main report.**

#### D.3.1.2 Perceived safety

**Perceived safety is covered in Section 3.9.3 in the main report.**

#### D.3.1.3 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, see Figure D-32.



**Figure D-32 – Cycle trial: whether cyclists would be more likely to cycle on busy roads if more junctions were like this (questionnaire)**

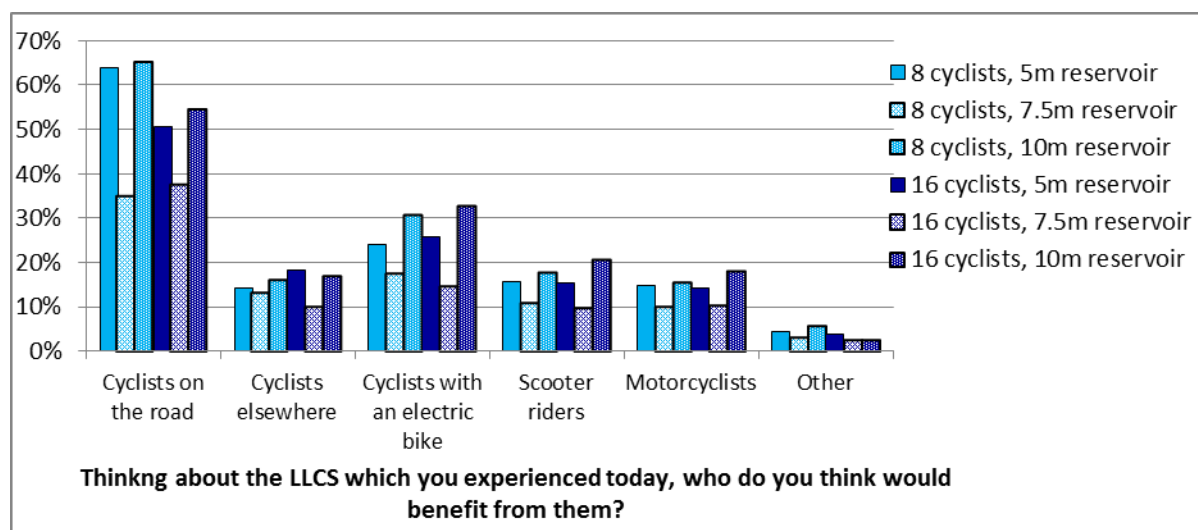
When asked to explain their answers, about 15% of cyclists said that the junction would make them feel safer or more protected and 7% said they felt more confident using this type of junction. Comments referred to both the LLCS and the cycle reservoirs.

*"Knowing there is certain lights for cyclists would make me feel safer to know people around i.e. cars could see when cyclists are going." (10m cycle reservoir, 8 cyclists)*

Participants who said 'It depends' typically said that it would depend on the amount of traffic or the provision of segregated cycle lanes.

### D.3.2 Perceived benefits of LLCS

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, see Figure D-33.



**Figure D-33 – Cycle trial: proportion of cyclists who thought different road users would benefit from the LLCS (questionnaire)**

Comments from cyclists relating to the perceived benefits of the LLCS include:

*"Much more visible than conventional signals at a more convenient height" (7.5m reservoir, 8 cyclists)*

*"Cars would benefit from the delayed start and get the cyclists out of their way before proceeding." (10m reservoir, 16 cyclists)*

*"It's useful to everyone so they can all see cyclists' movements." (5m reservoir, 8 cyclists)*

*"Perhaps cyclists would obey the lights better." (5m reservoir, 16 cyclists)*

*"This made cyclists more visible to other road users..." (5m reservoir, 16 cyclists)*

*"The advanced stop line and low level signals give cyclists confidence to enter junction without fear of oncoming motor vehicles" (7.5m reservoir, 16 cyclists)*

**Perceived benefits of LLCS is also covered in Section 3.3.1 in the main report.**

### **D.3.3 Perceived benefits of cycle reservoirs**

The following benefits of cycle reservoirs were cited by participants:

*"Roads designed better for cyclists with these junctions - they make you feel safer, gives you more space away from vehicles" (5m reservoir, 16 cyclists)*

*"Much easier to see lights and gave a protected clear area." (5m reservoir, 16 cyclists).*

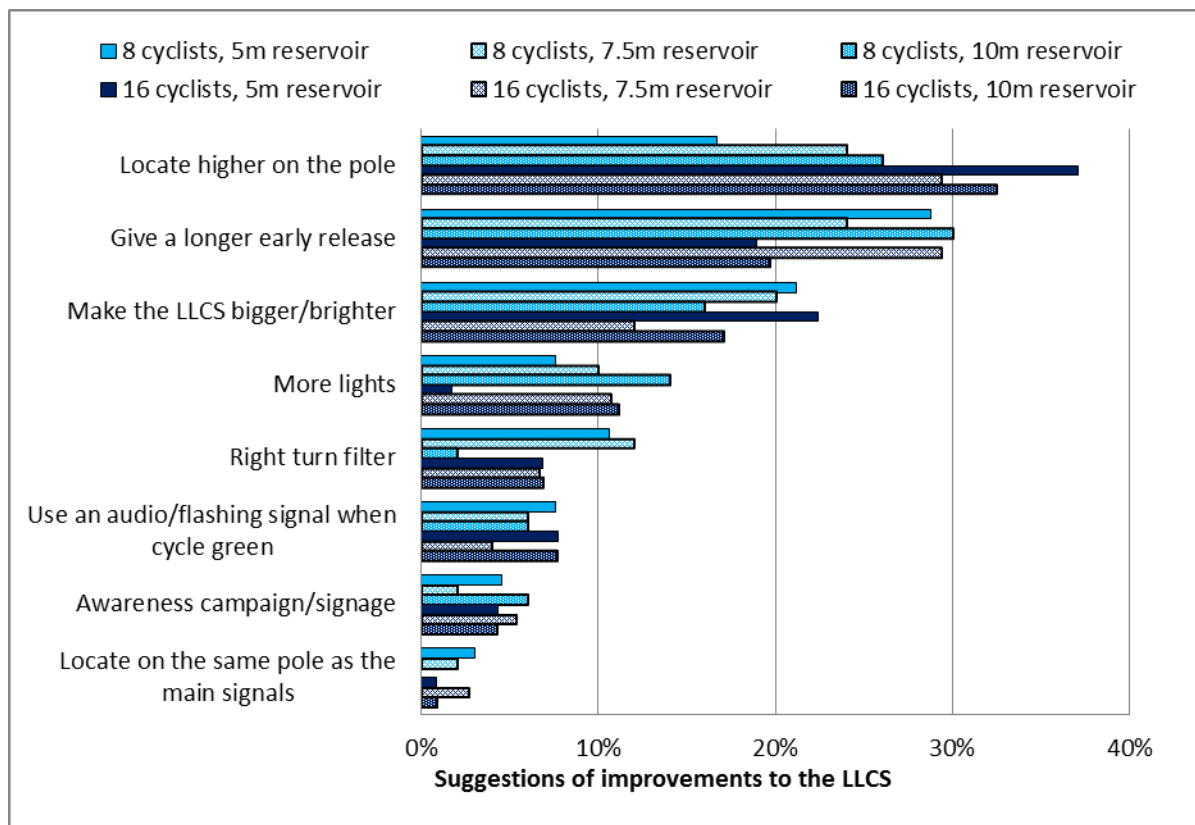
*"Creating time and space to get moving means a predictable gap or distance for motorised traffic to be able to pass." (10m reservoir, 16 cyclists).*

*"Knowing that you have time to position and manoeuvre before other traffic sets off makes it safer" (10m reservoir, 16 cyclists).*

*"I'd go over and in front of the cycle advance stop line less." (10m cycle reservoir, 8 cyclists)*

### **D.3.4 Suggestions for improvement and other comments**

At the end of the questionnaire, participants were asked whether they had any suggestions for improvements in the signals, or any other comments about the signals. Figure D-34 shows suggestions of improvements to the LLCS put forward by participant cyclists.



**Figure D-34 – Cycle trial: suggestions of improvements (questionnaire)**

**Suggestions for cycle reservoirs is also covered in Section 3.2.3 and 3.3.5 in the main report.**



## Appendix E Further analysis of questionnaire data (Car trial)

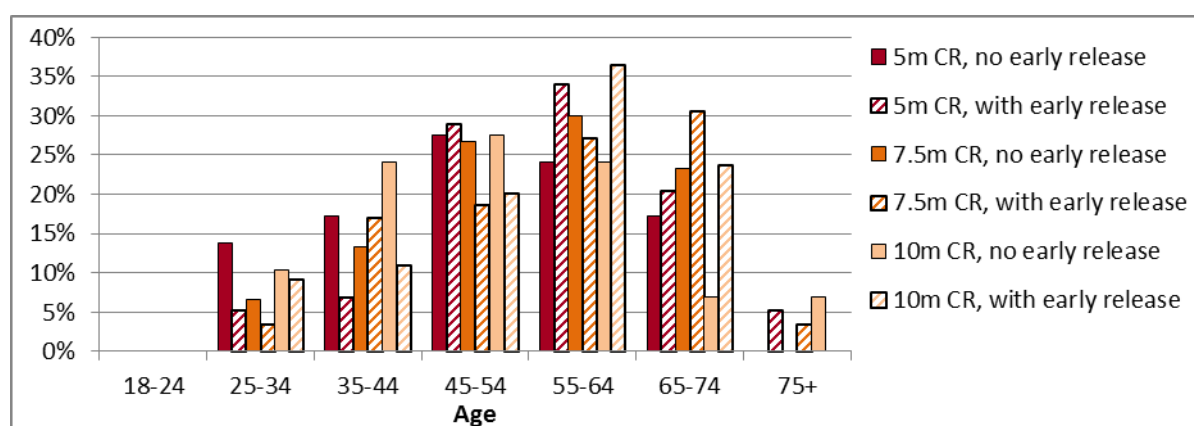
### E.1 Introduction

This appendix contains further analysis of the questionnaires from the car trial. Graphs are broken down by the three different reservoir depths and trials with and without an early release. Throughout this appendix participants from the previous trials will be referred to by the trial they participated in (see trial codes in Table D-1), followed by the road user type, for example 'M14 Cyclists'.

#### E.1.1 Participant characteristics

##### E.1.1.1 Age characteristics

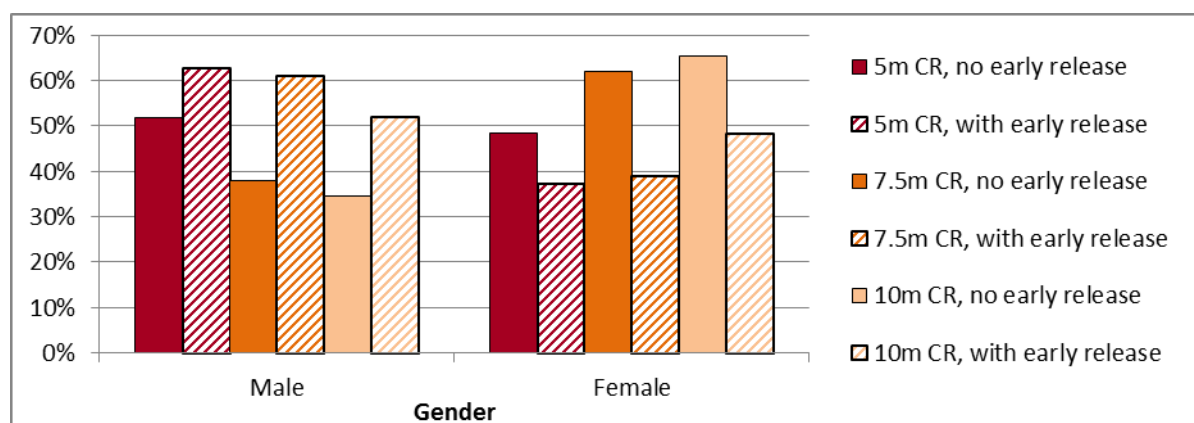
Most car drivers were aged between 45 and 74, see Figure E-1. The distribution of ages was broadly similar across the six different trials and also similar to previous car trials.



**Figure E-1 – Car trial: age characteristics (questionnaire)**

##### E.1.1.2 Gender characteristics

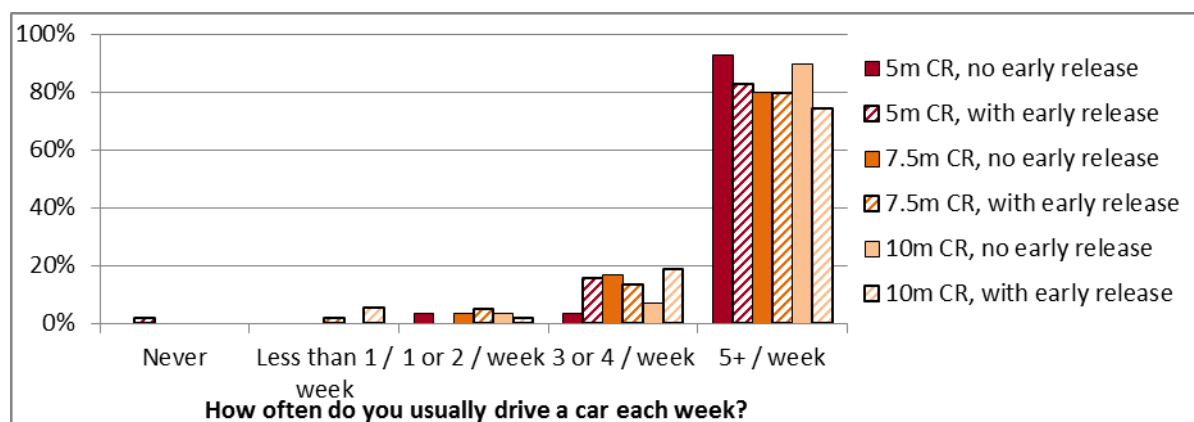
There was a fairly evenly split of gender, except there were more male car drivers within the 5m and 7.5m cycle reservoir groups with early release and there were more female car drivers within the 7.5m and 10m cycle reservoir group with no early release, see Figure E-2. The gender split is broadly similar to the previous car trials.



**Figure E-2 – Car trial: gender characteristics (questionnaire)**

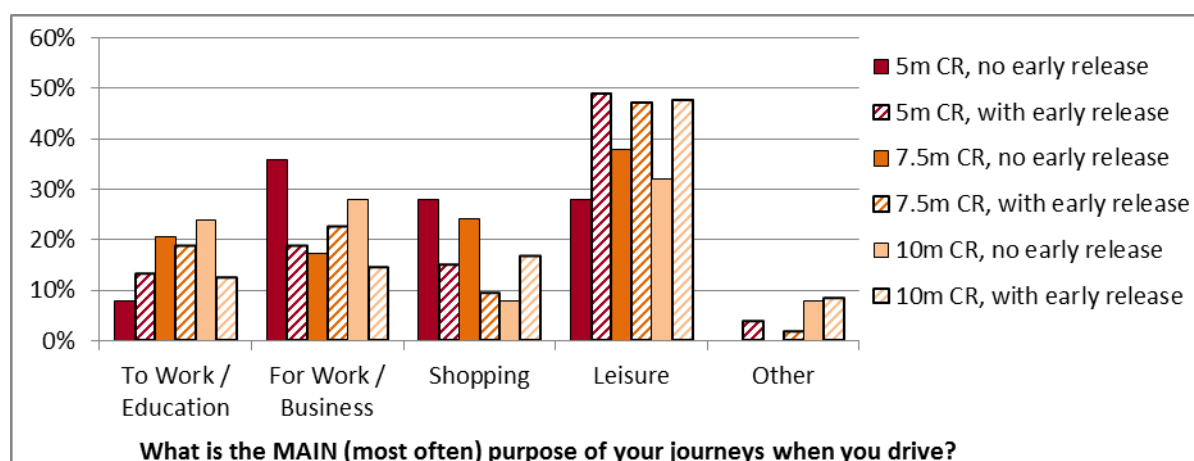
### E.1.1.3 Typical car journeys

Most car drivers (83%) said they drive a car at least five times per week. The frequency of car drivers driving their car each week was broadly similar across the six groups. Results are shown in Figure E-3.



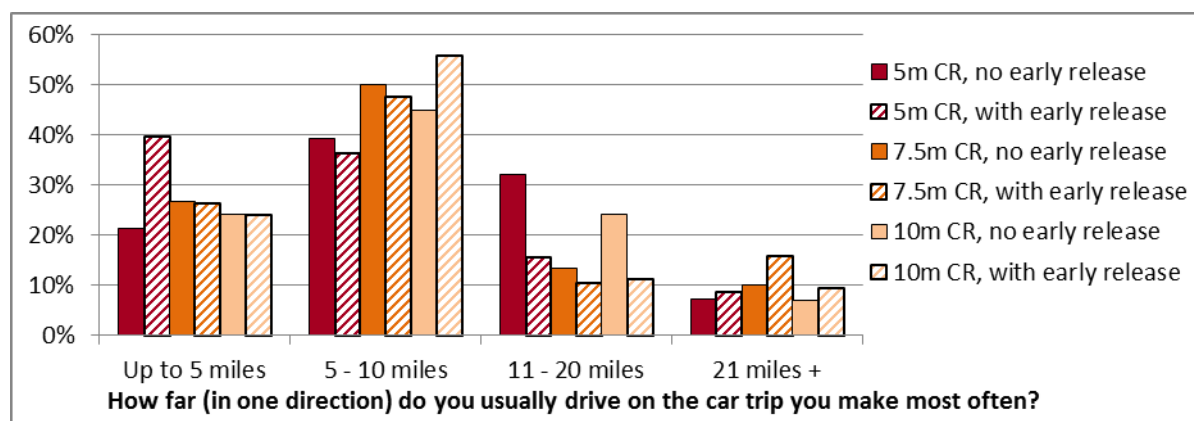
**Figure E-3 – Car trial: typical driving frequency (questionnaire)**

When asked about their typical journey purpose when driving, the most common response was “leisure”, see Figure E-4.



**Figure E-4 – Car trial: typical driving journey purpose (questionnaire)**

When asked about their typical journey distance when driving, the most common response was “5-10 miles”, see Figure E-5.



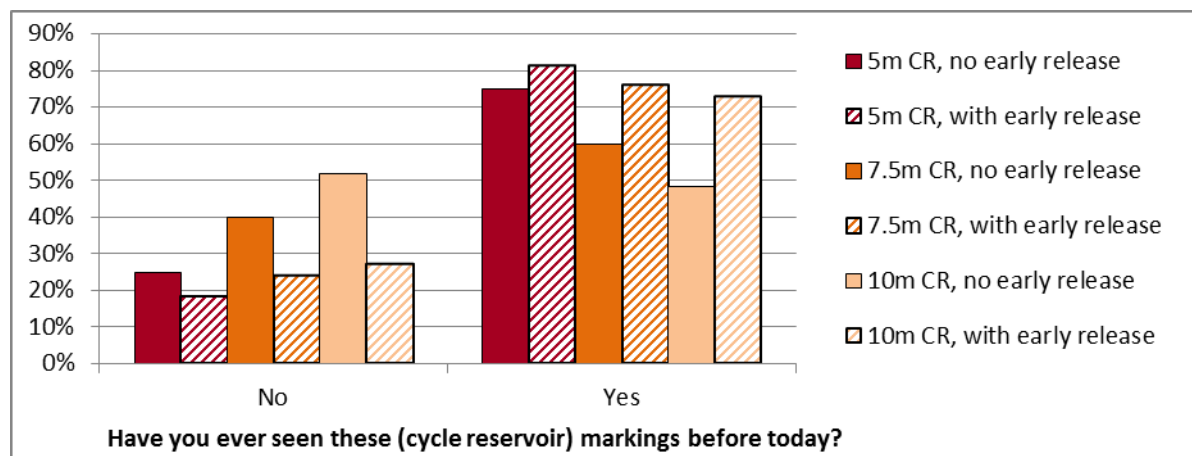
**Figure E-5 – Car trial: typical driving journey distance (questionnaire)**

Pooled across the six car trials, 14% of car drivers said they usually cycled at least once a week, which was similar to previous car trials.

## E.1.2 Experience of traffic signal junctions

### E.1.2.1 Cycle reservoirs

Between 20% and 50% of car drivers said they hadn't seen cycle reservoirs before, see Figure E-6. This was a similar proportion to previous trials, but higher for the trials with 7.5m and 10m reservoirs with no early release.



**Figure E-6 – Car trial: previous experience of cycle reservoirs (questionnaire)**

Pooled across the six car trials, 99% of the car drivers said they wouldn't stop in a cycle reservoir if there were cyclists present, whereas about 84% said they wouldn't if there were no cyclists present. The results across the six car trials were very similar.

The car drivers were 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. Pooled across the six car trials, 88% of the car drivers said 'no' and 10% said 'It depends'. Responses were broadly similar across the six groups, however a smaller proportion of participants in the 5m reservoir with early release group said 'no' (74%).

Some of the reasons given in response to the open-ended question for ever stopping within the cycle reservoir included 'if traffic ahead was queued', 'filtering in heavy traffic', 'to get out of the way for emergency services' and 'if there were not many cyclists about'.

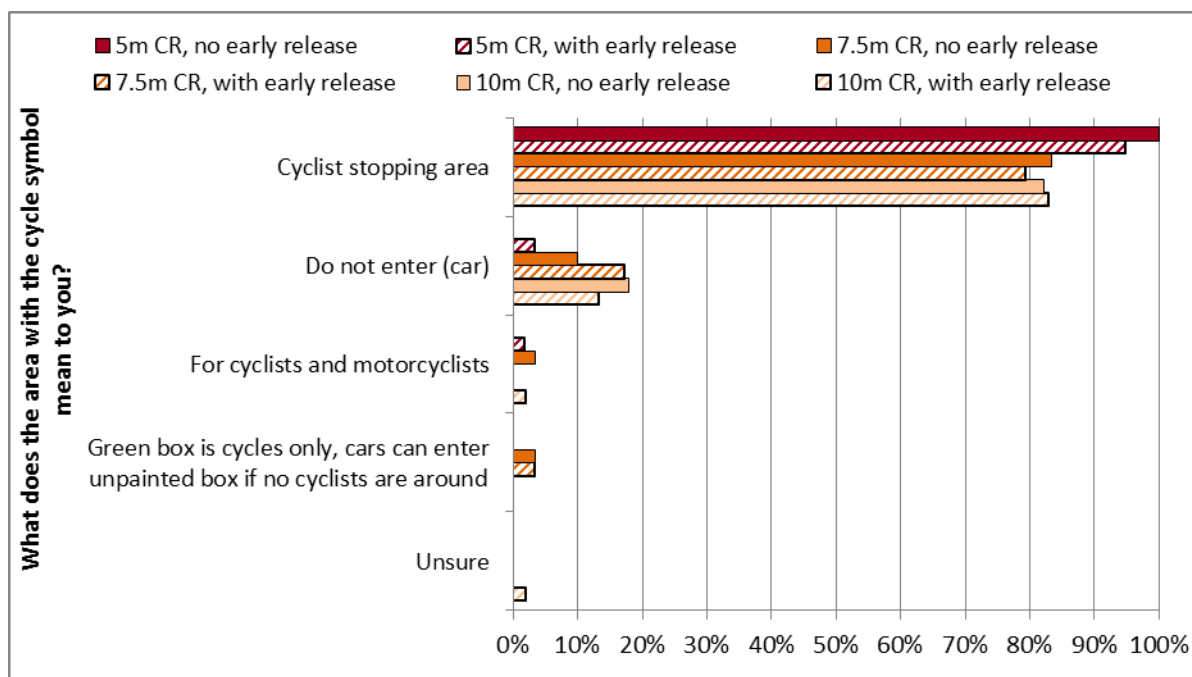
*"If it was rush hour and there was a queue of slow moving traffic so drivers had to make the most of available space and cyclists couldn't pass anyway".*

## E.2 Experiences from the trial

### E.2.1 Cycle reservoirs

#### E.2.1.1 Understanding of the cycle reservoirs

Figure E-9 shows the classification of responses from car drivers when asked "What does the area with the cycle symbol mean to you?". The car drivers generally showed a good understanding of the cycle reservoir.



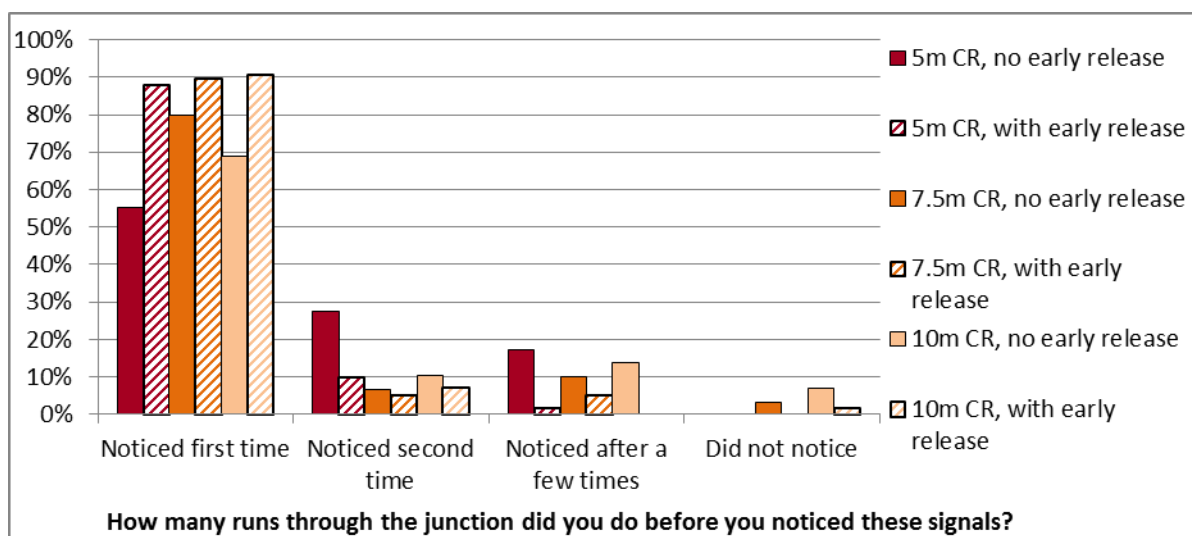
**Figure E-7 – Car trial: understanding of the cycle reservoir (questionnaire)**

Understanding of the cycle reservoirs is also covered in Section 4.1.1 in the main report.

## E.2.2 Low Level Cycle Signals

### E.2.2.1 Noticing the Low Level Cycle Signals

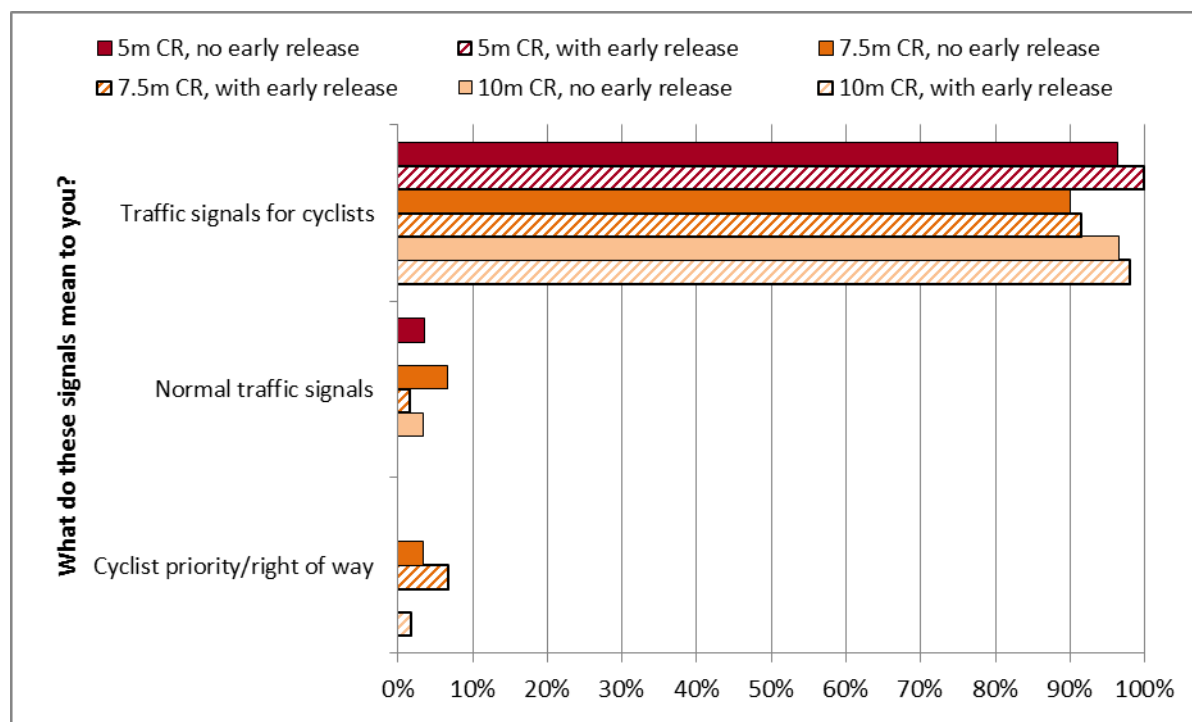
As with previous trials, about 90% of car drivers who experienced the scenarios with an early release noticed the LLCS on their first run, see Figure E-8. Those who experienced the no early release scenarios were more likely to take longer to notice the LLCS. Overall, the 7.5m cycle reservoir had the highest proportion of car drivers who noticed the LLCS on their first run (86%). A small minority (2%) of car drivers said that they did not notice the LLCS, which was mainly in the trial with no early release.



**Figure E-8 – Car trial: noticing the LLCS (questionnaire)**

### E.2.2.2 Understanding of the Low Level Cycle Signals

Figure E-9 shows the classification of responses from car drivers when asked "What do these signals mean to you?" referring to the LLCS.

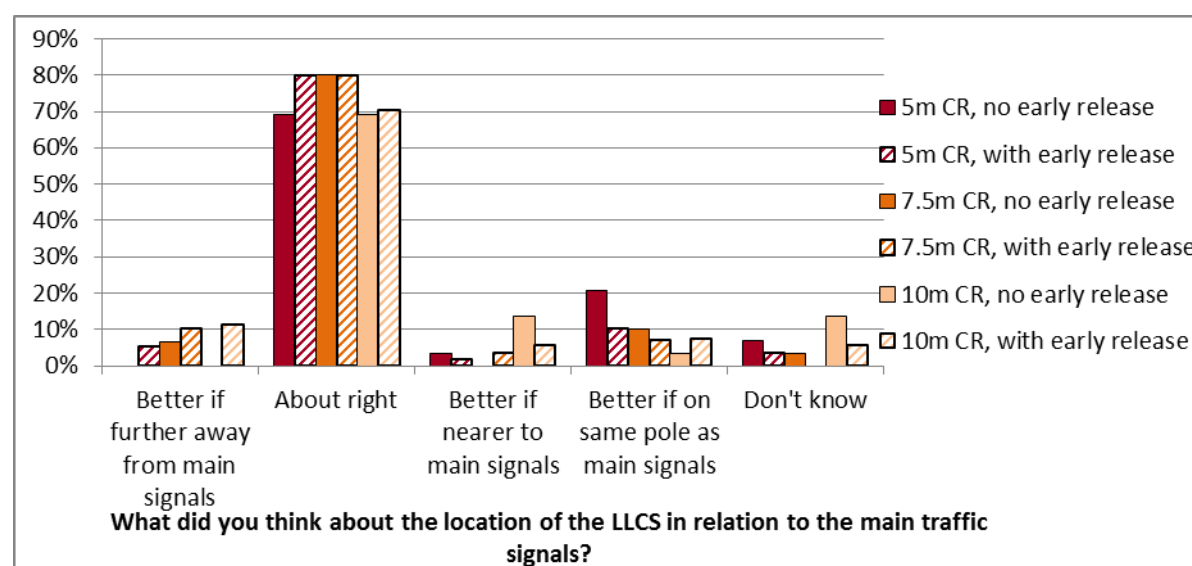


**Figure E-9 – Car trial: understanding of the LLCS (questionnaire)**

**Understanding of the Low Level Cycle Signals is also covered in Section 4.1.2 in the main report.**

### E.2.3 Location of the LLCS and main signals

Figure E-10 shows the responses from car drivers when asked about their views on the location of the LLCS and main signals at the junction.



**Figure E-10 – Car trial: views on the location of the LLCS (questionnaire)**

Based on the answers given for the open-ended question, car drivers tended to either be able to see both sets of lights so were happy as they were 'aware of what the cyclists were doing', or some thought that the LLCS should be on the same pole to make it 'more obvious to car drivers what cyclists were doing'.

*"It was low enough not to be confused with the main traffic lights - but high enough so it was in your straight line, so you were aware of what was going on with the cycle traffic in front of you" ('About right', 7.5m reservoir with early release)*

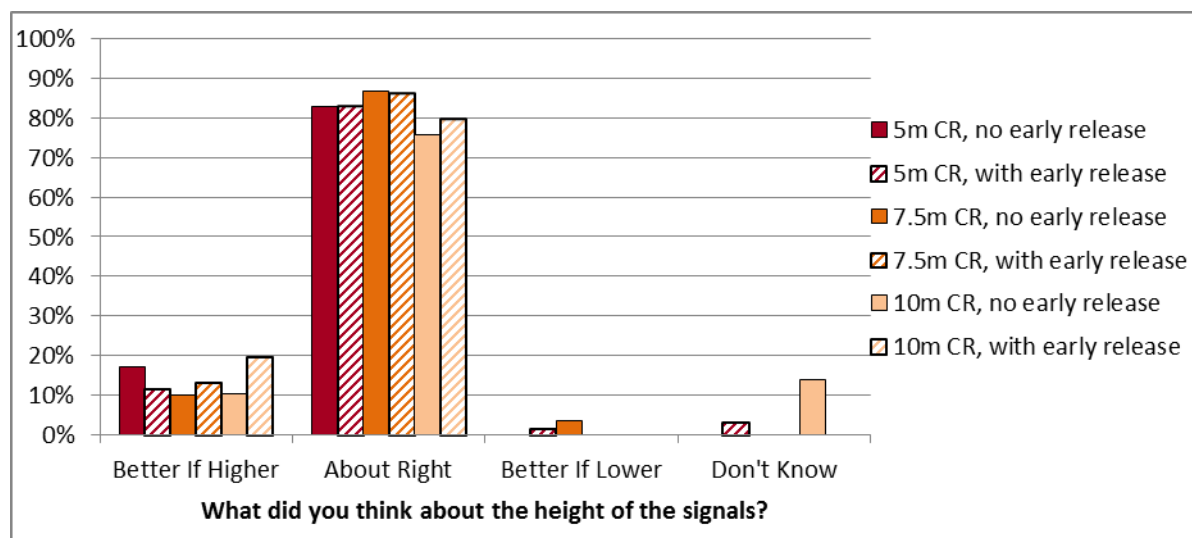
Other responses included that the LLCS would be more noticeable if higher, they should be on a 'separate pole so does not interfere or confuse' and they are 'not relevant to me so should not be visible to me'.

*"I found myself looking at the low level signals and getting ready to move when they started to change. Could cause confusion if the driver can see this more prominently than the main traffic light." ('Don't know', 10m reservoir with early release)*

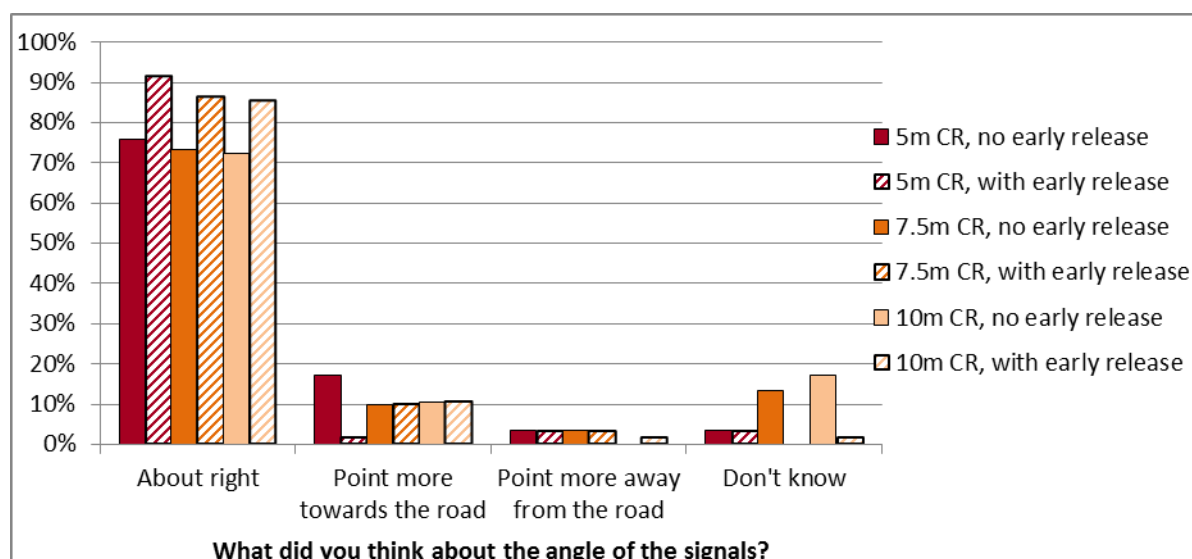
**Views on the location of the LLCS and main signals are also covered in Section 4.3.4 in the main report.**

#### E.2.4 Height and angle of the LLCS

Figure E-11 and Figure E-12 show the responses from car drivers when asked about the height and angle of the LLCS, respectively.



**Figure E-11 – Car trial: views on the height of the LLCS (questionnaire)**



**Figure E-12 – Car trial: views on the angle of the LLCS (questionnaire)**

The height and angle of the LLCS is also covered in Section 4.3.3 in the main report.

### **E.2.5 Size of the cycle reservoir**

The size of the cycle reservoir is covered in Section 4.2.1 in the main report.

### **E.2.6 Stopping position**

#### **E.2.6.1 Stopping position relative to the cycle reservoirs**

The extent to which participants waited in the cycle reservoir is measured and analysed from the video data in Section 4.5 in the main report and also Appendix C. However, to give context to the video data, participants were asked how often they waited in the cycle reservoir for the signals to change and then to explain their answer. Results are shown in Figure E-13.

Most participants who said they never stopped in the cycle reservoir explained that this was because they understood that the area was for use by cyclists only.

Three participants who stopped in the cycle reservoir 'every time' suggested that it was their understanding of the cycle reservoir, or what they would normally do:

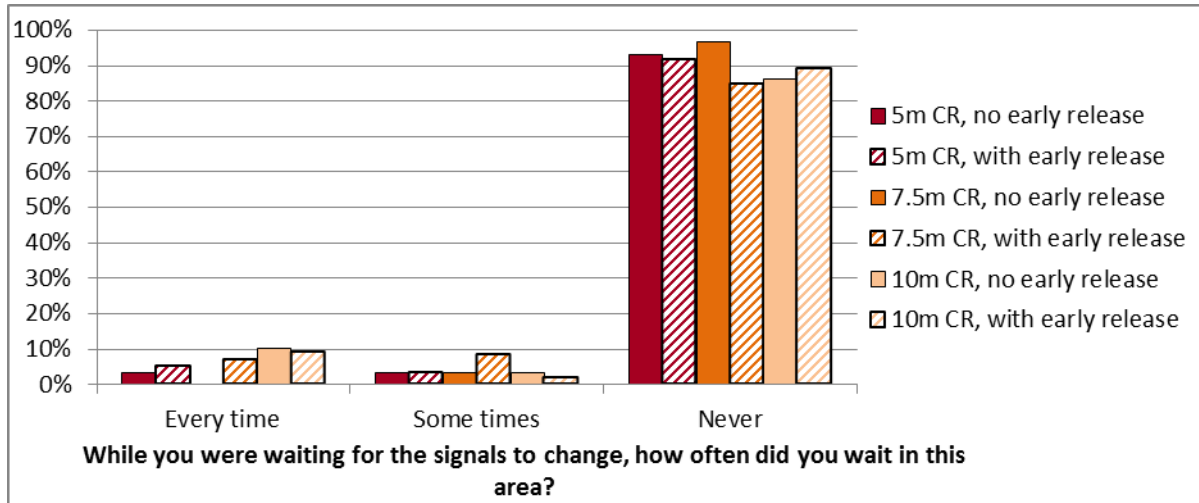
*"Understanding of requirement" (10m with early release)*

*"Always- normal road positioning" (10m with early release)*

Comments from those car drivers who responded that they 'sometimes' stopped in the reservoir included:

*"I waited in the area when there were no cycles present" (10m with early release)*





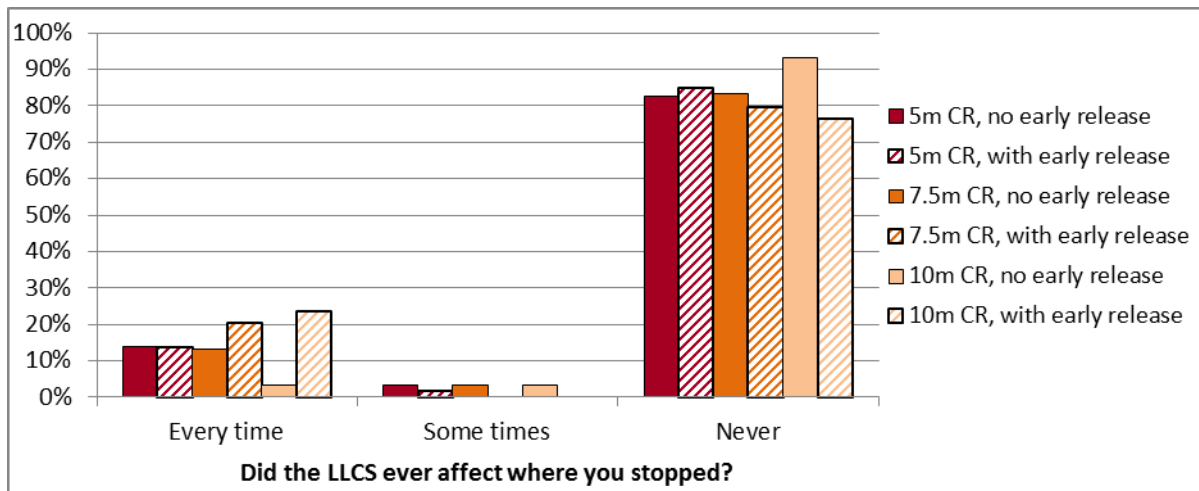
**Figure E-13 – Car trial: compliance with the cycle reservoir (questionnaire)**

**Stopping position is also covered in Section 4.5.2 in the main report.**

#### *E.2.6.2 Effect of the LLCS on stopping position*

The majority of car drivers (83%) said that the LLCS 'never' affected where they stopped at the junction (see Figure E-14). Participants in the 10m reservoir with early release group were more likely to say 'never' (93%) compared to the other groups. Of those that said 'Never', their explanations were typically one of the following:

- The LLCS are not relevant to me as a car driver
- I always stopped outside the box / before the stop line
- I was not affected by the LLCS as I just concentrated on the main lights.



**Figure E-14 – Car trial: effect of LLCS on stopping position (questionnaire)**

Participants who answered either 'every time' or 'some times' did not seem to have understood the question properly as their answers often related to them stopping outside the cycle reservoir or before the stop line, rather than being specifically about the effect of the LLCS. It might be that, for many, the presence of the LLCS simply reinforces their understanding that the cycle reservoir area needs to be kept clear for cyclists.

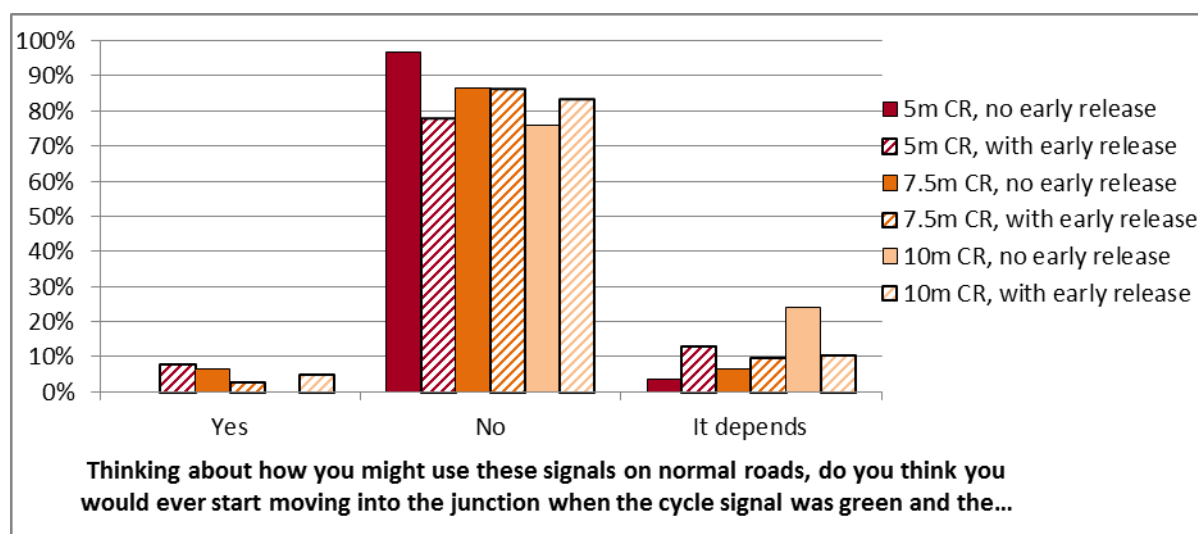
*"It highlighted the area was for cyclists beyond the advanced stop line" (Every time, 10m reservoir, with early release)*

### E.2.7 What participants said they looked at

**What participants said they looked at is covered in Section 4.4 in the main report.**

### E.2.8 Whether participants would react to an early release

Car drivers were asked whether, during normal driving, they thought they would ever start moving into the junction when the LLCS were green and the main signal was red. Results are shown in Figure E-15.



**Figure E-15 – Car trial: whether car drivers would react to an early release (questionnaire)**

Comments from car drivers who answered 'yes' or 'it depends' included:

*"If no cyclist about it should be safe to move off" ('It Depends', 5m reservoir with early release)*

*"If lights at differing times it would be dangerous - I did find myself watching the cyclists lights when I discovered they were in the same sequence as mine" ('Yes', 7.5m reservoir, no early release)*

**Whether participants would react to an 'early release' is also covered in Section 4.6.1.2 in the main report.**

## E.3 Attitudes

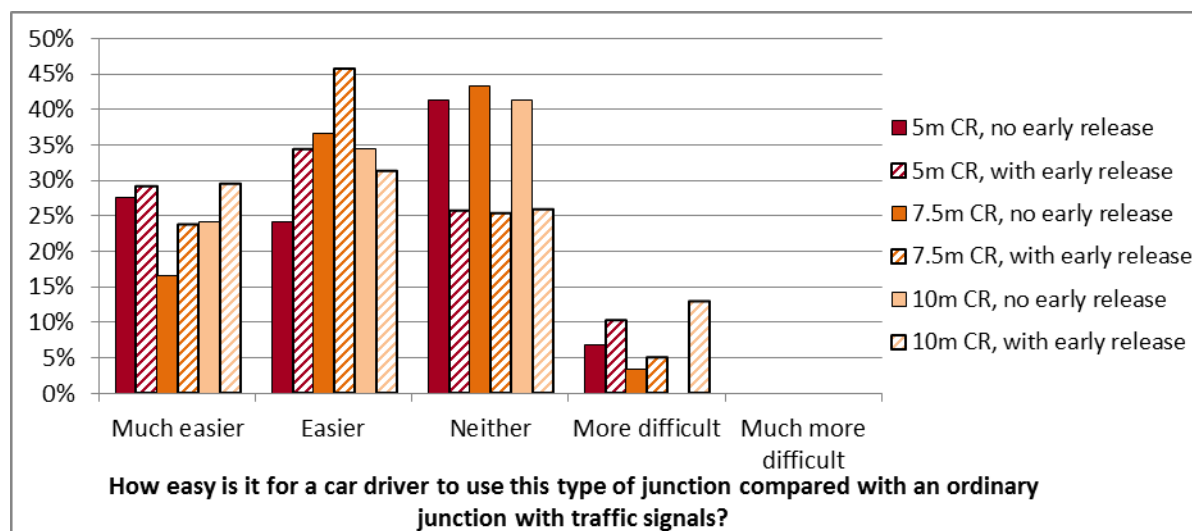
### E.3.1 Comparisons with an 'ordinary' junction

Participants were asked questions around how the trial junction compared with an 'ordinary' signal junction, regarding ease of use, safety and whether they would be more likely to cycle if more junctions were like this. The participant sample consisted largely of residents of the Wokingham/Bracknell area, where only few junctions have ASLs. As

such, many participants were not familiar with ASLs and interpreted an 'ordinary' signal junction to be one without an ASL.

### E.3.1.1 Ease of use compared with an ordinary junction

Around 60% of car drivers said that the trial junction was 'easier' or much 'easier' to use than an ordinary junction (see Figure E-16). This was similar across all reservoir sizes, and as with previous trials, the early release increased the ease of using the junction.



**Figure E-16 – Car trial: how easy it was to use the junction compared to an ordinary junction (questionnaire)**

The most common comments suggesting that the LLCS increased the ease of using the junction were that additional signals for cyclists help drivers to confirm what is happening, when cyclists are moving off and to anticipate the main signals changing (17%). 10% of car drivers said that the junction was easier because the LLCS meant the cyclists were out of the way before the cars were moving.

Comments also referred to the cycle reservoirs making the junction easier to use. About a third of car drivers who said the junction was easier to use said that the junction increased awareness of cyclists as they were more visible in front and 8% said that the junction separates road users so it is clearer where cyclists and car drivers should wait.

The 5m reservoir had the highest proportion of car drivers who said that the junction was 'more difficult to use' (17%) compared with the 7.5m reservoir (8%) and the 10m reservoir (13%); however no comments from this question specifically referred to the size of the reservoir. The most common comments given in relation to this were that this type of junction would slow the flow of traffic and that drivers would be more cautious due to there being more signs, signals and cyclists.

The most common responses to the open-ended question included: the junction helps to make you more aware of cyclists, gives you an indication about when your signals are going to change, improves safety and gives cyclists a head start so that they are not in the way.

*"Car drivers would be more aware of cyclists intentions" ('Much easier', 10m reservoir with early release)*

*"Pre-advice on changing of main lights and it clears the way ahead of cyclists"*  
*('Easier', 5m reservoir with early release)*

Many of the responses mis-interpreted the question and made reference to the ease of use for a *cyclist*, rather than for them as a car driver.

The main reasons for car drivers finding this type of junction 'more difficult' included:

- Need to be more cautious / drive more slowly

*"Safe for cyclists but more difficult for drivers as the drivers had to cross the junction very slowly behind the cyclist"* ('More difficult', 5m reservoir, with early release)

- Two sets of lights might cause confusion

*"Must not be distracted/confused and mistake the cycle signals as for cars."*  
 ('More difficult', 10m reservoir with early release)

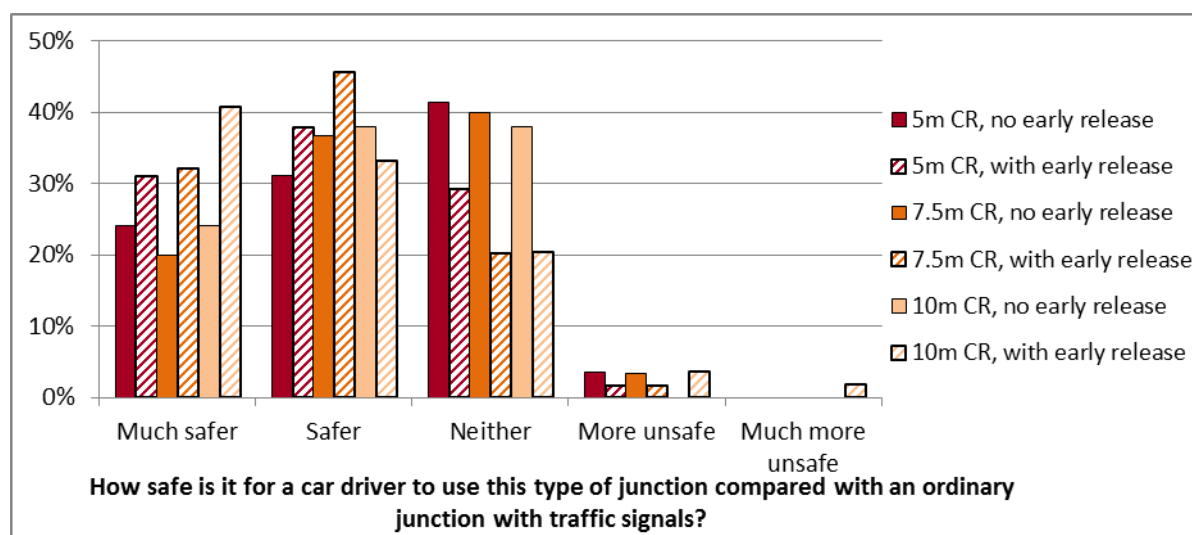
- Causes more congestion / a back-up of traffic

*"If several cyclists at a junction could cause a group to gather in front of motorists and slow down main traffic whilst waiting for them to disperse into cycle lanes or side of road"* ('More difficult', 10m reservoir with early release)

### E.3.1.2 Perceived safety

Participants were asked how safe it was for a car driver to use this type of junction compared with an ordinary junction with traffic signals; results are shown in Figure E-17.

Pooled across all car trials, 66% of car drivers said they considered the junction to either be 'safer' or 'much safer'. A small proportion of car drivers (less than 3%) thought that the junction felt 'more unsafe' or 'much more unsafe'.



**Figure E-17 – Car trial: how safe participants thought the junction was to use compared with an ordinary junction (questionnaire)**

Based on the responses to the open-ended question, a number of participants seemed to either misinterpret or not answer the question. Some answered it in relation to the safety for cyclists (rather than for a car driver) and others did not explain how safety

would be improved / worsened. Most responses tended to either say that the junction makes drivers more aware of cyclists or that it makes no difference.

*"A driver can see the cyclists in the box and be aware of their movements" ('Much safer', 5m reservoir with early release)*

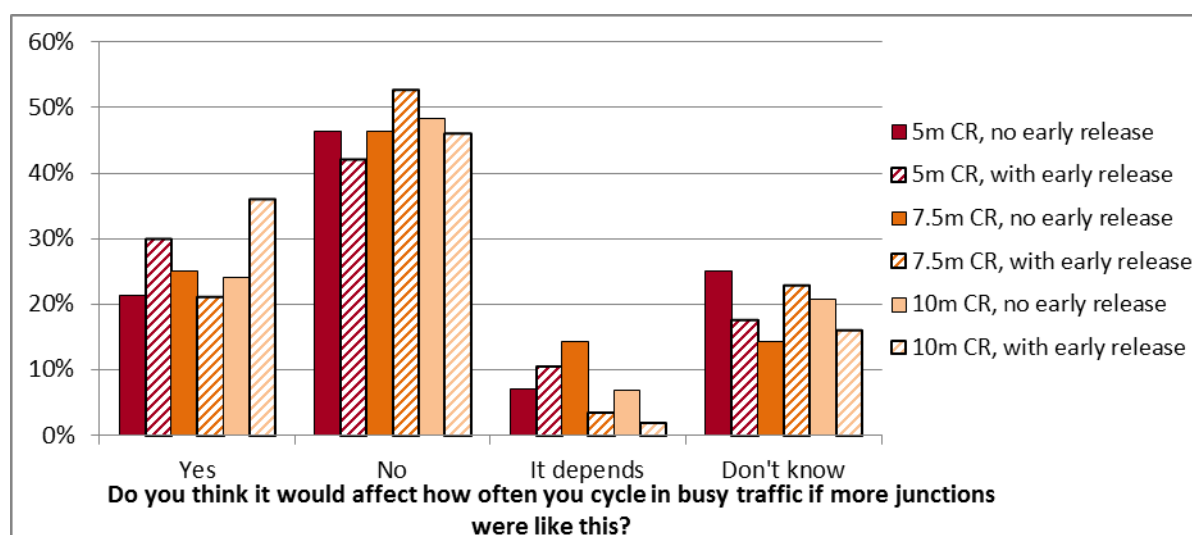
Some participants said there was less chance of hitting a cyclist at the junction.

*"Car drivers are much less likely to be involved in an accident with a cyclist" ('Much safer', 5m reservoir with early release)*

**Effect on perceived safety is also covered in Section 4.2.6 in the main report.**

### E.3.1.3 Influence on modal shift to cycling

Figure E-18 shows responses from car drivers when asked whether they would be "more likely to cycle in busy traffic if more junctions were like this".

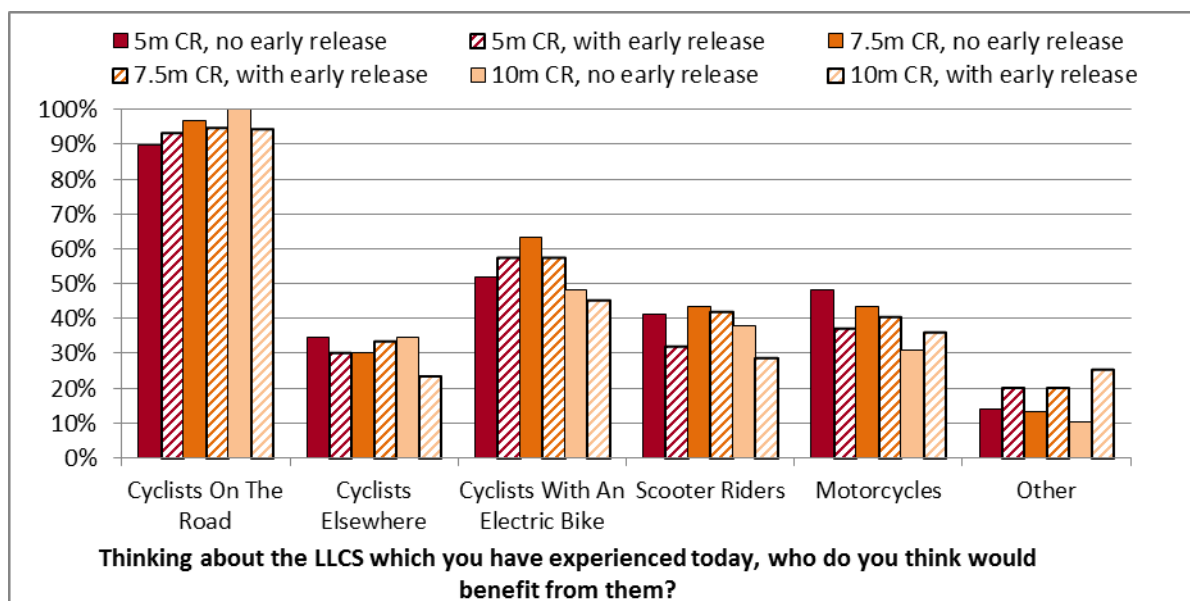


**Figure E-18 – Car trial: whether LLCS would increase the likelihood of car drivers cycling in busy traffic (questionnaire)**

**Influence on modal shift to cycling is also covered in Section 4.2.5 in the main report.**

### E.3.2 Perceived benefits of LLCS

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, see Figure E-19. About 40% of car drivers thought that scooter riders and motorcyclists would benefit.



**Figure E-19 – Car trial: who would benefit from the LLCS (questionnaire)**

When explaining their answers, the main reasons for the LLCS being considered beneficial were as follows:

- Cyclists would benefit as the LLCS would improve cycle safety and cycle confidence by giving them extra time to set off.
- The LLCS are at a low level so are easier for cyclists to see / correct eye level.
- There may be fewer accidents if cyclists obey signals / could prevent cyclists running red lights.
- Concern that / unsure if motorcyclists / scooters might use them too.
- Help to raise awareness of cyclists.

*"good idea to give cyclists a head start. The signals I think also made me think about and be more considerate to cyclists as road users"*

- Useful for cars to know when the main lights might change.

A number of positive responses were received about the signals. Many participants referred to the signals being a good idea and a number of other comments were received to do with the potential improvements to safety.

*"great signals, very good idea for cyclists using our busy roads, would make cycling safer for all cycle users and increase awareness for motorists" (7.5m reservoir with early release)*

## Appendix F Summary of focus groups

### 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.

Five focus groups (FG) were conducted for the M24 cycle trials:

- Cyclists – FG 1: 4<sup>th</sup> October 2013 – 5m cycle reservoir
- Cyclists – FG 2: 23<sup>rd</sup> October 2013 – 7.5m cycle reservoir
- Cyclists – FG 3: 14<sup>th</sup> November 2013, 10m cycle reservoir
- Car drivers – FG 4: 17<sup>th</sup> October 2013 – 7.5m cycle reservoir
- Car drivers – FG 5: 5<sup>th</sup> November 2013 – 10m cycle reservoir

#### F.1.1 Participant characteristics

##### *Cyclists*

#### **FG 1: Cyclists, 5m reservoir**

Nine participant cyclists took part in the focus group on the 4<sup>th</sup> October 2013 (6 Males, 3 Females): one commuted by bike five times a week; three cycled two to three times a week; one cycled off-road; one occasionally cycled for leisure; one occasionally travelled by bike; one cycled off-road for leisure at weekends; and one had not cycled in the last three years.

One participant described them self as a confident cyclist, one described them self as a fairly confident cyclist and the remainder described themselves as less confident in particular scenarios: around HGVs; on windy country roads; in heavy traffic in urban areas; turning right across busy roads; in busy traffic and turning right; in busy traffic and in unknown areas.

#### **FG 2: Cyclists, 7.5m reservoir**

Nine participant cyclists took part in the focus group on the 23<sup>rd</sup> October 2013 (5 Males, 4 Females): one cycled for leisure and work; four cycled for leisure; two cycled for local shopping trips; one cycled in the summer months; one participant did not cycle.

All nine participants described themselves as confident cyclists, however they were all less confident in particular scenarios: in London where there are no cycle lanes; in rush hour and where there are no cycle lanes; on fast roads / A-roads; around pinch points such as parked cars / on A-roads / at night on a single carriageway; around large trucks and stationary traffic; around pedestrians; when not seen by traffic. Most of the participants could drive.

#### **FG 3: Cyclists, 10m reservoir**

Eight participant cyclists took part in the focus group on the 14<sup>th</sup> November 2013 (6 Males, 2 Females): one cycled daily to work in London; one cycled two to three times per week for work and leisure; one cycled once per week for work; one cycled off-road occasionally for leisure; one cycled occasionally; one cycled on holidays abroad; one cycled occasionally around London; one didn't cycle but used to commute by bike.



Three of the participants described themselves as confident cyclists, one described them self as confident in London, one described them self as a confident cyclist but was less confident on dual carriageways. The other three participants described themselves as less confident in particular scenarios: when busy; on dual carriageways; on busy junctions/in fast traffic. Six of the participants could drive a car and one did not drive.

### *Car drivers*

#### **FG 4: Car drivers, 7.5m reservoir**

Eight participant car drivers took part in the focus group on the 17<sup>th</sup> October 2013: three drove every day; one drove most days for domestic and leisure purposes; two drove often; one drove generally to and from work most days; and one drove for leisure purposes.

Two participants described themselves as very confident drivers, two described themselves as confident drivers, one described them self as a fairly confident driver; one described them self as not overly confident; and one described them self as less confident since having an accident.

With regards to cycling behaviour, four of the participants did not cycle, one was not a confident cyclist, one often cycled on footpaths, one cycled occasionally for leisure and one was a confident cyclist who cycles to work and did long charity cycle rides.

#### **FG 5: Car drivers, 10m reservoir**

Eight participant car drivers took part in the focus group on the 5<sup>th</sup> November 2013 (5 Males, 3 Females): three drove every day; two drove most days; one drove four times a week; one drove three to four times per week; and one drove once per week.

Some of the participants stated that they were less confident driving in particular scenarios: driving in London; driving in adverse weather conditions; driving on country lanes/not knowing the route.

With regards to cycling behaviour, four participants did not cycle, one only cycled off-road; one cycled for leisure; one cycled three to four times a week and one cycled every day.

## **F.2 Experiences from the trial**

### ***F.2.1 Cycle reservoir: size***

#### *Cyclists*

#### **FG 1: Cyclists, 5m reservoir**

Half were in a group of 16 and the other half were in a group of 8. In the focus group they were asked about their perceptions of the size of the cycle reservoir separately.

There was a general agreement in the group of 16 that getting into the cycle reservoir could be difficult. One participant, who stated that she liked to be at the back of the group, said that she rarely got into the cycle reservoir due to other cyclists being in front of her.

When asked to imagine a scenario with lots of cars as well as cyclists one participant from the group of 16 stated that it would be impossible to get into the cycle reservoir as the filter lane on the inside would get blocked by only a few cyclists:

*"In real traffic... all of these bikes have got to [filter] from the left hand side... so it needs to be deeper, because as soon as you've got [some] cyclists on the left hand side, other cyclists won't be able to [enter the cycle reservoir]."*

Most participants in the group of 8 felt that there was enough room for them to be able to stop in the cycle reservoir and see the signals. However one participant stated that sometimes:

*"There were still people out the back [of the cycle reservoir]"*

However there was agreement that if they did want to get into the reservoir they could.

When asked what they would think about a reservoir twice the depth of the one they experienced, the following problems were put forwards:

*"[having a cycle reservoir that big is] over the top"*

*"You're going to get cars ignoring it"*

*"It would mean it would take too long for cars to get to the other side of the junction"*

## **FG 2: Cyclists, 7.5m reservoir**

The cycle reservoir contained plenty of room for the group of eight cyclists, with one participant commenting that cyclists need to be on the right side for turning. However, it was noted the group of sixteen cyclists could not all fit in the reservoir. One participant commented that it varied as to where you were in the group of cyclists as to whether you would be able to enter the cycle reservoir.

*"We couldn't all fit in ... [the cycle reservoir]"*

Other comments included a dislike for the cycle reservoir going all the way across the lane and that the size of the reservoir should differ depending on the location.

## **FG 3: Cyclists, 10m reservoir**

It was acknowledged that the size of the cycle reservoir should depend on the volume of traffic. A 10m cycle reservoir was considered big enough for most environments. However, it was commented that if the cycle reservoir was too big then cars may encroach into it.

*"You run the risk if the bigger the box, the more you're going to get frustrated car drivers or people or motorcyclists going to go in it"*

All agreed that the small group (8 cyclists) fitted in the cycle reservoir and that everyone also fitted into it when travelling in the large group (16 cyclists), although some cyclists at the back were half in and half out of the reservoir.

## **Car drivers**

### **FG 4: Car drivers, 7.5m reservoir**

Most participants were ambivalent towards the size of the cycle reservoir (7.5m), although one stated that it was slightly larger than they would expect and this would only be appropriate with high cycle flows. One driver thought that based on the number

of cyclists in the trial (either 0 or 1), the cycle reservoir may have been too large. Another participant thought that the large cycle reservoir was okay in areas with high cycle flows:

*"The length of that cycle [reservoir]... ought to be dependent on the number of cyclists that are expected to use that."*

#### **FG 5: Car drivers, 10m reservoir**

It was agreed that a larger cycle reservoir would help to reinforce the overall meaning and identify who was allowed to enter. One participant thought that the cycle reservoir (10m) seemed quite large and may be difficult to fill with cyclists. Another commented that they felt safer with the larger cycle reservoir and a further participant indicated that as a cyclist the reservoir would feel safe being that size. One participant thought that there should be segregation between cyclists and drivers and that the size of the cycle reservoir should be dependent on location and road traffic usage.

*"It seemed quite large...I thought that it would be very difficult to fill that with cyclists"*

*"I like the fact that it is bigger, I have to say, it feels safe."*

#### **F.2.2 Cycle reservoir: understanding and perceptions of layout and colour**

Participants were asked about their understanding of the junction layout, in particular their perceptions on having the main signals at the first stop line and the LLCS at the second stop line.

##### **Cyclists**

#### **FG 1: Cyclists, 5m reservoir**

All showed that they understood the junction and how to use it. There was a general agreement that they thought other road users would find it easier to use this kind of junction and that cars would be less likely to stop in the cycle reservoir.

*"[As a driver] if the lights were at front of the green box you would tend, if there weren't any cyclists, to go forward [into the cycle reservoir]... [With this set up] it would make it a more defined thing"*

There was an agreement that they felt comfortable crossing the first red light and then stopping at the second (LLCS) red light, although one participant felt slightly wary on the first run. Some made particular mention of the main signal post location, stating that they liked these being on the motor vehicle stop line at the entrance of the cycle reservoir.

Four participants preferred the green cycle reservoir and five did not think it made a difference. Those that did think it made a difference stated that the contrast between the black tarmac and the green was the key factor in their effectiveness. One participant suggested that the green road surface was for the drivers benefit:

*"As a cyclist it made no difference, but as a car driver I prefer it green"*

## **FG 2: Cyclists, 7.5m reservoir**

There was some uncertainty at the beginning of the trial as to the use of the LLCS, with some participants initially stopping at the motor vehicle line, but then realising that they could use the cycle reservoir.

Individual views expressed were that motorists do not understand the cycle reservoir and that it needs to have a thick white line to make it obvious that car drivers must stop. Some participants questioned the purpose and general understanding of the layout. It was suggested that increased education for all road users was required. It was suggested that drivers would require educating not to go into the cycle reservoir.

All participants liked the green painted surface and the colour made people think that it was for cyclists, although some considered it slippery to use.

## **FG 3: Cyclists, 10m reservoir**

The dedicated areas for road users was considered good, segregating and providing specific access for cycles / cars. One participant commented that the approach to Arm D needed reservation painted lines in the centre.

All participants commented that they would prefer a solid green cycle reservoir. It was noted that the cycle symbol made its purpose clear, although one participant did not realise that they could enter the cycle reservoir on their first run.

*"I think that the designated green area is good because it gives cyclist's permission to jump the queue... it's a message to motorists that bikes go in front"*

Five participants commented that the green cycle reservoir would make cyclists feel confident and assured that they were meant to be in it. They felt that as a driver they would not enter the solid green reservoir. Similarities between a green cycle reservoir and red bus lanes were discussed; drivers know not to enter them and they are colour-coded for the appropriate mode of travel.

*"You felt more confident and like you felt it was yours"*

*"If it is green, if you're a motorcyclist or driver you don't go in it"*

## **Car drivers**

### **FG 4: Car drivers, 7.5m reservoir**

All drivers knew what the cycle reservoir was and how it should be used. Some drivers stated that they sometimes enter cycle reservoirs when they should not by accident.

There was a general consensus that the green cycle reservoir did make the cycle reservoir more obvious and therefore less likely that they would enter by mistake:

*"[I do sometimes enter the cycle reservoir by mistake] particularly if it's not marked with a different colour."*

*"The green coloured... [cycle reservoirs] stand out a lot more than the black ones."*

### **FG 5: Car drivers, 10m reservoir**

All participants understood that cars should stop before the cycle reservoir and that motorcyclists are also not allowed to use it. All participants stated there was no

confusion over the LLCS positioning on poles with one participant suggesting that they knew there was a cycle reservoir due to the LLCS.

All participants thought that the cycle reservoir needed to be coloured. Green was suggested with a yellow cross hatched box incorporated into it. One person felt using colour would help to make it clear who could use the reservoir, with another noting that cycle symbols on the ground can be obscured.

*"Just very visible from a distance, very clear...you could see the picture of the bicycle on the green"*

### **F.2.3 Low Level Cycle Signals: understanding and perceptions**

#### **Cyclists**

##### **FG 1: Cyclists, 5m reservoir**

All participants were positive about the junction layout they experienced, one participant stated:

*"I think... most cyclists would feel more confident knowing that those signals were specifically aimed at them."*

All participants expressed that they understood how to use the junction; however there was some confusion around the right turn on Arm D. All understood, after using the junction a few times, that they did not have right of way over oncoming vehicles.

All participants were positive about the layout and thought they would be more confident cycling though this type of junction compared to an ordinary junction. One participant thought that this kind of infrastructure would help improve the general attitude towards cyclists amongst all road users.

A number of participants thought that there would need to be some kind of education campaign, so that everybody knew that there was an early release and how long it would be, this was particularly relevant for reducing confusion with the right turn.

##### **FG 2: Cyclists, 7.5m reservoir**

One person questioned the logic between LLCS and traffic lights and another participant indicated they were confused by the different traffic lights. It was suggested that the longer the time gap between cyclists starting and vehicles starting, the clearer the difference was between the LLCS and the traffic lights.

*"I stopped at the light, and then I noticed the signals"*

*"I think it needs to be longer...you need to clear those cyclists otherwise the cars behind you will try to push through"*

There were mixed views towards the LLCS. All participants recognised that the LLCS were provided for the use of cyclists with two participants stating that the use of the LLCS was clear for cyclists. One participant recognised that the LLCS would also be of benefit to vehicle drivers as they would let them know when cyclists were starting to move.

One participant noted that the purpose of the LLCS needed to be clear as they thought that it was not obvious why they are there. Another liked the cycle reservoir, but did not like the LLCS.

*"[The Signals] they're good, but I don't know if there's a huge benefit if there is already an advanced stop line"*

### **FG 3: Cyclists, 10m reservoir**

None of the group were confused by the cyclist lights and one participant commented that the LLCS were the same as traffic lights making it automatically clear and understandable.

*"I think that the low level lights are really great, really good"*

*"It was intuitive"*

[The layout of the LLCS junction] was considered good for cyclists, giving them an edge over motor vehicles, with the delayed signalling contributing towards this. One participant described the LLCS as 'really great'.

It was suggested that education for all road users may be required. Various suggestions were made as to the requirement for informing users of the new layout. These included: the Highway Code; marketing campaign on TV and radio; installation of a sign stating 'New Road Layout Ahead' or 'New Signals Ahead'.

Participants were asked for their opinions on the early release and its applicability to real life. Their comments included that: it would depend on the speed of motor vehicles; when on a bike, you judge it on its own merit; people would get used to looking at cycle lights if the early release varied.

### **Car drivers**

#### **FG 4: Car drivers, 7.5m reservoir**

All participants thought that the layout made it clear that the signals were for cyclists only, although one participant suggested that he did not fully understand the purpose of the LLCS until he experienced the early release. All understood the signals to be for cyclists on the road, not cyclists crossing the road, although some participants were not sure if they were also for powered two wheelers.

*"It was self-explanatory, we weren't given any information and it seemed to [work well]."*

All participants understood that the LLCS were there to help the cyclists negotiate the junction:

*"[The lights were] to give cyclists a heads up."*

*"[give them] a chance to get away first."*

One participant suggested that using the signals was intuitive. They noticed that each junction was different and felt able to negotiate each approach without having to think more than she would at a normal junction.

#### **FG 5: Car drivers, 10m reservoir**

No one entered the cycle reservoir after looking at the LLCS. One participant only noticed the LLCS when turning right whilst another indicated they had thought that they were new pedestrian lights.

*"As I approached the junction I thought that they had new pedestrian lights on the signal"*

*"It's pretty self-explanatory"*

#### **F.2.4 Using the LLCS whilst stopped at the junction**

##### **Cyclists**

##### **FG 1: Cyclists, 5m reservoir**

In general the cyclists in both the small and large groups could see the signals most of the time. Not being able to see the signals was not considered to be a major issue by any of the participants. Three participants stated that they made special effort to be towards the front so they could see the signals, and the junction more clearly:

*"At the front I could see the car, I could see the lights and I knew if I was at the back I would have trouble..."*

*"[I wanted] to be at the front, to see the signals and have [a] clear view"*

One participant disagreed with this, and said she liked to be at the back suggesting that this was because she was slower and knew that the others would overtake her after the junction. She stated that:

*"[I] could see the signals almost all of the time from the back"*

Some participants stated that it did not matter if they couldn't see the LLCS as the other cyclists moving would be a signal for them to move. One participant responded that:

*"I would not like to relinquish responsibility... I don't mind being at the back but I would like to see the signals and make my own decision"*

One participant who was in the group of 16 cyclists said that when there were about two banks of cyclists in front they could not see the signals, but did not see this as a problem.

One participant liked to be able to see both the main signal and the smaller signal, so having the secondary signal was important for them. Other participants were comfortable entering the junction using the LLCS only.

Five participants felt that the LLCS on the right hand side were unnecessary, giving the following reasons:

*"[The LLCS on the right would] just cause confusion"*

*"Your natural action is to look to the left"*

*"I think the right hand light helps, but I don't think it is absolutely necessary"*

The remaining four participants commented that LLCS on the right were particularly useful when turning right or if the junction was particularly wide:

*"[I would prefer] More than less [signals]"*

*"If you're turning right you tend to ignore the left lights... you're just looking for the right hand side one..."*

##### **FG 2: Cyclists, 7.5m reservoir**

One participant explained that the lights for other vehicles were difficult to see and this resulted in being unclear which lights to trust. Another participant suggested that the LLCS needed to be higher and set further back.



*"if you had the signal a bit higher up, still make it clear that was a bicycle one...and to perhaps have it further in the distance as well"*

One participant commented that they could not see the LLCS and that they relied on the cyclist in front to go then would follow them. Another commented that they knew that the trial was a safe situation therefore they could follow the cyclist in front. Three participants commented that in real life they would be more aware.

*"I did have trouble seeing it (LLCS) on a bike, if there was a lot of cyclists... so it would benefit from being higher up"*

*"I think that in the real world you would be much more focused on the car behind you"*

Three participants noted that on Arm D it was harder to see the LLCS and they would be inclined to alter their position to see the LLCS. Another suggested that if LLCS were in sync with the main lights they would be inclined to focus on the main lights only. One participant mentioned that with LLCS they could turn across traffic coming towards them if the LLCS was on the right hand side.

### **FG 3: Cyclists, 10m reservoir**

Seven participants commented that on the approach they looked at the main traffic lights. One participant indicated that whilst looking at the main traffic lights they did not even notice the low level lights on approach. Another participant suggested that on their first approach they concentrated on the main lights, and it is only when they had noticed the LLCS and got used to them that they started using the LLCS. One participant was noted to use the main lights at all times.

*"I always personally used the main signals, big signals, as my indication until it came to get going...I then found it quite handy that I had my personal signals at my level"*

One participant indicated they had tried to be at the front of the cycle reservoir as they were a slower rider. The cycle gate was recognised to indicate that cyclists should proceed to the front of the queuing traffic. However, one participant stated that they would get into the cycle reservoir any way that they could, on the left or the right, not necessarily using the cycle gate.

*"Generally speaking I would get into that junction [cycle reservoir] any way I could...I wouldn't worry... if the line was broken or not"*

All participants commented that they used the LLCS on the left. One participant commented that when waiting in the designated area to turn right in a large group of cyclists it was difficult to see the lights (this was at Arm D, when LLCS were only provided on the left hand side). Some participants suggested that LLCS should be provided on both sides, though one participant commented that on Arm D it was fine just to have the LLCS on one side. Another commented that the light was on the left and that they had to look right round to see it rather than ahead.

It was suggested that at a large junction repeater lights would need to be provided for cyclists. Another participant commented that they always looked at the main traffic signals but thought that it was handy to have personal signals at their level.

*"If you're right at the front [of the cycle reservoir]... you're completely looking left...I thought that it was ridiculous"*

Two comments were made specifically regarding Arm A. The first was that not all participants could see the low level lights, particularly if they were in the middle of the pack of cyclists. The second comment was related to the fact that not all participants had realised there were lights on both sides.

### **Car drivers**

#### **FG 4: Car drivers, 7.5m reservoir**

Most participants stated that they had no difficulty seeing the signals and they would always notice them if they were at the front of the queue:

*"[Perhaps not for] the subsequent cars in the queue, but if you were the first or second [I would be able to see them]"*

One participant commented that the position of the main signal head meant that they had to crane their neck to see it; they also said that they did not like to rely on the secondary signal so seeing the main signal was important. Another participant agreed with this.

#### **FG 5: Car drivers, 10m reservoir**

There were mixed views regarding the visibility of the LLCS with some drivers thinking it beneficial to see them, whilst others thinking the opposite.

Six participants thought that the traffic lights were imposing, with one stating they felt that the traffic lights were high at the front. One participant noted they could not easily view the traffic lights when sat at the front of the cycle reservoir.

### **F.2.5 Using the LLCS when moving off through the junction**

#### **Cyclists**

#### **FG 1: Cyclists, 5m reservoir**

All participants agreed that when moving forward following other cyclists they checked the LLCS as they went past them:

*"[I would look at the signals] as I went past"*

Regarding the whole junction and the early release, one participant said that the main positive for her was:

*"Having the opportunity to get the momentum going, and wobble about a bit [before the car came]"*

For going straight on, about half thought the early release was long enough, whereas the others said they would have preferred more time. In total six thought that the early release was useful, and three thought it was unnecessary:

*"Liked it so I could get the momentum of going before the car started coming"*

Of all participants, one stated that he occasionally jumped lights in his normal behaviour and said that the junction layout he experienced today would be enough of a benefit to encourage him not to jump the lights if they were properly explained.

*"If you knew that you had an early start, if it was a general thing that cyclists had an early start it's probably less likely that people would be jumping the lights"*

## FG 2: Cyclists, 7.5m reservoir

Three participants stated that they would skip red lights, whilst some cyclists went on amber.

## FG 3: Cyclists, 10m reservoir

With respect to the timing of the LLCS, all participants noticed the early release and all liked it.

*"I liked the early start"*

*"It is good that cycles have a bit of an edge on oncoming traffic"*

However, one person commented that if they were at the back of a group of cyclists, they would be more inclined to follow the person in front rather than checking the LLCS. Seven of the group suggested that car drivers wouldn't notice the cycle lights.

Five people commented that they trusted the LLCS on their first attempt with the other three commenting that they treated them with caution. One person felt that if they had been alone at the LLCS they would not have known what to do. If other people were there and they went, then they would follow.

*"You end up just following like a sheep"*

Another person commented that although the LLCS are there to assist cyclists they were unlikely to totally trust them.

One participant admitted to jumping red lights in their normal behaviour and suggested that this layout would not change this. One cyclist admitted that it probably wouldn't stop them from jumping red lights.

## Car drivers

## FG 4: Car drivers, 7.5m reservoir

They all noticed that the LLCS had an early release and most of the participants stated that they used the LLCS to give them an early indication that the main signals were about to change and got into gear.

Two drivers thought that once they had got used to the early release they might go when the LLCS turned green, rather than wait for the main signals to turn green:

*"[If I was in a rush], I could see [myself] thinking 'it is going to go green in a minute anyway... [and the other signal] must have gone red'. It would be very tempting [to go with the cycle signals]."*

Another participant agreed with this sentiment and went on to say that people could also inadvertently go when the cycle signals were on green and the main signals were on red:

*"[I may go through the signals] if there were no cyclist there, and [if I was] tired or distracted... [I may] just see a green light and go"*

Most participants thought that motorists may get frustrated by the delay, particularly if there were no cyclists in the area. It was also noted by one participant that he did not mind the 2 second delay but found the 4 second delay frustrating:

*"Motorists would get frustrated for seeing green time being given to non-existent cyclists... being held up for 2 to 3 seconds when there is no one there"*

*"I did think the difference between the 2 and the 4 seconds [made a difference to how frustrated I felt], because we did the 4 seconds one without any cyclists, and it was frustrating whereas with the 2 seconds I didn't mind."*

One participant felt that the 2-second delay did not give enough time for cyclists, so thought that it did not matter if the motorist was frustrated, the priority should be the safety of the cyclists.

When shown a picture of a left turning vehicle cutting across the path of a cyclist there was a general consensus that this type of accident was less likely to occur with the road layout they experienced:

*"We were never in that position [on the inside left when the car was turning left]."*

*"You really want to put... [the cyclists] in front of you because there are so many blind spots that [if they were anywhere else], you're going to miss them"*

However one driver was concerned that a cyclist arriving at the junction just after the car lights had turned green may enter the junction at speed on the inside of a car turning left.

All drivers stated that if the cyclists had not cleared the cycle reservoir within the early release time the drivers would still allow them to complete their manoeuvre before entering the junction themselves.

#### **FG 5: Car drivers, 10m reservoir**

One participant suggested that at best, LLCS will be ignored and at worst someone will jump the lights.

One participant liked the time lag between cyclists and vehicles receiving a green light.

*"I liked the fact that there was a time lag between the time when the lights changed for the cyclists"*

Three participants commented that when the cyclists' lights turned to amber this told them to get ready to go.

### **F.2.6 Turning right at the junction**

#### **Cyclists**

#### **FG 1: Cyclists, 5m reservoir**

There was a general concern amongst the group about the right hand turn, with some participants suggesting that they followed other cyclists and turned right in front of the car, assuming that they had priority.

One participant, who was a regular commuter cyclist, was unsure of the priority turning right and only became sure after using the junction a few times. The first time she entered the junction she was following the other participants and did not look at the signals and assumed she had right of way:

*"I am most defiantly concerned, in a real life situation the four of us at the back [of the group turning right] would have been [knocked] off our bikes"*

Four participants agreed with this sentiment:

*"For cyclists turning right, they gave a false sense of security"*

*"The first couple of times I did not know the car was going to move, I really thought I had right of way."*

Another participant stated that he was not sure if the lights had given him priority:

*"In a real world situation I would hang back"*

Two participant stated that it was obvious that they did not have right of way over the oncoming vehicle:

*"[I didn't go because I] saw [the approaching car] coming"*

*"These are our lights, we will obey these ones, but if cars are coming we've still got to give way."*

One cyclist suggested that the right of way would be more obvious with a filter arrow for turning right. Another suggested that some kind of road marking would be necessary to make it obvious that cyclists did not have priority when turning right.

There was an agreement from most participants that after a few runs they took more care when making the right turn:

*"The right turn made you watch more, the straight on [movements] I did not watch as much"*

When turning, some seemed to think that a longer early release would allow them to get off in front of the car but others recognised that unless they had a dedicated right turn a longer early release would make the priority more ambiguous.

## **FG 2: Cyclists, 7.5m reservoir**

The facility was thought to be beneficial for cyclists turning left or travelling straight ahead, however there was some debate as to their suitability for turning right. Seven participants stated that they turned right in front of the car, but only when oncoming cars were stationary. Two participants explained that they were unsure of approaching vehicles and would be inclined to wait and see what the vehicle would do prior to turning right. It was agreed that there should be more of a gap to let cyclists go through. One participant stated that when turning right they definitely needed to know how much time they had.

## **FG 3: Cyclists, 10m reservoir**

The potential conflict with oncoming motor vehicles when turning right at the junction was considered an issue.

When the cycle light turned green, one participant assumed that the oncoming cars would be held and it made them jump when the car proceeded. They had assumed that the green bike light was a filter light, when cyclists were turning right and cars were travelling straight on. Another participant, when turning right, would judge the car and try to get ahead of the car coming the opposite way. Two participants thought that they had priority over oncoming cars when turning right. Another participant commented that they had followed the other cyclists and when there was a car coming they had then assumed that they had priority. For the large group it was considered difficult manoeuvring over to the centre when turning right from Arm D, because there were cars coming from behind as well.

Various suggestions were made to assist cyclists making a right turn: erecting a sign up to warn cyclists of oncoming traffic; providing a central box / lane in the centre of the carriageway; painting 'give way' markings in the centre of the junction for cyclists.

### **F.3 Attitudes**

#### **F.3.1 Perceptions of safety**

##### **Cyclists**

##### **FG 1: Cyclists, 5m reservoir**

Participants were generally favourable of the combination of LLCS, cycle reservoir and early release, suggesting that it provided cyclists with increased space and time leading to a safer environment for cyclists.

##### **FG 2: Cyclists, 7.5m reservoir**

All focus group participants said they felt safe acting on the LLCS green signal. Participants recognised that the facility would improve the situation for cyclists, for example by increasing their confidence and feelings of safety.

##### **FG 3: Cyclists, 10m reservoir**

All participants agreed that the facility made it safer for cyclists. Seven of the participants thought that it made it easier for cyclists whilst the remaining participant felt it was more difficult entering the cycle reservoir.

*"Getting in to the box can be tricky"*

##### **Car drivers**

##### **FG 4: Car drivers, 7.5m reservoir**

Car drivers were generally positive about the layout, they felt that the design was intuitive and was a safety improvement for cyclists.

All participants thought that allowing the cyclists to go first was a positive thing, some saying that this was because it separated their movement from the car movement and it made their intentions clearer:

*"[It was safer because] the lights allowed the cyclist to go before I was even on the move"*

*"It makes it clearer about where they are going and what they are doing"*

All participants agreed that the presence of the cycle lights made them more aware of cyclists and one participant thought that it would make them more aware of cycling in general.

##### **FG 5: Car drivers, 10m reservoir**

The time delay was considered safe and beneficial through separating out cyclists and motor vehicles. It was also felt that the LLCS facility made car drivers think more about cyclists.

One participant commented that it would make you feel more comfortable with LLCS provided at junctions whilst another stated that they would feel safer.

*"I'd feel more comfortable at a busy junction with lights like that"*

Individual views expressed were that: LLCS made it a lot safer for cyclists going straight ahead with cars turning left; they have good potential; they would make cycling safer; provision of LLCS is not a huge sea change, but would help to highlight cyclists.

One participant felt safer using a junction with LLCS whilst another commented that it felt safe, but not more or less than normal.

*"Not particularly more or less safe than I would with a current cycle box. I don't know whether the lights make it a hell of a lot safer"*

### **F.3.2 Willingness to cycle**

#### **Cyclists**

##### **FG 1: Cyclists, 5m reservoir**

When asked if this infrastructure would make them more likely to cycle in urban areas two participants suggest that it would make a difference:

*"I'd still use them [roads], but probably feel a bit safer"*

*"If there was something like that at a junction I'd probably stay on the road, [rather than cycle on the pavement]"*

However there was general agreement between four participants that they would need to be part of a wider set of measures, such as segregated cycle lanes:

*"It is all very well having the junction [made safer], but how do you get to that junction?"*

*"You've still only got a white line which separates you from the traffic"*

##### **FG 2: Cyclists, 7.5m reservoir**

Three participants stated that provision of this sort of facility would make them more likely to cycle, with a further participant stating that drivers would be more likely to 'see' them. Two participants commented that it gave increased priority to cyclists.

*"cars can see you and...cyclists are noticed more"*

Although three participants thought that LLCS would encourage them to cycle in London, none of the participants felt it was safer for children or that the provision of LLCS would make a difference for children.

##### **FG 3: Cyclists, 10m reservoir**

It was noted that LLCS provision should make cycling safer, but there was no consensus as if that would encourage more people to cycle in London.

*"Improving road safety is obviously going to encourage more people to ride"*

*"This will make it safer but I don't know how much more that's going to make people go out and get bikes and ride"*

One participant referred to a junction that they use daily, Blackfriars Bridge, which is noted to be extremely dangerous in the morning with approximately 30 cyclists waiting to enter the bridge at any one time. The participant felt that the provision of LLCS at this junction would be an excellent improvement.



### Car drivers

#### FG 4: Car drivers, 7.5m reservoir

Most participants suggested that, whilst it was a help to cyclists, the intervention would not make a difference to how much they cycle personally.

#### FG 5: Car drivers, 10m reservoir

No strong views were expressed either way as to if the layout would encourage cycling for adults and children in London.

One participant stated that they would not be more or less likely to cycle. Two participants advised that provision of LLCS would not make them cycle more.

*"I don't think that it would make me cycle any more, or less"*

*"It makes you feel marginally less worried maybe, about your children being on the road"*

### F.3.3 Concerns

#### Cyclists

#### FG 1: Cyclists, 5m reservoir

There was an agreement that they should not be installed on faster roads. One user suggested that installing them in congested areas was likely to make congestion worse, whereas other participants said that they would be of most use in congested areas.

One participant thought that it would not work in isolation and that there would need to be a coherent roll out of the infrastructure for it to be effective.

There was a general consensus that on its own it was only a small improvement that would need to form part of a wider cycling improvement to make a real difference.

*"A step in the right direction"*

#### FG 2: Cyclists, 7.5m reservoir

One participant noted that if the cyclist in front is not paying attention there was the chance a cyclist behind could go into the back of them.

One participant suggested that provision of the facility would be too confusing at pedestrian crossings.

One participant suggested, from the perspective of a motorist, having a group of cycles in front would slow the traffic down.

*"Waiting for them all to clear before you can get off will slow traffic down"*

#### FG 3: Cyclists, 10m reservoir

Trying to access the cycle reservoir was considered to be tricky if there was queuing traffic. It was suggested that the additional provision of a cycle lane, marked by a solid white line, which led into the cycle reservoir would be helpful, though one participant commented that they would feel vulnerable as a cyclist if there was queuing traffic. This may be alleviated by having penalties for cars blocking the cycle path.

The facility was considered useful at busy junctions and accident black spots. However, concern was expressed that there would not be enough space in the centre of the junction if there were lots of cyclists turning left / right.

Mixed views were expressed regarding the LLCS. They were considered by some as a positive asset, but other participants said that they didn't trust them and wouldn't rely on them.

### **Car drivers**

#### **FG 5: Car drivers, 10m reservoir**

There were queries regarding the capacity of the layout with respect to large groups of cyclists.

One participant suggested that LLCS may cause more traffic congestion if too much green time was re-allocated to the early release.

*"Would it cause more traffic if people have got to wait another four seconds each time?"*

Three participants thought that the early release was sometimes not long enough.

### **F.3.4 Suggestions**

#### **Cyclists**

It was suggested that sensors in the cycle reservoir could identify if there were cyclists present and activate an early release, which would help to prevent any delay to vehicles if there were no cyclists present in the cycle reservoir.

One participant commented that the LLCS timing should be uniform if installed across the whole scheme in that all LLCS should be set to give an early release. Another participant stated that when turning right you definitely need to know how much time you've got.

*"It needs to be uniform if it is ever implemented because then you know how much time you've got"*

It was suggested that a gap, perhaps a 'hatched' area was required between the vehicle stop line and the cycle reservoir. The cycle reservoir may be of a smaller size if that was the case. One participant stated that they felt unsafe when they were not in the cycle reservoir.

*"There needs to be a gap between the box and the car so that can actually see...the whole of that box"*

#### **Car drivers**

Suggestions made to improve the facility were the provision of a countdown sign and sensors to implement the time delay only when cyclists were present.

A variety of comments were made regarding the best locations for LLCS, including: where there are a lot of cyclists; where bunching of cyclists occurs; in city centres; where there are existing cycle lanes; on cycle routes.

It was suggested that LLCS should all be set at the same time for all sets of lights, whereas others thought that there could be different early releases at different junctions.

*"If you keep [the early release] the same every time it will cause more traffic"*

*"I think some car junctions have different durations to let the traffic through, so I don't see why cyclists couldn't have the same consideration maybe"*

One participant suggested the addition of a sensor box would help to tell when a cyclist was in the cycle reservoir whilst another commented that use of the LLCS could depend on the time of day and the traffic flow.

One participant commented that a time countdown could be provided on the motorists lights.

One participant suggested that there should be a more imposing position for the LLCS, although another contradicted this idea.

### **F.3.5 Trial realism**

#### **Cyclists**

General comments from all of the cyclist focus groups were that the trial could have been improved by having more vehicles on the track and more variations in manoeuvres. Including more road users at the same time was also suggested.

#### **Car drivers**

Car drivers generally agreed that it would be useful to have other participants on the trial as well and that it would have been good to have the cyclists approaching the junction behind the car. Manoeuvres that involved overtaking cyclists and increasing the number of cyclists were also suggestions made to increase the realism of the trial.