The value of measuring cycling diversity as well as cycling volume: a case study from South London.

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AG designed the study, and AG and CM designed and supervised the data collection. AG led on data analysis and all authors contributed to the report. The authors take full responsibility for the work presented here, and all the opinions expressed are solely their own.

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The cover photographs are of the Dulwich LTN.

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Executive Summary

In 2020, 'Low Traffic Neighbourhoods' (LTNs) were implemented widely across London. Emerging evidence suggests these measures may increase levels of cycling, but little or no information has been collected on how they affect the demographic profile of cyclists. This report assesses a) changes in cycling levels and b) current levels of cycling diversity in four new LTNs in South London.

Two separate 12-hour manual counts were carried out in late March and late April 2021 at four sites in new LTNs and four matched control locations. This data was compared with data from 2018 and 2019 manual counts by the Department of Transport to assess changes in numbers of cyclists.

Compared to counts conducted in 2018/19, cycling increased at all intervention sites (+80% pooled). However, cycling also increased at all control sites (+41% pooled). Only two intervention sites had an increase that was statistically significantly larger than the matched control. The pooled effect for the increase in intervention sites versus control sites was a rate ratio of 1.26 (95% confidence interval 0.77 to 2.06), i.e. a positive trend that was not statistically significant. This indicates the need to collect further evidence regarding the impact of LTNs on cycling volumes, and the importance of using control groups when doing so.

Taking a case study approach, we contrasted the two intervention sites with the largest cycling increases (Dulwich and Walworth). These two sites were strikingly different in the composition of cyclists and the likely causes of cycling increase. The Dulwich intervention site had the highest proportion of women and of children among cyclists, and comparisons with historic data suggested that increased cycling to school made an important contribution to the observed 71% increase in total cycle numbers.

By contrast, the Walworth intervention site stood out for a very high proportion of delivery bikes (37%). This seemed likely to have contributed to the observed 237% increase in total cycle numbers at the site and also (because almost all delivery cyclists were men) contributed to Walworth having the lowest observed proportion of women and children among cyclists.

We conclude that LTNs may increase cycling levels, but the magnitude and the nature of the increase is likely to differ between sites. Collecting data on cycling diversity as well as cycling volumes allows assessment of equity impacts, and can deepen understanding of how and why cycling is changing at a specific site.

1 INTRODUCTION AND RESEARCH AIM

'Low Traffic Neighbourhoods' (LTNs) are area-based interventions that reduce or remove through motor traffic from residential areas. They do this using 'modal filters' that restrict motor vehicles while allowing access for pedestrians and cyclists. In London, 72 Low Traffic Neighbourhoods (LTNs) were built in March-September 2020, covering around 300,000 people (4% of London's population).[1] LTNs aim to discourage driving and simultaneously to create safer and more pleasant walking and cycling environments. An example of an LTN is provided in Figure 1. 2020 also saw the implementation of other emergency infrastructure to support cycling, e.g. new cycle tracks.

Figure 1: An example of a low traffic neighbourhood in Walworth, Southwark.

Left side: New modal filters in 14 places (orange dots) create two low traffic neighbourhoods (red) in Walworth, South London. All homes can be accessed by motor vehicle, but one cannot drive straight through the area. Right side: An example of one of the Walworth modal filters, which blocks motor traffic while allowing pedestrians and cycles to pass freely. This modal filter uses physical barriers, but other modal filters are enforced with cameras. Photo credit: Crispin Hughes

[1] Aldred, R., Verlinghieri, E., Sharkey, M., Itova, I. & Goodman, A. Submitted. Equity in new active travel infrastructure: a spatial analysis of London's new Low Traffic Neighbourhoods. Available from https://osf.io/preprints/socarxiv/q87fu/

Initial evaluations conducted by the London boroughs of Lambeth have reported cycling increases inside new LTNs (range +10% to +117%, across five LTNs) [2] but have not used control groups to adjust for background changes in cycling levels during the pandemic. [3] One small longitudinal survey of Outer London found that residents in new 2020 LTNs reported improved perceptions of the quality of the local environment for cycling but had not increased their cycling levels relative to a control group.[4] Thus while existing findings are broadly encouraging, they remain mixed and inconclusive.

To date, local authority evaluations have measured cycling using methods such as automatic traffic counters and A.I. camera sensors. These methods can, however, only capture total numbers of bicycles, providing little or no information as to the type of people or bicycles involved. From an equity perspective this is unfortunate. Most low-cycling settings have hitherto seen cycling disproportionately undertaken by adult men, whereas in high-cycling settings cycling is much more equal by age and gender.[5] Examining cyclist diversity can therefore be valuable in assessing how far new measures are making cycling more inclusive. It may also deepen understanding as to how and why cycling is changing at a given site.

In this report, we examine a) the change in number of cyclists and b) current cyclist diversity at four south London LTN sites, compared to matched controls.

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[2] Reports available from https://beta.lambeth.gov.uk/streets-roads-transport/low-traffic-neighbourhood-monitoring-reports . In addition, an evaluation of the St Peter's LTN in Islington found no change in cycling before versus after the LTN was implemented, but was based on comparing June 2020 to November 2020 rather than comparing neutral months. We are not aware of any other published monitoring and evaluation reports of 2020 LTNs that estimate changes in cycling volumes.

[3] The utility of London-wide monitoring data to assess background trends is unfortunately the limited by the fact that most automatic cycle counters are in central London and on main roads. Data compiled from these sources in Autumn 2020 indicated a shift in the type of cycling being done (less commuting, more leisure) and perhaps an increase in total cycling levels (TfL, Travel in London 13). The Department for Transport's Road Traffic Statistics estimate a 38% increase in cycling in London in 2020, relative to the average for 2017-2019 (table TRA0413 from https://www.gov.uk/government/statistics/road-traffic-estimates-in-great-britain-2020). However national evidence suggests that much of this increase may have been concentrated in April-June 2020. In March and April 2021, weekday cycling levels nationally were similar to their pre-pandemic baseline levels (https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic).

[4] Aldred, R. & Goodman, A. 2021. The Impact of Low Traffic Neighbourhoods on Active Travel, Car Use, and Perceptions of Local Environment during the COVID-19 Pandemic. *Findings* (March). doi.org/10.32866/001c.21390

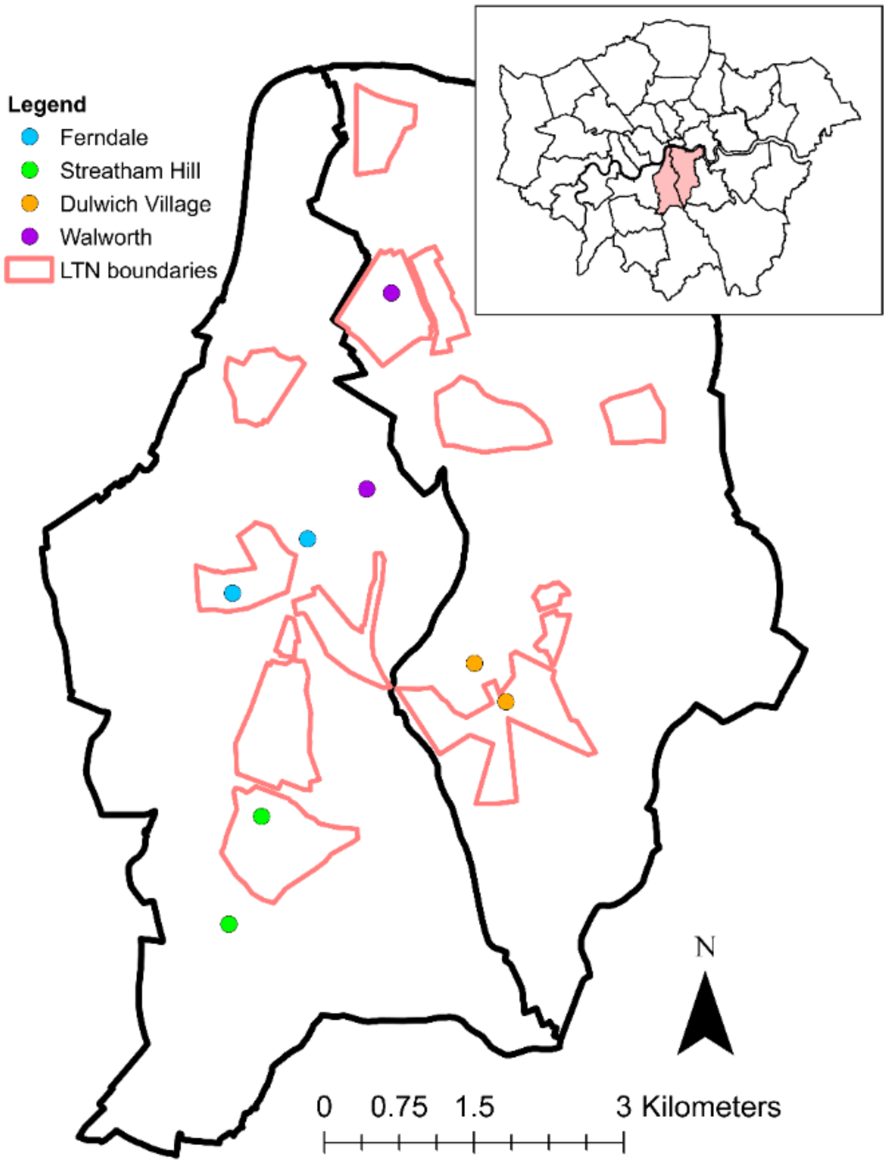
[5] Goel, R., Goodman, A., Aldred, R., Nakamura, R., Tatah, L., Garcia, L. M. T., . . . Woodcock, J. (2021). Cycling behaviour in 17 countries across 6 continents: levels of cycling, who cycles, for what purpose, and how far? Transport Reviews doi: 10.1080/01441647.2021.1915898

2 RESEARCH METHODS

2.1 Sources of 'Before' Data

The UK Department for Transport routinely performs 12-hour manual counts (7am-7pm) on a random sample of minor roads.[6] In 2018 and 2019, counts were performed at 38 sites in the boroughs of Southwark and Lambeth. Four of these were in areas where 'low traffic neighbourhoods' were subsequently created in 2020 ('intervention sites'), and a further four were selected as matched 'control sites' (see Figure 2, plus Appendix 1A for details). We used this as baseline data.

Figure 2: Eight intervention and control sites across Lambeth and Southwark, with associated low traffic neighbourhoods



LTN = low traffic neighbourhood. The main map shows the observation sites in the borough of Lambeth and Southwark. The inset map shows these two boroughs in Greater London.

[6] Data available from https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints

2.2 Collection of 'After' Data

At each intervention and control site, we conducted two follow-up 12-hour manual observations (7am-7pm) in late March 2021 and late April 2021. For each passing bicycle, enumerators recorded the following characteristics: the cyclist's estimated age and sex (categories: adult male, adult female, child aged 0-10, child aged 11-17); the number of children being pulled/carried, e.g. in a bicycle seat; and whether the bicycle was a cargo bicycle (yes/no), a mobility-adapted bicycle (yes/no), or a branded delivery bike (yes/no, category first added April 2021). See Appendix 2 for the data collection form.

Pairs of intervention and control sites were always surveyed either on the same day or on sequential days. All observations, both in 2018/19 and in 2021, were made on weekdays during school termtime,[7] with dry weather or at most brief rain.

2.3 Reliability and consistency across time

During two hours in which five enumerators simultaneously recorded cycles independently, we found relatively high agreement for the total number of cycles (range 235-238); for the proportion of women (range 44%-46%); and for the proportion of children (range 22%-24%).

We examined the correlation between repeat 12-hour observations conducted at the same site approximately 4 weeks apart. Correlations were high, despite Covid-19 lockdown rules easing in the interim[8]: 0.99 for the total number of bicycles, 0.96 for the proportion of women and 0.98 for the proportion of children. This suggests that the characteristics of cyclists were relatively stable between March and April 2021, and informed our decision to pool data across these two time points in the analysis.

2.4 Data Analysis

We used negative binomial regression to examine baseline/follow-up differences in the number of bicycles between matched pairs. We used Poisson regression with robust standard errors to examine differences between pairs in (i) the proportion of adults who were women, and (ii) the proportion of people on bicycles who were children (including children being carried). We estimated effects separately for each matched pair and combined effect sizes using random effects meta-analysis.[9]

[7] In transport research, weekdays from March - October during school termtime are treated as "neutral" days, as travel behaviour is fairly constant across that period. Of course, in 2021 this neutrality was disrupted by the Covid-19 pandemic.

[8] In late March 2021, schools and colleges were open but non-essential shops were closed. From mid-April 2021, all shops were open, as were pubs and restaurants for outside dining.

[9] A pooled analysis that combined the individual-level information from all sites would be expected to produce an unbiased estimate of total changes across Lambeth and Southwark, because it is based on a random sample of four intervention points. It would, however, be very sensitive to the trends at sites with more cycles. I^2 values capturing between-site heterogeneity indicated significant variation between the sites. We therefore chose instead to use a random effects meta-analysis approach to combine results from across the different sites. This approach gives more weight to larger sites than to smaller sites, but to a less marked degree than would be the case simply from pooling the individual data. In a random-effects meta-analysis each site is effectively given weight proportional to the square root of the number of cycles observed, as opposed to a pooled estimate which gives each site weight in proportion to the raw number of cycles observed. This method can be thought of as estimating what happens in a 'typical' intervention versus control site.

3 RESEARCH FINDINGS

3.1 Total Number of Cycles

Cycling increased at all intervention sites (range +20% to +237%, or +80% pooled: Table 1). However, cycling also increased at all control sites (range +17% to +76%, +41% pooled), and only two intervention sites had an increase that was statistically significantly larger than the matched control. These were Dulwich (rate ratio 1.46, 95%CI 1.26 to 1.68) and Walworth (rate ratio, 95%CI 2.05 to 3.35). The variability across the intervention-control pairs explains why the pooled effect after meta-analysis was not statistically significant (rate ratio 1.26 for the increase in intervention sites versus control sites, 95% CI 0.77,2.06).

This indicates the need to collect further evidence regarding the impact of LTNs on cycling volumes, and the importance of using control groups when doing so.

Table 1: Number of bicycles counted in 12 hours (7am to 7pm) at the 8 sites, at baseline and follow-up.

Site ID (low traffic neighbourhood)	N at baseline (2018/19)	Average N at follow-up (March + April 2021)	% change	Incident rate ratio, Int vs Con
Ferndale intervention site Control for Ferndale	41 34	49 60	20% 76%	0.68 (0.40, 1.15)
Streatham Hill intervention site Control for Streatham Hill	115 156	166 263	44% 68%	0.86 (0.65, 1.13)
Dulwich intervention site Control for Dulwich	901 528	1539 619	71% 17%	1.46 (1.26, 1.68)
Walworth intervention site Control for Walworth	147 296	496 381	237% 29%	2.62 (2.05, 3.35)
All Intervention sites All Control sites			80% 41%	1.26 (0.77, 2.06)

Average follow-up N based on pooling results from March and April 2021. In the analyses of ‘All intervention/control sites’, the % change figures and rate ratios are calculated from a random effects meta-analysis of the four separate interventions/control sites above. Random-effects rather than fixed-effects models were used because I^2 tests provided strong evidence (all p<0.001) of heterogeneity between the sites.

3.2 Cycle diversity across the eight sites

Variation between sites was also apparent with regard to cyclists’ characteristics. Although overall there was a trend towards a higher proportion of women, children, cargo bikes and delivery bikes at intervention sites, this pattern varied considerably across the intervention-control pairs and the pooled estimate was only statistically significant for cargo bikes (Table 2).

Across 192 hours of data collection at the eight sites, and 7143 cycles, we did not observe a single mobility-adapted bicycle. This indicates that cycling in these areas of South London is currently far from inclusive for people with disabilities.

Table 2: Characteristics of bicycles and people riding them in 2021 (March + April pooled)

Site	% females among adult cyclists			% children among people on cycles			% cycles that are delivery bikes (April only)			% cycles that are cargo bikes		
	N	%	Rate ratio, Int vs Con	N	%	Rate ratio, Int vs Con	N	%	Rate ratio, Int vs Con	N	%	Rate ratio, Int vs Con
Ferndale intervention site	95	32%	2.12 (1.25, 3.60)	100	5%	0.76 (0.26, 2.26)	47	2%	0.20 (0.02, 1.61)	98	1.0%	-
Control for Ferndale	114	15%		122	7%		56	11%		120	0.0%	
Streatham Hill intervention site	297	28%	0.96 (0.76, 1.20)	336	12%	3.82 (2.17, 6.72)	170	5%	4.76 (1.31, 17.38)	331	1.2%	2.11 (0.48, 9.4)
Control for Streatham Hill	510	30%		526	3%		270	1%		525	0.6%	
Dulwich intervention site	2462	37%	1.36 (1.22, 1.52)	3177	23%	1.28 (1.11, 1.46)	1606	0.2%	0.56 (0.09, 3.37)	3077	1.5%	2.64 (1.2, 5.84)
Control for Dulwich	1028	27%		1248	18%		604	0.3%		1238	0.6%	
Walworth intervention site	964	21%	0.62 (0.53, 0.73)	997	3%	0.82 (0.51, 1.33)	521	37%	5.48 (3.77, 7.97)	992	0.9%	6.91 (0.88, 54.48)
Control for Walworth	741	34%		772	4%		412	7%		762	0.1%	
All Intervention sites		30%	1.10 (0.69, 1.76)		11%	1.38 (0.77, 2.47)		10%	1.71 (0.43, 6.87)		1.3%	2.79 (1.44, 5.42)
All Control sites		27%			8%			7%			0.3%	

Note that this table shows raw numbers for the sum of March + April 2021, and numbers are therefore approximately twice as big as in Table 1 which shows the average of March and April. The numbers also differ slightly as Table 1 shows the numbers of cycles. By contrast this Table shows: numbers of adult cyclists (i.e. excluding children) to look at % females; number of people on bicycles (i.e. including carried children) to look at % children; no. cycles in April only (i.e. excluding March, when this information was not recorded) to look at % delivery bikes; and no. cycles (i.e. same as Table 1) for % cargo bikes. In the analyses of ‘All intervention/control sites’, the combined % and combine rate ratios are calculated based on a random effects meta-analysis of the four separate sites above. Random-effects rather than fixed-effects models were used because I^2 tests provided strong evidence (all p≤0.002) of heterogeneity between the sites.

3.3 Contrasting cycling profiles: a case study approach

Taking a case study approach, we built on our observation of inter-site variation to contrast the two intervention sites with the largest cycling increases.

Dulwich case study

Across all eight sites, the Dulwich intervention site had the highest observed proportions of women (37% of adults) and children (23% of people on bicycles: Table 2 and Figure 3). These proportions were statistically significantly higher than at the matched control site.

Historic data on cycling to school suggests the Dulwich intervention and control sites did not greatly differ in the proportion of children cycling to school in 2011, and that modelled cycling to school potential is higher at the control site (see Appendix 1C).

Furthermore, during peak school run hours, the Dulwich intervention site had the largest cycling uplift of any site (+111% increase in numbers of cyclists during the hours 08:0-08:59 and 15:00-15:59, versus +6% at the matched control: raw data in Appendix 1D).

Taken together, this suggests that increased cycling to school made an important contribution to the 71% increase in total cycle numbers observed at the Dulwich site.

Walworth case study

The Walworth intervention site stood out for its very high proportion of delivery bikes (37% versus 0.2-11% in the other sites), mostly delivering take-away food. It is plausible that increased numbers of delivery bikes made an important contribution to the 237% increase in total cycle numbers at this site, particularly as the largest cycling uplift was during the hour when numbers of delivery bikes also peaked (cycle numbers increased 18-fold between 12-12:59 in Walworth, and 70% of cycles during this hour were delivery bikes: raw data in Appendix 1D).

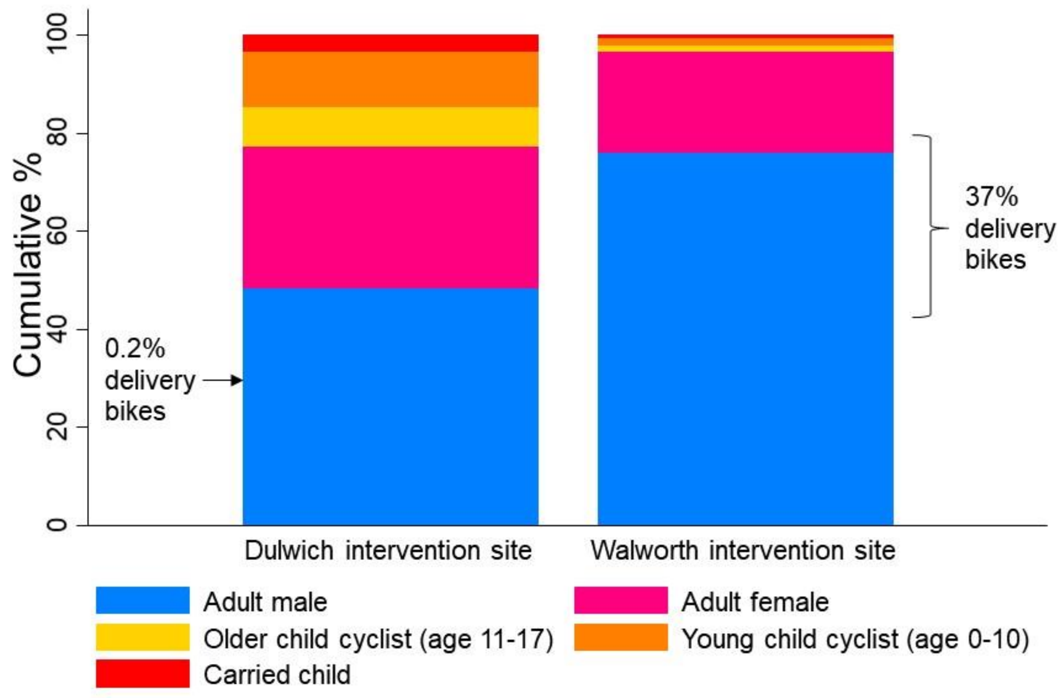
90% of the delivery bikes we observed in Walworth were ridden by men (91% across all eight sites). This contributed to the Walworth intervention site having the lowest observed proportion of women (21%) and children (3%: Figure 3).

Our findings therefore suggest that an increase in delivery cycling increased cycling volumes but decreased cycling diversity (by age and sex) in Walworth.

An increase in delivery cycling may have important road safety and pollution benefits if it replaces delivery driving and motorbiking.[10] As these results indicate, however, it may also increase the overrepresentation of adult men among cyclists. This highlights that one cannot assume an increase in cycling volumes necessarily translates into an increase in cycling diversity.

[10] Aldred, R., Johnson, R., Jackson, C., & Woodcock, J. (2021). How does mode of travel affect risks posed to other road users? An analysis of English road fatality data, incorporating gender and road type. Injury Prevention, 27(1), 71-76. doi: 10.1136/injuryprev-2019-043534

Figure 3: Comparison of the composition of cyclists in two intervention sites that showed a large increase in cycling.



% delivery bikes shown to scale and indicating the gender-split in each site (100% male in Dulwich, 90% male in Walworth).

4 CONCLUSION

The large increase in cycling at the Dulwich and Walworth sites indicates the potential for LTN measures to support increased cycling. However, the magnitude of such effects may vary considerably between sites, as indicated by the fact that cycling at our other two LTN sites did not increase more than their matched controls. This indicates the need to collect further evidence regarding the impact of LTNs on cycling volumes, and the importance of using control groups when doing so.

Although both Dulwich and Walworth saw substantial increases in total cycling numbers, the composition of cyclists and the likely drivers of change varied markedly - cycling to school was prominent in Dulwich, whereas delivery cycling was prominent in Walworth. This underlines the potential value of collecting information on cycling diversity as well as cycling volumes, to better understand how and why cycling is changing at a specific site. Such cycling diversity data would ideally be collected both before and after the implementation of new infrastructure, and we hope researchers and local authorities will consider this in future evaluations.

APPENDICES

APPENDIX 1A: Additional information on eight sites

Identification of intervention sites and matched controls

We identified all manual counts conducted by the Department for Transport on minor roads in Southwark and Lambeth in 2018 and 2019. [11] Four of these occurred on roads inside areas where new modal filters had substantially reduced traffic.

For each of these 'intervention' sites, we defined a matched control site as follows.

a) Select all points on C / Unclassified roads within 2km Euclidean distance.
b) Subset to those with 12-hour cycle counts +/-50% of the intervention site.
c) Amongst those remaining, choose the side most similar in terms of motor-vehicle volume.

We confirmed that all control points were, in our judgement, on roads that would be amenable to area-wide traffic reduction measures (in one case requiring a bus gate). None of the control points were on roads directly parallel to a road getting new traffic calming measures (which could artificially deflate numbers of cyclists at the control site if they simply diverted into new low traffic neighbourhoods). Nor were any control points on the same cycle desire line as a road inside a low traffic neighbourhood (which could lead to us double counting the same cyclist at different points on the same trip).

One control point in Dulwich was, however, on the same cycle desire line as new Streetspace timed modal filters that restricted northbound traffic 8-10am and 3-6pm on weekdays. This may have made cycling along this route more comfortable, and therefore tended to decrease the difference we observe. Unfortunately, we could not identify any more suitable control for the Dulwich intervention site from among the sites where counts had been conducted in 2018/19.

Comparison of characteristics of intervention sites and matched controls

Our eight intervention and control sites are described in Table A1. It shows that there was considerable variation between the sites with respect to daily traffic in 2018/19 (range 34 to 901 for bicycles counted). The sites also varied considerably with respect to area-wide characteristics like deprivation and car ownership, which ranged from the Dulwich intervention site (on the 13th deprivation percentile with 575 cars/1000 adults) to the Ferndale control site (on the 94th deprivation percentile with 168 cars/1000 adults).

In aggregate the intervention and control sites were reasonably similar. The total number of cycles counted in 2018/19 was 1204 in the intervention sites versus 1014 in the control sites. The mean deprivation percentile 56% and car ownership 299/1000 in intervention sites versus 59% and car ownership 257/1000 in control sites.

2019 data was available for one of the four intervention sites and two of the four control sites; the remainder of the data was from 2018. Note that between 2018 and 2019 the average daily number of cycle trips was estimated to increase by approximately 0.4% in Inner London.[12] As such, there are not expected to be large systematic differences between these two years.

[11] Data available from https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints
[12] https://content.tfl.gov.uk/travel-in-london-report-13.pdf

Table A1: Details of the eight sites

Study ID	DfT count point ID	Borough	Easting / Northing	2018/19 12-hour cycle count	2018/19 12-hour motor vehicle count	Deprivation percentile 2019 (higher = more deprived)	% cycling to work, 2011	Car ownership per 1000 adults, 2019	Dates of manual observations
Ferndale intervention site	942741	Lambeth	530427 / 175277	41	382	61%	10%	192	10/07/2019 ; 23/03/2021 ; 27/04/2021
Control for Ferndale	803663	Lambeth	531218 / 175819	34	407	94%	9%	168	25/04/2018 ; 24/03/2021 ; 26/04/2021
Streatham Hill intervention site	803661	Lambeth	530718 / 173042	115	1336	61%	7%	246	04/10/2018 ; 29/03/2021 ; 23/04/2021
Control for Streatham Hill	942751	Lambeth	530391 / 171964	156	2024	39%	6%	213	08/10/2019 ; 29/03/2021 ; 22/04/2021
Dulwich intervention site	801350	Southwark	533166 / 174190	901	4613	13%	11%	575	11/09/2018 ; 22/03/2021 ; 29/04/2021
Control for Dulwich	810983	Southwark	532851 / 174575	528	7716	27%	10%	396	06/09/2019 ; 22/03/2021 ; 28/04/2021
Walworth intervention site	804225	Southwark	532018 / 178282	147	3365	88%	10%	181	02/05/2018 ; 26/03/2021 ; 21/04/2021
Control for Walworth	803664	Lambeth	531771 / 176319	296	2146	76%	11%	250	26/09/2018 ; 25/03/2021 ; 20/04/2021

Data for count point 942741 is available from https://roadtraffic.dft.gov.uk/manualcountpoints/942741 ; with equivalent URLs for other count points, substituting in the appropriate count point number. Deprivation percentile calculated using the Index of Multiple Deprivation 2019, relative to the rest of London. % cycling to work taken from the 2011 Census. Car ownership per 1000 adults taken from DVLA statistics end 2019. All three measures calculated at the Lower Super Output Area (LSOA), these being Census geographies.

APPENDIX 1B: Data collection form

Time notes		Male adult (18+)	Female Adult	Child, 0-10	Child, 11-17		No. kids carried/ pulled	Cargo bike?	Delivery bike?	Mobility bike?
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	11									
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	28									
	29									
	30									
	31									
	32									

APPENDIX 1C: Estimation of the number of children cycling to school.

The 2011 National School Census recorded all state-maintained schools recorded pupils' usual main mode of travel to school. This, in combination with anonymized information on where pupils lived, was used to create the Propensity to Cycle Tool 'schools' layer.[13] This Tool models likely routes and estimates the number of children who cycled to school in 2011 on different road segments. It also estimates the number who would cycle in a "Go Dutch" scenario in which English children were as likely to cycle a given school trip as their Dutch counterparts. [14] We extracted these 2011 estimates for the road segments corresponding to Dulwich intervention and control sites (Table A2).

At both the sites, we also estimated the number of children cycling to state schools. We did this by conducting an additional observation from 07:15 and 09:15 on 30/03/2021, a day when state schools in the Dulwich area were open but private schools were on holiday.

Table A2: Estimated number of children cycling to state-maintained schools at the Dulwich intervention and control sites.

Site ID	2011 (baseline)		March 2021		
	Modelled actual number	Modelled "Go Dutch" cycling potential	Observed number	Ratio of increase from baseline	% relative to Go Dutch
Dulwich intervention site	10 (24 sens)	156	76	7.6 (3.2 sens)	49% (19% sens)
Control for Dulwich Village	12	438	16	1.3	4%

As shown in Table A2, the number of children at the Dulwich intervention site was 7.6 times greater than the modelled number from 2011, as opposed to only 1.3 times greater at its matched control, i.e. a relative difference of 7.6/1.3=5.8. This difference persisted even in a conservative sensitivity analysis that diverted to the Dulwich intervention site all plausible alternative routes to school in the 2011 baseline data (3.2-fold absolute increase at the Dulwich intervention site; 2.4-fold increase relative to its matched control).[15]

In addition, the number of children observed at the Dulwich intervention site was 49% of the modelled "Go Dutch" cycling potential (or 19% in the sensitivity analysis), as opposed to only 4% at the control site. The number of children cycling school was therefore considerably greater at the Dulwich intervention site than its matched control, relative both to modelled actual cycling levels in 2011 and also to modelled school cycling potential.

These findings should be treated with some caution, as the 'before' data from the Propensity to Cycle Tool is a decade old and is based on modelled rather than actual routes. Nevertheless, it does provide some evidence that our observation of more children cycling to school at the Dulwich intervention site was not simply a reflection of a long-standing trends and nor does it reflect the innate cycling potential of the site relative to its matched control. It therefore strengthens the case for beginning that increased cycling to school was an important contributor to the overall increase in cycling observed at the Dulwich intervention site.

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[13] Goodman et al. 2019.Scenarios of cycling to school in England, and associated health and carbon impacts: Application of the 'Propensity to Cycle Tool'. Journal of Transport & Health. 12, 263-278

[14] The "Go Dutch" scenario in the Propensity to Cycle Tool takes existing trip patterns from 2011 – i.e. existing home locations and school locations – and estimates the number of children who would cycle if English children were as likely as Dutch children to cycle a trip of a given distance. It can be thought of as estimating what would happen if one had the English trip patterns but a Dutch cycling culture and cycling infrastructure.

[15] Specifically, we assumed that no children came down Calton Avenue but then turned onto Gilkes Crescent before reaching the Dulwich intervention site on Calton Avenue; and that all children cycling on the section of East Dulwich Grove between Dulwich Village and Townley Road instead cycled via Calton Avenue.

APPENDIX 1D: Additional tabulation of raw data

Table A3: Characteristics of people on bicycles at all sites, pooling March 2021 and April 2021

Site ID	N	% carried children	% young child cyclists	% older child cyclists	% adult female cyclists	% adult male cyclists
Ferndale intervention site	100	2%	3%	0%	30%	65%
Control for Ferndale	122	2%	2%	3%	14%	80%
Streatham Hill intervention site	336	1%	6%	4%	25%	63%
Control for Streatham Hill	526	0%	1%	2%	29%	68%
Dulwich intervention site	3177	3%	11%	8%	29%	49%
Control for Dulwich	1248	1%	5%	12%	23%	60%
Walworth intervention site	997	1%	1%	1%	21%	76%
Control for Walworth	772	1%	1%	2%	33%	63%

These figures are tabulated for the Dulwich and Walworth intervention sites in Figure 2 of the main text.

Table A4: Number of bicycles per hour, for 2018/19 baseline versus 2021

Site ID		7	8	9	10	11	12	13	14	15	16	17	18	19
Ferndale intervention site	Baseline	7	6	2	1	3	1	4	1	2	7	2	5	7
Control for Ferndale	2021	3	3	2	3	2	4	5	6	7	2	7	8	3
Streatham Hill intervention site	Baseline	2	6	2	0	2	2	0	5	1	2	3	9	2
Control for Streatham Hill	2021	1	6	6	1	6	6	7	4	5	7	8	7	1
Dulwich intervention site	Baseline	22	22	12	5	4	7	4	2	4	9	11	13	22
Control for Dulwich	2021	15	26	9	10	8	9	11	12	20	13	13	21	15
Walworth intervention site	Baseline	23	32	13	4	7	5	7	9	6	10	16	24	23
Control for Walworth	2021	34	40	15	11	11	19	13	12	17	25	38	32	34
Ferndale intervention site	Baseline	124	179	43	18	27	26	22	23	80	84	122	153	124
Control for Ferndale	2021	160	357	73	53	37	59	62	58	191	187	181	124	160
Streatham Hill intervention site	Baseline	74	123	39	30	21	8	9	10	44	43	66	61	74
Control for Streatham Hill	2021	72	109	43	22	27	30	26	29	68	67	69	59	72
Dulwich intervention site	Baseline	21	33	6	7	8	3	9	6	15	12	16	11	21
Control for Dulwich	2021	28	34	39	28	35	55	35	35	46	49	57	57	28
Walworth intervention site	Baseline	22	53	23	17	17	11	19	23	17	18	35	41	22
Control for Walworth	2021	32	47	33	19	26	22	23	21	29	32	46	53	32

2021 values are the average across March and April 2021.