LTNs for all?

Mapping the extent of London's new Low Traffic Neighbourhoods

November 2020

Possible is a UK based climate charity working towards a zero carbon society, built by and for the people of the UK. Our Car-Free Megacities project seeks to build support for a near-future vision of Paris, London and New York in which no-one is dependent on private cars to get around our cities.

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Set up in September 2019, the ATA brings together a broad spectrum of expertise to lead research, teaching and knowledge exchange, with a focus on walking and cycling, use of other 'micromobilities' from e-scooters to electric hand cycles; and reduction in car use. The ATA contributes to addressing issues around air pollution, climate breakdown, an inactivity epidemic, road injuries and deaths, unequal access to transport and the loss of independent mobility in childhood and at older ages.

The mission of KR Foundation is to address the root causes of climate change and environmental degradation.

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This analysis, written by Professor Rachel Aldred and Dr Ersilia Verlinghieri of the Active Travel Academy, is the third report written as part of the Car-Free Megacities project funded by the KR Foundation and led by climate change charity Possible. It examines the location and geographical extension of LTNs introduced in London between March and September 2020, and disparities between boroughs. It also contains a demographic analysis comparing residents of residential streets and main roads/high streets in London. We would like to thank Irena Itova and Megan Sharkey which have contributed to the data collection, and Anna Goodman for contribution to the data collection and comments on drafts of the report.

Contents

Executive Summary

Low traffic neighbourhoods, or LTNs, are increasingly being used in London and other cities and countries to reduce through motor traffic in residential areas, aiming also to increase local walking and cycling. This report explains what LTNs are, what they look like, potential impacts and reasons for their introduction, and limits of this intervention. It then considers LTNs in London, and how equitably they are being introduced.

Specifically, we examine where in London LTNs have been put in place (between March and September 2020), and disparities between boroughs. In addition, we conduct demographic analysis of travel survey data comparing residents of residential streets (where LTNs are most likely to be implemented) and main roads/high streets. This compares four 'protected characteristics' under Britain's Equality Act: age group, income group, ethnic group, and disability status. Across all groups we compared, around nine in ten Londoners live on residential streets. Differences were negligible in Inner London, with slightly more disparities in Outer London. While LTNs have the potential to benefit the majority of Londoners in all groups, it is important also to introduce measures that benefit Londoners living on the 5-10% of roads where LTNs may not be possible, particularly in Outer London. Encouragingly, a look at traffic levels around an early LTN implementation in Walthamstow Village also suggests that traffic trends on the nearby boundary roads were little different to broader London trends.

Our analysis of LTN locations shows a borough lottery. Ten boroughs have either introduced no LTNs during this time or (in two cases) introduced them briefly and then removed them. Boroughs lacking LTNs are more likely to be in Outer London, where motor traffic rebound (and hence impact on residents) is strongest. Some of these ten boroughs have overall high levels of deprivation, making this a missed opportunity to provide mobility and public space for those in most need. But all London boroughs contain poorer areas where homes are more crowded and fewer own cars, which might particularly benefit from/need LTNs.

Ten boroughs have introduced substantial LTN-type measures[1]. City of London (atypical in many ways; highly commercial, with few residents) has introduced LTN-type measures in nearly half of the 'square mile'. Lambeth and Ealing had by the end of September each introduced more than three square kilometres of new LTN areas, each created with around thirty bollards, planters, or camera gates. Other boroughs that had already introduced LTNs pre-Covid continued to do so. Despite Hackney already having many LTNs, during March and September 2020 it covered another 14% of the borough in new LTNs, with more going in in October and longer-term plans to cover the whole borough.

We recommend that boroughs without LTNs introduce them. Boroughs should consider equity when developing and prioritising LTNs, given that LTNs may particularly benefit people living without access to private greenspace or local safe public spaces for playing and socialising. Although 7.7m of London's 8.5m residents live on the residential streets most amenable to benefit from LTN-type interventions, other interventions must be planned and implemented to improve roads where an LTN is not possible.

[1] We define LTNs later, but note here that not all these boroughs specifically describe these measures as 'LTNs'.

Introduction

Recent months have seen dramatic changes to ways of urban living. Many activities that form part of city life have stopped or changed drastically. People are travelling much less, and this, coupled with evidence of lower Covid-19 risks outside, has led to local outdoor spaces becoming more prominent as places to meet, socialise or exercise. Reduced public transport capacity to facilitate social distancing has made the need for safe walking and cycling environments even more important to avert damaging new growth in private car use.

With central business districts across the world still operating at a fraction of their usual strength, ideas for reviving local neighbourhood life, such as Barcelona's 'superblocks', Paris's '15-minute city' concept, New York's Open Streets[2], or London's 'low traffic neighbourhoods' have gained momentum. Many cities have adopted pedestrianization, temporary closure of streets to motor traffic, and re-purposing on-street car parking spaces. Already part of efforts to create a healthy urban environment and promote low-carbon transformations before Covid-19, such actions have now assumed even stronger value.

But what equity impact might these changes have? What do they mean for the future of our cities if they become more than temporary solutions? As often is the case, much depends on how new ideas and concepts are understood and put into practice. This is a chance to radically reimagine what - and who - public space is for. Across the world lower-income neighbourhoods struggle for space. Children are less likely to enjoy private greenspace - gardens, terraces or even small balconies. Homes are more overcrowded. Cars dominate even where less than half of all households own a car, as in many London boroughs. City parks are often concentrated in central areas serving tourists and the more affluent. In local areas, greenspace access is skewed by income. We don't all have formal parks nearby or private gardens, but we do all have streets, which in theory belong to all of us.

What measures such as low traffic neighbourhoods (LTNs) could - and should - do is redistribute that space away from

[2] NY Department for Transport. Open Streets Locations | NYC Open Data. [Accessed 3 November 2020]. Available from: https://data.cityofnewyork.us/Health/Open-Streets-Locations/uiay-nctu.

cars, towards people. Creating car-free and car-lite spaces in our neighbourhoods can be a low cost, rapid and efficient way to ensure that the many who have limited access to private gardens or urban parks, or who live in crowded flats or poor quality homes, can take a breath of fresh air, socialise maintaining a safe distance, play and exercise. Longer term, establishing spaces in which it is possible to safely walk and cycle, linked to a wider network of safe pedestrian routes and cycleways, is a key strategy to help enable a shift toward low-carbon mobilities.

While measures to reduce car use and enable active travel have multiple co-benefits, some policy goals may pull against each other in the shorter term. If we were primarily interested in reducing car use, this might suggest we should prioritise LTNs in richer areas, where car ownership and use is highest. This would have equity implications, as the people and neighbourhoods who might most benefit from LTNs would then be left behind; although indirectly they may benefit from wealthier people driving less. We need to understand better how the impacts of active travel measures vary by area of introduction, and to ensure that equity is considered alongside environmental criteria as part of a wider long-term vision for greener and more equitable cities.

About Low Traffic Neighbourhoods

What is a low traffic neighbourhood?

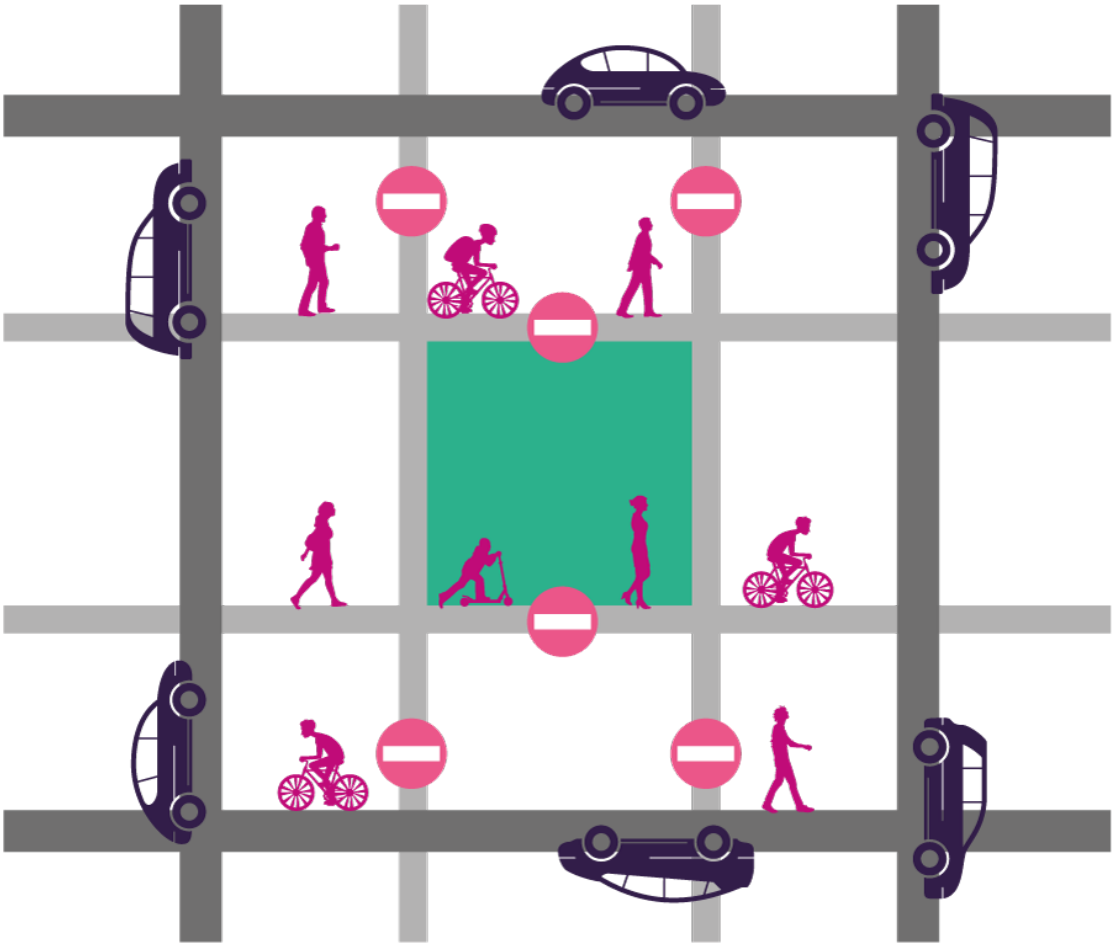
A Low Traffic Neighbourhood (LTN) is a group of residential streets where temporary or permanent measures restrict the passage of through motor traffic (driven by non-residents or by residents[3]). People walking, cycling, or using wheelchairs or mobility scooters can travel through the restrictions, as often can emergency vehicles (where for instance lockable bollards are used). Motor vehicles can still access all addresses within the area, including for deliveries and parking. Whilst they especially serve those living within the LTN itself, these new walkable and cyclable areas contribute to enlarging and complementing the available active travel network for other local residents.

The Netherlands adopted this approach decades ago, making it a core urban planning tool[4]. Academic expert Paul Schepers and colleagues call it 'unbundling'[5] (=separating active travel from car networks), describing the approach as a key reason for both the country's high rates of cycling and its high levels of cycling safety. Under different terminology the approach has been used in other European cities, for instance, Barcelona's 'superblocks' programme designates neighbourhoods in which cars have access, but cannot simply transit the area.

[3] In London there is one borough where borough residents are allowed to drive through camera-controlled gates. We consider this at best a borderline case, although we have included it in our dataset, as it forms part of the same wave of interventions between March and September 2020 on which this study is focused.
[4]Zee, R. van der 2015. How Groningen invented a cycling template for cities all over the world. The Guardian. [Online]. [Accessed 14 September 2020]. Available from: https://www.theguardian.com/cities/2015/jul/29/how-groningen-invented-a-cycling-template-for-cities-all-over-the-world.

[5]Schepers, P., Heinen, E., Methorst, R. and Wegman, F. 2013. Road safety and bicycle usage impacts of unbundling vehicular and cycle traffic in Dutch urban networks. European Journal of Transport and Infrastructure Research. 13(3). https://journals.open.tudelft.nl/ejtir/article/view/3000

Fig 1: LTNs are normally created by closing residential roads to through motor traffic.[6]



In previous decades, parts of London had already introduced patchwork measures using similar traffic infrastructure interventions. The Inner London borough of Hackney has since the 1970s closed a number of streets to through motor traffic, with controversies in neighbourhood forums at the time calling to mind more recent debates[7]. Some estates (council, social housing, or private) in London have had LTN-type characteristics designed in, such that cars may enter the estate to access parking, but unlike pedestrians (and often cyclists) drivers cannot cut through it. More recently, the Outer London borough of Waltham Forest has created low-traffic areas within its 'mini-Hollands' programme of walking and cycling interventions.

[6] Adapted from: https://healthystreetsharrow.wordpress.com/vision/low-traffic-neighbourhoods/
[7] Hackney cyclist 2015. The history behind the filtered permeability in De Beauvoir Town. [Accessed 3 November 2020]. Available from: http://hackneycyclist.blogspot.com/2015/10/the-history-behind-filtered.html.

Walking charity Living Streets[8] characterises LTNs as being:

> 'Places where through motor vehicle traffic has been removed or reduced – so only residents and [...] deliveries and services have access [...] networks of quieter streets where children play out, neighbours catch up, air pollution is lower, and walking and cycling are the natural choice for everyday journeys.'

Various strategies are used to implement LTNs, with the most common being bollards, planters, or traffic cameras which allow through permitted traffic such as buses or emergency service vehicles, as in the images below. Such measures are called 'modal filters' as they allow some 'modes of transport' through (e.g. people walking or cycling, buses in some cases) but not others (people in cars).

Modal filter in Southwark 2020.
Credit: Crispin Hughes.

[8] Rosehill Highways, Living Streets and London Cycling Campaign. 2020. Low traffic neighborhoods - A guide for policy makers. https://londonlivingstreets.files.wordpress.com/2018/09/lcc021-low-traffic-neighbourhoods-intro-v8.pdf

Why are LTNs introduced?

LTN are introduced for a number of reasons, mostly linked to reducing car use and/or increasing levels of active travel, including local walking and street-based activities such as playing and socialising with neighbours. If LTNs are able to reduce car use and/or increase active travel, this contributes to achieving other policy goals, related to health, environment, society, and economy[9].

Successful LTNs work through two mechanisms: firstly, making car use less convenient, and secondly, making walking and cycling more attractive. A study of pre-Covid London LTNs in Waltham Forest found evidence of both reduced car ownership and/or use, and even larger increases in active travel than those found in areas with new active travel routes but without LTNs[10]. This supports earlier research findings that cycling infrastructure can increase cycling uptake[11], especially for "inexperienced cyclists, women and younger cyclists"[12], whilst the attractiveness of walking environments and the availability of walking facilities can positively influence walking trips across all groups[13]. Research also finds that making driving more difficult, more expensive, or less convenient helps discourage driving and encourage the use of other types of transport[14]. Hence LTNs' dual mechanism ('carrot' of making walking and cycling more pleasant, plus 'stick' of driving becoming more difficult) might be expected to have a stronger effect than interventions doing only one of these[15].

Removing fear of motor traffic may be particularly important for getting people cycling. 66% of respondents in the most recent National Travel Attitudes Study agreed that '"It is too

[9] See e.g. http://www.nyc.gov/html/dot/downloads/pdf/dot-economic-benefits-of-sustainable-streets.pdf

[10] Aldred, R., Goodman, A., 2020. Low Traffic Neighbourhoods, Car Use, and Active Travel: Evidence from the People and Places Survey of Outer London Active Travel Interventions. Transport Findings 17128. https://doi.org/10.32866/001c.17128

[11] Goodman, A., Panter, J., Sharp, S.J., Ogilvie, D., 2013. Effectiveness and equity impacts of town-wide cycling initiatives in England: A longitudinal, controlled natural experimental study. Social Science & Medicine 97, 228–237. https://doi.org/10.1016/j.socscimed.2013.08.030

[12] Heinen, E., Wee, B. van, Maat, K., 2010. Commuting by Bicycle: An Overview of the Literature. Transport Reviews 30, 59–96. https://doi.org/10.1080/01441640903187001 (page 63)

[13] Sugiyama, T., Howard, N.J., Paquet, C., Coffee, N.T., Taylor, A.W., Daniel, M., 2015. Do Relationships Between Environmental Attributes and Recreational Walking Vary According to Area-Level Socioeconomic Status? J Urban Health 92, 253–264. https://doi.org/10.1007/s11524-014-9932-1

[14] Pucher, J. and Buehler, R. 2008. Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany. Transport Reviews. 28(4), pp.495–528. https://www.tandfonline.com/doi/full/10.1080/01441640701806612

[15] However, given limited space and time in urban centres, it is hard to have interventions that only benefit walking and cycling without discouraging driving.

dangerous for me to cycle on the roads"[16]. This does not only mean that people are frightened to cycle on major roads. Studies show that busy traffic on residential streets can also be a strong deterrent, especially for cycling with children[17] and hence for women, more likely to be making school run trips.

Modal filter in Southwark 2020.
Credit: Crispin Hughes.

Beyond reducing traffic risk, LTNs seek to make environments more pleasant and so positively attract people to walk, cycle, and spend time in local streets. In the current context such an environment should be Covid-safe, making it even more important that pedestrians are not forced to pass others closely on narrow footways. Manual for Streets states that with more than 100 motor vehicles per hour, 'pedestrians treat the general path taken by motor vehicles as a 'road' to be crossed rather than as a space to occupy'[18]. By contrast, with lower volumes of motor traffic, streets become usable by people walking in their entirety. In a typical residential street this may double or triple usable pedestrian space.

[16] Department for Transport, 2019. Walking and Cycling Statistics, England: 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906698/walking-and-cycling-statistics-england-2019.pdf
[17] Aldred, R., 2015. Adults' attitudes towards child cycling: a study of the impact of infrastructure. European Journal of Transport and Infrastructure Research 15. https://doi.org/10.18757/ejtir.2015.15.2.3064
[18] Department for Transport 2007. Manual for streets. London: Telford. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/341513/pdfmanforstreets.pdf

As well as having positive impacts on Covid and traffic safety, this represents an opportunity to generate what transport planners call 'induced demand'. 'Induced demand' is a well established phenomenon for car travel, if often forgotten by policy-makers: if you widen roads or build more, then (particularly in congested cities with suppressed demand) you get more motor traffic. Increasing evidence suggests that the same applies to active modes: building infrastructure for walking and cycling generates more demand for these modes[19].

Reviews show that a shift from car use to active travel (e.g. walking, cycling) leads to substantial net population health benefits in diverse geographical contexts[20]. As shown in the boxes below, car-oriented urban environments generate high risks for human health that cannot be overcome without reducing the number of cars. Although people walking and cycling are more vulnerable to road injury than people in cars, at a population level benefits from increased physical activity outweigh this. If shifts from the car to active travel are large, there may even be a reduction in road injuries, because the majority of road injuries involve at least one motorised vehicle, so fewer vehicles to collide with can mean fewer injuries[21]. For those people who take up active travel, evidence from a range of contexts shows that physical activity benefits outweigh possible increased exposure to air pollution, except for longer exposure in very high pollution contexts (e.g. Delhi)[22].

[19] Aldred, R. 2019. Built Environment Interventions to Increase Active Travel: a Critical Review and Discussion. Current Environmental Health Reports. 6(4), pp.309–315. https://link.springer.com/article/10.1007/s40572-019-00254-4

[20] Mueller, N., Rojas-Rueda, D., Cole-Hunter, T., de Nazelle, A., Dons, E., Gerike, R., Götschi, T., Int Panis, L., Kahlmeier, S. and Nieuwenhuijsen, M. 2015. Health impact assessment of active transportation: A systematic review. Preventive Medicine. 76, pp.103–114. https://www.sciencedirect.com/science/article/pii/S0091743515001164

[21] Woodcock, J., Givoni, M. and Morgan, A.S. 2013. Health Impact Modelling of Active Travel Visions for England and Wales Using an Integrated Transport and Health Impact Modelling Tool (ITHIM). PLOS ONE. 8(1), p.e51462. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051462

[22] Tainio, M., de Nazelle, A.J., Götschi, T., Kahlmeier, S., Rojas-Rueda, D., Nieuwenhuijsen, M.J., de Sá, T.H., Kelly, P. and Woodcock, J. 2016. Can air pollution negate the health benefits of cycling and walking? Preventive Medicine. 87, pp.233–236. https://www.sciencedirect.com/science/article/pii/S0091743516000402

In London, road transport accounts for more than 5% of NOx and PMx, exposing more than 2 million Londoners, including 400,000 children, to levels of air pollution which exceed legal limits. This burden of disease[23] equates to the highest social cost across main cities in Europe (estimated at over £10 billion in 2018, or £1,173 per person associated with poor air quality[24]). Negative health effects are linked also to the high level of traffic related noise. Researchers found in 2010 that almost 2.4 million people in Greater London were exposed to road traffic noise levels above 55dB, the WHO recommended maximum[25]. In 2019 there were a total of 25,338 collisions in Greater London, resulting in 30,051 casualties with 125 people killed (more than half of which, 68, were walking), and 3,781 seriously injured (20% of which were cyclists, despite cycling only making up 2.5% of trips)[26].

In New York City, PM2.5 pollution from traffic sources was estimated to contribute, in 2016, to 320 premature deaths and 870 emergency department visits and hospitalizations per year, with exposure to the pollutant 5% higher in high poverty neighbourhoods. In 2019 there were 220 road traffic fatalities (more than half, 124, pedestrians) and 60,666 total injuries (7% of which were cyclists and 17% pedestrians)[27] in the city.

[23] Transport for London n.d. Air quality. Transport for London. [Online]. [Accessed 3 November 2020]. Available from: https://www.tfl.gov.uk/corporate/about-tfl/air-quality.

[24] de Bruyn, S. and De Vries, J. 2020. Health cost of air pollution in European cities and the linkage with transport [Online]. CE Delft. [Accessed 3 November 2020]. Available from: https://cleanair4health.eu/wp-content/uploads/sites/2/2020/10/final-health-costs-of-air-pollution-in-european-cities-and-the-linkage-with-transport-c.pdf.

[25] https://www.london.gov.uk/sites/default/files/ambient_noise.pdf

[26] Department for Transport 2020. Road traffic statistics. [Accessed 4 November 2020]. Available from: https://roadtraffic.dft.gov.uk/custom-downloads/road-accidents/reports/ab1da0ea-d51c-41cc-949d-10e021e9524e.

[27] NYC 311 2020 Vision Zero View. [Accessed 4 November 2020]. Available from: https://vzv.nyc/.

In 2019, in Paris' region Ile-de-France, more than 1 in 2 residents were exposed to in excess of the limit value for NO2[28]. Nearly 15% of the population of the same region is at risk of being exposed to traffic noise levels that exceed the regulatory limit values, with road transport the leading factor[29]. In the Metropolitan area of Great Paris, welfare losses linked to direct and indirect health effects due to air pollution was estimated to be over £3 billion in 2018 data[30]. In the same area in 2017 101 fatalities were reported from road transport, 45% or which were pedestrians.[31]

Reductions in car use generate multiple benefits across a range of impacts, including greenhouse gas emissions, local noise and air pollutants. But even without reducing car use, active travel interventions such as LTNs can have substantial health benefits due to reductions in illness and early death stemming from increased physical activity. Lack of physical activity is linked to cardiovascular diseases, cerebrovascular disease, cancer (colon, breast and lung), type 2 diabetes, dementia, anxiety, depression, obesity. A study of Outer London's 'mini-Holland schemes' found that infrastructural interventions costing around £80m had health economic benefits of over £700m due to increased active travel alone, mostly from increased life expectancy but also reduced sickness absenteeism[32].

To benefit health, this physical activity does not necessarily need to be in the form of traditional 'active travel' such as walking from A to B. The 'Play Streets' movement seeks to

[28]Air Parif 2019. Bilans et cartes annuels de pollution | Airparif. [Accessed 4 November 2020]. Available from: https://demo.airparif.fr/surveiller-la-pollution/bilan-et-cartes-annuels-de-pollution.
[29] Bruit Parif n.d. Synthèse des expositions au bruit des transports en Ile-de-France. [Accessed 4 November 2020]. Available from: https://www.bruitparif.fr/synthese-des-expositions-au-bruit-des-transports-en-ile-de-france/.
[30]de Bruyn, S. and De Vries, J. 2020. Health cost of air pollution in European cities and the linkage with transport [Online]. CE Delft. [Accessed 3 November 2020]. Available from: https://cleanair4health.eu/wp-content/uploads/sites/2/2020/10/final-health-costs-of-air-pollution-in-european-cities-and-the-linkage-with-transport-c.pdf.
[31] France and Observatoire national interministériel de sécurité routière 2018. La sécurité routière en France: Bilan de l'accidentalité de l'année 2017. https://www.securite-routiere.gouv.fr/sites/default/files/2019-04/bilan2017delasecuriteroutierevfinternet.pdf

[32] Aldred, R., Woodcock, J. and Goodman, A. 2020. Major investment in active travel in Outer London: impacts on travel behaviour, physical activity, and health [Online]. SocArXiv. [Accessed 4 November 2020]. Available from: https://osf.io/preprints/socarxiv/5ny4c/.
https://osf.io/preprints/socarxiv/5ny4c/

reclaim street space for children with periodic street closures to motor traffic, particularly important in London for children living in the 21% of London households without private green space[33]. In some contexts LTNs are seen having a key role in providing everyday play space for children, particularly those without other opportunities to play and socialise.

Modal filter in Southwark 2020.
Credit: Crispin Hughes.

Public views on LTNs

As LTNs partly work through making driving more difficult (although not impossible, unlike full pedestrianisation), they have been controversial in London and in many other contexts, from 1970s Amsterdam to Barcelona today. It can be difficult to disentangle the balance of support or opposition from social media debate, which quickly becomes polarised where measures seek to restrict car use. And as with any measure involving short-term construction or disruption, initial consultation responses may be skewed negative reflecting early disruption rather than benefits (for instance, until services like Google Maps are updated, drivers may continue to try to use 'filtered' streets, causing disruption as they U-turn to avoid the new restrictions).

[33]Office for National Statistics 2020. One in eight British households has no garden - Office for National Statistics. [Accessed 4 November 2020]. Available from: https://www.ons.gov.uk/economy/environmentalaccounts/articles/oneineightbritishhouseholdshasnogarden/2020-05-14.

There is some evidence that the concept of LTNs is increasingly popular. In January-February 2020 - prior to LTNs becoming a high profile policy issue - 34% of the 1,384 respondents to England's National Travel Attitude Survey were in favour of closing local streets to through motor traffic, as opposed to 32% against[34]. In October, a YouGov poll found a support:oppose balance of 57:16. In this poll, 26% of people said they strongly supported LTNs, and 31% would "tend" to, while 8% strongly opposed them, and the same number tended to oppose them[35].

A recent survey by Transport for London (TfL) (August-September 2020) found that 51% of over 1,000 Londoners supported LTNs (both temporary Covid-19 measures and permanent implementation, which would be subject to further consultations for individual projects), against 16% who opposed the measure[36]. Very similar views (52% vs 19%) were reported by Redfield and Wilton, from a sample of 2,000 Londoners interviewed in September 2020. The survey found that support for LTNs is higher amongst younger Londoners (for example, 57% of 25-34 year olds vs 42% of 55-64 year olds), who have relatively low levels of car ownership[37]. As this report was going to press, the Department for Transport published their own new public polling finding that over three quarters of people in England support measures to reduce traffic in their neighbourhoods, while 65% support reallocation of road space to walking and cycling (with 24% opposed)[38]. Protecting the environment in general is becoming another motivation for supporting these measures, with more than half of Climate Assembly UK participants in favour of measures restricting car access to certain areas, against 22% in opposition.[39]

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[34] Department for Transport 2019. National Travel Attitudes Study (NTAS). GOV.UK. [Online]. [Accessed 4 November 2020]. Available from: https://www.gov.uk/government/statistical-data-sets/national-travel-attitudes-study-ntas.

[35] Walker, P. 2020. Despite a loud opposing minority, low-traffic neighbourhoods are increasingly popular | Environment | The Guardian. The Guardian. [Online]. [Accessed 4 November 2020]. Available from: https://www.theguardian.com/environment/bike-blog/2020/oct/22/despite-a-loud-opposing-minority-low-traffic-neighbourhoods-are-increasingly-popular.

[36] This survey was delivered by IIRC for TfL. We have been given access via personal correspondence (September 2020). See also: https://twitter.com/bbctomedwards/status/1306643636583624705

[37] Redfield & Wilton 2020. Majority of Londoners Support Pedestrianisation of London, but Find Policies So Far Ineffective - Redfield & Wilton Strategies. Available from: https://redfieldandwiltonstrategies.com/majority-of-londoners-support-pedestrianisation-of-london-but-find-policies-so-far-ineffective/.

[38] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/934617/DfT-Public-Opinion-Survey-on-Traffic-and-Road-Use-Phase-1-Report.pdf

[39] Climate Assembly UK 2020. The path to net zero. Climate assembly UK Full report. House of Commons. Available from: https://www.climateassembly.uk/report/read/final-report.pdf.

Overall, then, the general opinion polls suggest that at this point, around half of the public in London and in England support LTNs in principle, with around a third undecided and around a sixth opposing. This picture seems to have shifted since the pre-Covid position, where the mix was more like a third in each camp. It would be interesting to know which groups have shifted position - e.g. have some opponents changed their minds to supporting LTNs, or is it more that some opponents have become undecided, and some undecided now support?

Limits of LTNs

LTNs reduce the space allocated to motor vehicles, by removing or reducing through motor traffic in streets where these measures are introduced. One controversy surrounding LTNs is what happens to the motor vehicles that previously used those spaces. While this controversy is particularly sharp around LTNs at present, the argument is not new and has been used against other measures that restrict motor traffic. For instance, bus lanes have been charged with increasing congestion by displacing cars into a smaller number of lanes[40]. Bus lane proponents would respond that introducing bus priority will over time encourage more trips to shift to public transport, and fewer to be taken by car. (They might also add that congestion is not caused by the people in buses, but by the people in cars.)

In this they would be supported by wide evidence that 'traffic evaporation' (the opposite of 'induced demand') happens when space for cars is removed. Cairns and colleagues[41] found evidence of 'traffic evaporation' in over 70 road space reallocation schemes in eleven different countries where space for cars was removed (and often reallocated to other modes). Traffic evaporation is likely even if in the weeks after a road closure, traffic conditions worsen: so early impressions can be deceptive. Cairns et al concluded that "given appropriate local circumstances, significant reductions in overall traffic levels can occur, with people making a far wider range of behavioural responses than has traditionally been assumed". This might include changing from driving to public

[40] E.g. in Coventry: https://coventryobserver.co.uk/news/coventry-bus-lanes-suspended-in-trial-will-now-be-permanently-scrapped/

[41] Cairns, S., Atkins, S. and Goodwin, P. 2002. Disappearing traffic? the story so far. Proceedings of the Institution of Civil Engineers. Municipal Engineer 151(1), pp.13–22. http://www.onestreet.org/images/stories/Disappearing_traffic.pdf.
See also: Cairns, S., Hass-Klau, C., Goodwin, P. 1998. T*raffic impact of highway capacity reductions: assessment of the evidence*. London, Landor Publishing. https://www.cycling-embassy.org.uk/sites/cycling-embassy.org.uk/files/documents/Traffic%20Impact%20of%20Highway%20Capacity%20Reductions-%20Assessment%20of%20the%20Evidence.pdf.

transport, walking, or cycling, re-timing a trip, combining car journeys, or changing destinations (for instance, shopping locally on foot instead of driving to a larger store).

'Evaporation' versus 'displacement': the case of the Walthamstow Village trial

The balance between 'evaporation' and 'displacement' is likely to vary depending on local circumstances. For instance, if there is plenty of motor traffic capacity available in a parallel route, this would tend to favour displacement. If space is made available for other types of transport, this would tend to favour those modes (through induced demand). However, no algorithm exists to tell us exactly what the balance will be in advance. One reason for this is that motor traffic flows are naturally variable, and any count or estimation method is likely to have a margin of error.

We now explore one available example for which traffic counts were conducted as part of the Walthamstow Village Review[42]. This sought to examine various impacts after experimental LTN-type measures were trialled in part of Walthamstow between 2014 and 2016, to test their impacts. While the review found overall reductions in motor traffic flows and large reductions on many 'village' roads, increased motor traffic was found on three boundary roads; Lea Bridge Road, Hoe Street, and Shernhall Street.

[42] London Borough of Waltham Forest n.d. Walthamstow Village Review. Available from: http://www.enjoywalthamforest.co.uk/wp-content/uploads/2016/09/2017-08-23-WV-report-FINAL.pdf

Table 1: Average daily vehicle count comparison, Boundary roads, 2014 to 2016. [43]

Road Name	Pre-scheme (2014) daily vehicle count	Post-scheme (2016) daily vehicle count	Change in daily vehicle count	% change in daily vehicle count
Hoe Street	15624	16025	401	2.6
Lea Bridge Road	15007	16674	1667	11.1
Shernhall Street	7231	9276	2045	28.3

But what do these changes represent in the context both of natural fluctuation/margin of error, and background trends on those streets and across London? What might have caused them? To examine this further we downloaded count data from three DfT count points close to the sites used by Waltham Forest Council. Hoe Street and Lea Bridge Road are A roads that are counted once every few years as part of national traffic data, while Shernhall Street (a minor road) was a manual count site each year until 2009[44]. By comparing the estimates of daily flow produced by DfT from each manual count, we can explore how the Waltham Forest figures fit within that broader picture. As with any counts and estimates, one would expect some variation, such that a DfT and a WF count in the same year might (and do) vary a little due to normal fluctuation or random differences.

For Hoe Street and Lea Bridge Road, the fluctuation between 2014 and 2016 is within the 'normal' recent range. For Shernhall Street, the 2016 level of estimated motor traffic flow is similar to the final DfT estimate in 2009.

[43] Source: http://www.enjoywalthamforest.co.uk/wp-content/uploads/2016/09/2017-08-23-WV-report-FINAL.pdf

[44] In the years in between manual counts, DfT factor up or down based on local authority trends at other roads - hence we have not included those years.

Fig. 2: Hoe Street average daily motor traffic flows.

Fig. 3: Lea Bridge Road average daily motor traffic flows.

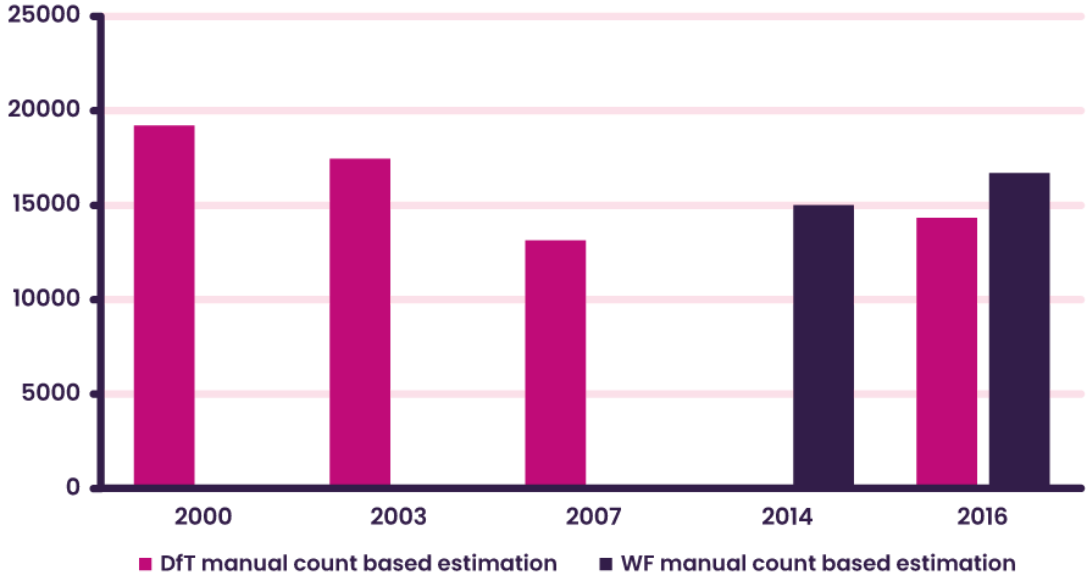
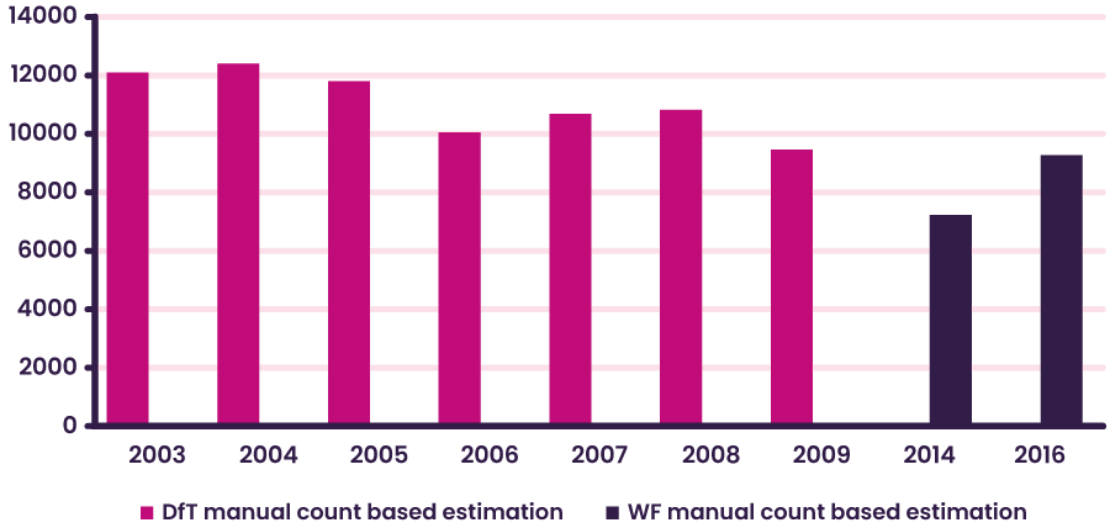


Fig. 4: Shernhall Street average daily motor traffic flows.



There has been a longer-term decline in motor traffic on the boundary roads in Walthamstow. The charts might suggest that the LTN-type measures introduced experimentally between 2014 and 2016 made little difference to this trend on Hoe Street, but may have reduced somewhat its impact on the other two streets (although for Lea Bridge Road a reversal of trend may have been happening already by 2014). However, looking at broader London trends suggests that wider factors have more impact than LTNs on levels of motor traffic on the boundary roads. Across the whole of London, 2008-9 marked a turning point where motor traffic started to grow after years of decline[45]. The graphs above fit within a wider pattern whereby a period of decline is followed by a bounce-back, sharper on minor roads such as Shernhall Street than on A roads such as Hoe Street.

This is broadly reassuring (in terms of the impact of LTNs, that is) but is only data from one early LTN trial. Now LTNs are being implemented across London, it will be possible to conduct more detailed and more generalisable analysis of the 2020 wave of LTNs to explore whether there are differences compared to broader traffic flow trends, once data becomes available. This will allow us to disentangle changes (positive or negative) around LTNs from wider changes at regional level. To make such an assessment, these schemes will need to stay in place for at least a year, ideally longer. It will be important not only to look at initial snapshot figures but to look at trends across a range of schemes, including comparisons over time and with areas without LTNs.

[45] https://roadtraffic.dft.gov.uk/regions/6

Supporting measures for main roads and high streets

While LTNs can improve conditions in many residential streets, they are not appropriate everywhere, so other interventions need to be considered in other types of street. People are not only affected by changes on their own streets: people not living in high streets may go there to shop, and people not living on main roads may go there to access public transport. Conversely, LTNs may provide people living outside them with improved walking and cycling routes. In other words, interventions that affect a street do not only impact those living on the street itself.

One advantage of implementing LTNs is that it can make it easier to control motor traffic more widely. Where motor traffic can use any road without restriction, changes made on main roads may be ineffective or lead to unwanted consequences, as drivers shift to using residential streets. Controlling residential traffic can and should support measures to control and reduce the impact of motor traffic on other road types.

Some high streets may be suitable for inclusion within LTN zones, benefiting shoppers and visitors as well as residents. LTNs in Waltham Forest have included high streets, even when designated as 'B Roads', reducing or restricting through motor traffic to make visiting shops and services more pleasant, bringing benefits to residents and visitors alike. Similarly, Hackney Council's London Fields LTN includes the busy shopping destination of Broadway Market. Such measures form part of a growing trend of pedestrianised town centres in major cities worldwide, bringing it to local and district urban centres, rather than only iconic 'international' locations (like London's Trafalgar Square or Times Square in New York). Evidence shows potential for increase in footfall[46]. It fits well with the '15-minute city' idea where rather than expecting everyone to drive or get public transport to go out, local neighbourhoods provide key destinations within walking and cycling distance[47].

[46] For more evidence visit https://tfl.gov.uk/corporate/publications-and-reports/economic-benefits-of-walking-and-cycling and https://wfcycling.wordpress.com/mini-holland/evidence/

[47] Hellen, N. 2020. Waltham Forest, the suburb that pioneered the '20-minute neighbourhood'. [Accessed 4 November 2020]. Available from: https://www.thetimes.co.uk/article/waltham-forest-the-suburb-that-pioneered-the-20-minute-neighbourhood-fm0dkw6bs.

As part of Waltham Forest's mini-Holland programme, high streets including Orford Road (shown here, where private motor traffic was prohibited between 10am and 10pm) have been included within LTN area measures.

Source: We Support WF Mini-Holland[48].

While high streets may be suitable for LTN-style interventions, main roads are less likely candidates, given the low probability that through motor traffic can be removed. Pedestrian charity Living Streets argues that many improvements can be made on such roads to provide alternatives to car use, improve air quality, and protect people using or living on main roads from the pollution[49]. For instance, providing a protected cycleway can enable more medium-distance cycle trips, both for main road residents and others, potentially replacing car trips. The cycleway also means pedestrians, cyclists, and open windows are further from car exhausts than they would otherwise be. Adding a 'green buffer' at the edge of main roads may also improve the situation, by (partially) screening residents, as well as pedestrians and cyclists, from noise and pollution[50].

Wider measures targeted at reducing the most damaging motor traffic may particularly benefit main road residents, users, and visitors. Removing the most polluting vehicles from our roads and introducing cleaner public transport can have a dramatic effect on air quality. The London Air programme has predicted ongoing substantial reduction in many pollutants mostly as a consequence of improving engine

[48] Aldred, R., Croft, J. and Goodman, A. 2019. Impacts of an active travel intervention with a cycling focus in a suburban context: One-year findings from an evaluation of London's in-progress mini-Hollands programme. Transportation Research Part A: Policy and Practice. 123, pp.147–169. https://linkinghub.elsevier.com/retrieve/pii/S0965856417314866

[49] Molteno, R. and Leach, J. 2019. Improving main roads in London – London Living Streets. London Living Streets. [Online]. [Accessed 4 November 2020]. Available from: https://londonlivingstreets.com/2019/12/03/improving-main-roads-in-london/. See also *Tackling the Main Roads,* by Ranty Highwayman: https://therantyhighwayman.blogspot.com/2020/08/tackling-main-roads.html

[50] Abhijith, K.V. and Kumar, P. 2019. Field investigations for evaluating green infrastructure effects on air quality in open-road conditions. *Atmospheric Environment*. **201**, pp.132–147.https://www.sciencedirect.com/science/article/pii/S1352231018308938

standards and restrictions on engine types within London.[51] The impact of such broader policies on air quality levels, particularly in the most affected areas, is likely to be much greater than the impact of LTNs, which, aimed at reducing motor traffic overall, do not discriminate between vehicles based on emission levels. Clean air zones in London have already contributed to reducing levels of NO2 at central roadsides sites by 44% between early 2017 and early 2020[52].

Finally, and thinking about longer-term urban equity, LTNs might be associated with gentrification, if improved local environments feed through into higher prices and rents, pricing people out. This risk is not specific to LTNs: it has been noted in association with other urban regeneration interventions that increase attractiveness of an area (for example, new green spaces and street tree planting) or improve transport connections (e.g. new rapid bus services or metro stations). This is not an argument against improving the public realm. The problem results from housing and land use policies that prioritise free markets and profit maximisation over tenancy rights. Pricing and regulation measures, while outside the scope of this paper, are needed to protect low-income residents. The solution to high house prices is not to maintain dirty and dangerous residential streets to suppress prices.

[51] Imperial College London 2020. London Air Quality Network » Annual Pollution Maps. London Air. [Online]. [Accessed 5 November 2020]. Available from: https://www.londonair.org.uk/london/asp/futuremaps.asp.
[52] Mayor of London n.d. Air quality in London 2016-2020. Greater London Authority. Available from: https://www.london.gov.uk/sites/default/files/air_quality_in_london_2016-2020_october2020final.pdf.

Low Traffic Neighbourhoods in London

LTNs are often invoked as a response to pressing issues such as air pollution, or indeed the Covid-19 context of social distancing. However, in a broader context, LTNs in London form part of a developing vision for 'Healthy Streets'. This vision has been emerging over the past decade and its twin pillars are discouraging car use and encouraging active travel to generate health and other social benefits in London[53] .

The 'Healthy Streets' approach aims "to improve air quality, reduce congestion and help make London's diverse communities greener, healthier and more attractive places to live, work, play and do business"[54]. The mini-Holland programme, which now sits within the Healthy Streets agenda, led to a £100m investment in Enfield, Kingston and Waltham Forest to improve streets by creating new cycle tracks, motor traffic calming and reduction measures, and pedestrian routes, including some new LTNs. More funding for similar initiatives have been included in the Liveable Neighbourhoods programme, part of the 2019 Mayor's Transport Strategy, which provided funding for long-term schemes that encourage walking, cycling and the use of public transport.

[53] Transport for London n.d. Healthy Streets. [Online]. [Accessed 4 November 2020]. Available from: https://www.tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/healthy-streets.
[54]Mayor of London n.d. Healthy Streets | London City Hall. [Accessed 4 November 2020]. Available from: https://www.london.gov.uk/what-we-do/health/transport-and-health/healthy-streets.

Fig 5: Area-based LTN-type interventions within 'Blackhorse Village'.

Source: Waltham Forest Council.[55]

With the Covid-19 pandemic, however, LTNs have become more widespread in London, and elsewhere in the UK. Since the early days of the pandemic, councils started to consider widening pedestrian footways, building pop-up cycleways and introducing traffic calming measures in response to concerns with maintaining safe social distance. In May 2020 the Mayor launched the Streetspace for London programme[56] with the aim of averting a damaging car-led recovery from Covid-19. This programme explicitly promoted LTNs and included funding for new protected cycleways, footway extensions, and closing roads to motor traffic. Across London the programme funded 430 'School Streets', which restrict access by motor vehicle outside school entrances during drop off and pick up[57]. Via both TfL's Streetspace programme

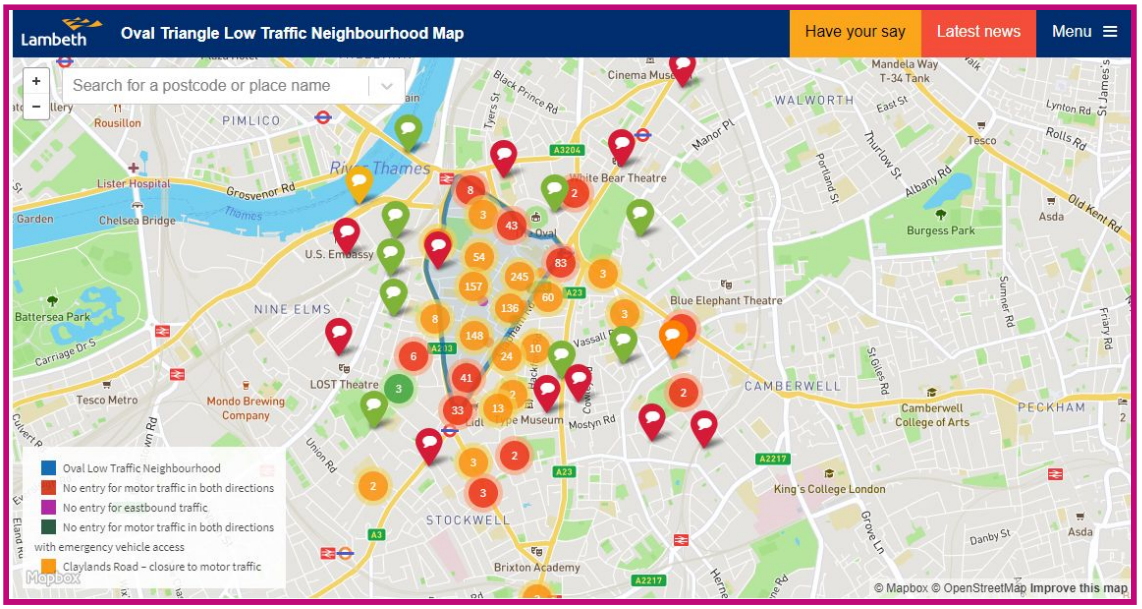
[55] http://www.enjoywalthamforest.co.uk/wp-content/uploads/2015/03/Blackhorse-Village-map.pdf

[56] Transport for London n.d. Streetspace for London. [Online]. [Accessed 4 November 2020]. Available from: https://www.tfl.gov.uk/travel-information/improvements-and-projects/streetspace-for-london.

[57] Mayor of London 2020. School Streets air quality monitoring project launched on Car Free Day. London City Hall. Available from: https://www.london.gov.uk//press-releases/mayoral/school-streets-air-quality-project-launched.

and the DfT's Emergency Active Travel Fund, London boroughs have been funded to implement LTNs using Experimental Traffic Orders (ETO). These orders allow measures to be put in place on a trial basis with consultation happening during the implementation period[58]. Many have been using online platforms for engagement with residents as in the example below.

Fig 6: Online platform for feedback on the temporary 'the Oval Triangle LTN' in Lambeth, London[59]

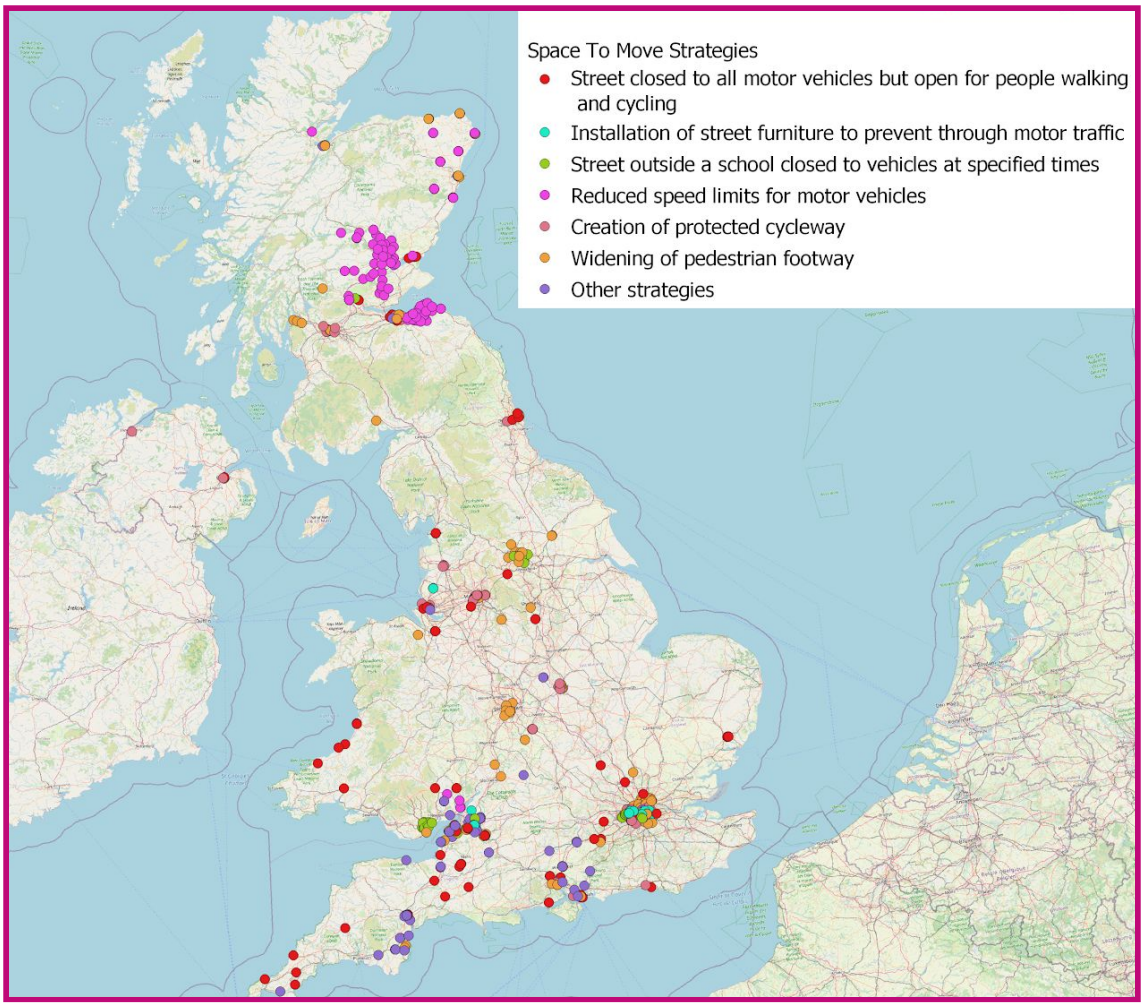


Between March and September 2020, over seventy new Low Traffic Neighbourhoods were introduced by boroughs across London, with more LTNs and related 'emergency active travel' schemes such as pop-up cycleways going in nationally.

[58] For more detail see https://therantyhighwayman.blogspot.com/2017/01/experimental.html

[59] From: https://ovalltnproposals.commonplace.is/schemes/proposals/tell-us-how-the-temporary-scheme-is-affecting-you/details

Fig 7: Sustrans' Space to Move map showing some of the 2020 street changes across the UK including LTNs, but also protected bike lanes, wider footpaths, and reduced speed limits[60].



[60] From: https://www.sustrans.org.uk/space-to-move

London's LTNs and equity

There are many definitions of 'equity' in relation to transport, environment, and other issues. While this report lacks scope to go into these, we highlight that 'equity' is different from 'equality'. Equality refers to treating people the same, or providing the same services (for instance), while equity asks that we consider and seek to address existing disadvantages or different needs. For instance, in lower income areas, crowding is higher and access to green space often lower than in richer areas, and so the need for usable street space is greater. Similarly, a single mother or an older person relying on public transport might be more negatively affected by lack of shopping facilities within walking distance than someone having easy access to a car.

Many studies looking at equity have highlighted how the negative impacts of motorised transport are notoriously unevenly distributed, providing evidence of disadvantaged groups disproportionately affected by transport-related air pollution[61], traffic collisions, or climate change[62] across most countries. The same groups are also often less able to travel because of restricted access to a car or to reliable public transport options, or have to spend a disproportionate amount of their income or time to travel. Therefore, they have restricted access to many key opportunities and social networks, in a well-known self-reinforcing cycle of transport disadvantage and social exclusion[63].

These relationships hold in the UK and should be considered when changes to transport systems and public space are introduced. When planned with equity in mind and considering implications for different social groups, measures that curb the dominance of motorised transport have the potential to reduce inequalities in a range of ways. One example is the intersection of demography and trip purposes: traditionally, commuting is prioritised when considering car

[61] Barnes, J.H., Chatterton, T.J. and Longhurst, J.W.S. 2019. Emissions vs exposure: Increasing injustice from road traffic-related air pollution in the United Kingdom. Transportation Research Part D: Transport and Environment. 73, pp.56–66. https://www.sciencedirect.com/science/article/pii/S1361920919300392
Brook, R. and Katie, K. 2017. Updated analysis of air pollution exposure in London. Aether Ltd. Available from: https://www.london.gov.uk/sites/default/files/aether_updated_london_air_pollution_exposure_final_20-2-17.pdf.

[62] Walker, G. and Burningham, K. 2011. Flood risk, vulnerability and environmental justice: Evidence and evaluation of inequality in a UK context. Critical Social Policy. 31(2), pp.216–240. https://doi.org/10.1177/0261018310396149

[63] Lucas, K., 2012. Transport and social exclusion: Where are we now? Transport Policy, URBAN TRANSPORT INITIATIVES 20, 105–113. https://doi.org/10.1016/j.tranpol.2012.01.013

travel or sustainable transport trips, yet commuting trips are skewed to men and working age adults; whereas by contrast, women make relatively high numbers of school run trips. If LTNs make walking and cycling to school, to the shops, or to local friends' houses safer and more pleasant, this can help redress the balance in transport planning which has often seen only the commute as important.

Another contribution that LTNs could make to social equity is reducing inequality in injury risk. London's Black children are more at risk from pedestrian injury than its white or Asian children[64], while Black Londoners are less likely to own cars than white or Asian Londoners[65]. If LTNs are introduced in neighbourhoods with a demographic mix suffering high traffic injury risk, they may help redress these inequalities and provide safer environments and public space for those most disadvantaged by the current situation.

The TfL criteria for identifying priority LTN areas include variables related to deprivation, car ownership, and social distancing challenges, as well as traffic levels[66]. However, not all boroughs have introduced LTNs, and there is substantial variation in the amount of interventions among those that have. This will impact pan-London equity. Below we examine the extent to which across London, boroughs with higher deprivation and lower car ownership have benefited, given that some boroughs have failed to introduce any LTNs, some have introduced small scale interventions, and others have done much more.

Before this borough-level analysis, we consider some wider data about demography and road type. This aims to examine the extent to which some demographic groups (e.g. low-income households) are concentrated on roads for which LTNs are not appropriate; primarily main roads and potentially some high streets. Should this be the case, it would imply a broader social equity issue where LTNs are introduced but no interventions are planned for neighbouring main roads or high streets. Note that this equity issue exists even without assuming that LTNs cause 'displacement' (see Limits of LTNs above); it relates to potentially widening the gap between demographic groups in terms of living conditions, for instance. This street type analysis has to be much more aggregate than borough-level; because data on

[64]Steinbach, R., Green, J., Edwards, P. and Grundy, C. 2010. 'Race' or place? Explaining ethnic variations in childhood pedestrian injury rates in London. Health & Place. 16(1), pp.34–42. https://www.sciencedirect.com/science/article/pii/S135382920900080X

[65] Transport for London n.d. Technical Note 12 - How many cars are there in London and who owns them? Roads task force Thematic Analysis. Available from: http://content.tfl.gov.uk/technical-note-12-how-many-cars-are-there-in-london.pdf

[66] Transport for London 2020. Strategic Neighbourhoods Analysis. Available from: http://content.tfl.gov.uk/lsp-app-six-b-strategic-neighbourhoods-analysis-v1.pdf

street type does not exist in more granular deprivation or Census data.

Equity in relation to street type

LTNs are particularly appropriate to residential streets, and these streets are where they have been primarily implemented[67]. The majority (around 90%) of Londoners live on residential streets rather than in main roads or high streets (around 5% each). In this section we look at data from the London Travel Demand Survey 2017/8 to 2019/20, presented in Table 2, to examine how far the balance between road types varies, and hence the extent of any social 'equity' problems associated with implementing LTNs, especially in the absence of concurrent main road interventions. Specifically, we concentrate on the potential effects on different social groups, looking at the distribution of the population by age, ethnicity, disability, income and car ownership. The first four are 'protected characteristics' under Britain's Equality Act and hence supposed to be taken into account by public authorities in planning processes.

Data in Table 2 suggests that in Inner London there is no clear social equity problem related to LTNs or other interventions that target residential streets while leaving out main roads. Making residential streets better might be slightly more likely to benefit disabled than non-disabled people, children than adults, and middle-income than low- or high-income earners, and white, Black, or Asian people compared to people from mixed/other/Arab ethnic groups: but differences are small. Patterns may vary by local area, but across Inner London as a whole there are few differences by age group, income group, ethnic group, or disability status.

Inner Londoners living on a main road or high street are less likely than those living on residential roads to have access to one or more cars. Given the lack of demographic disparities, this does not seem to be due to income differences, but rather it plausibly reflects the lower availability of car storage and/or better access on main roads to alternatives (e.g. bus routes and stops). This then means that Londoners of all income levels are less likely to own a car, if they live on a main road or high street: they have both less need to and less opportunity to, than do people living on residential streets. (Still, the large majority of non-car owners live on residential streets, as do car owners).

Outer London sees more differences by ethnicity and household income in the likelihood of living on a main road.

[67] Although see later on high streets.

This is again within a broad context of similarity: while Asian Outer Londoners are more likely than white Outer Londoners to live on main roads or high streets, the overwhelming majority (89%; compared to 93% for whites) live on residential streets. Middle- and high-income Outer Londoners have similar propensities to live on a main road or high street. Low-income Londoners have higher than average propensities (9.4%), and 65+ year olds lower than average (7.3%). There is no difference by disability.

While these differences are relatively small (e.g. 90.2% of low income Outer Londoners live on residential streets, against 91.5% of the richest group), they suggest that in terms of social equity, it is more important in Outer London to introduce main road measures alongside LTNs, and ensure that high streets within an LTN area are included where possible. The Outer London borough of Waltham Forest is a good case study here: some high streets were treated with LTN-type measures, while cycleways and improved pedestrian crossings along main roads have provided improvements for residents there. This also makes sense in terms of maximising 'mode shift' among those living on residential streets, which also can help main road residents by reducing motor traffic displacement.

As in Inner London, people without cars in Outer London are more likely than average to live on a main road or high street, and as in Inner London, the gap between car- and non-car owners is bigger than the gap between any other groups. This suggests that again 'push' and 'pull' factors may be encouraging those who might otherwise own a car not to do so (as is hoped for LTN-type measures).

Overall, 87% or more of Londoners from each age, ethnic, disability, car ownership, and income group tabulated below live on residential streets. Therefore, interventions in general that improve all residential streets within an area should benefit most people living there in each demographic category[68]. In some cases, this could improve equity for those whose mobility tends to be more restricted (e.g. for children in Inner London, or over 65s in Outer London), although as with the converse cases (e.g. low income Outer Londoners), these differences are relatively small. However, main road interventions are also important across London, for residents and for locals who use such roads to access services like shopping.

[68] Of course, categories often overlap and exclusions are multiple and intersectional (e.g. disabled people tend to be on lower incomes)

Table 2: Street type for a range of demographic groups in inner London.[69]

Inner London		Main road	High street	Main road or high street	Resid-ential	Other
Age	**Under 16**	3.8%	3.2%	7.0%	92.1%	0.9%
	16 to 64	5.1%	3.7%	8.8%	90.0%	1.2%
	65 plus	6.2%	2.0%	8.2%	90.3%	1.5%
Ethnicity	**White**	4.9%	3.2%	8.1%	90.8%	1.1%
	Black	4.9%	3.5%	8.4%	90.5%	1.1%
	Asian	4.6%	4.1%	8.7%	90.1%	1.2%
	Mixed, Other & Arab	7.0%	3.5%	10.5%	87.7%	1.8%
Disability that limits travel	**Yes**	4.6%	2.1%	6.7%	91.9%	1.3%
	No	5.1%	3.6%	8.7%	90.2%	1.2%
Household income	**<£20k**	4.5%	3.8%	8.3%	90.4%	1.3%
	£20k -£49k	5.8%	3.7%	9.4%	88.9%	1.7%
	£50k+	4.6%	3.1%	7.7%	91.7%	0.6%
Household car access	**No car**	5.7%	4.6%	10.3%	88.2%	1.5%
	One car	4.0%	2.6%	6.6%	92.4%	0.9%
	Two or more cars	4.9%	1.2%	6.0%	93.6%	0.4%

[69] Note that the rows in the table do not exactly sum to 100% for Inner or Outer London because a very small % (around 1%) of people live in roads that are not classed as high street, main road, nor residential road.

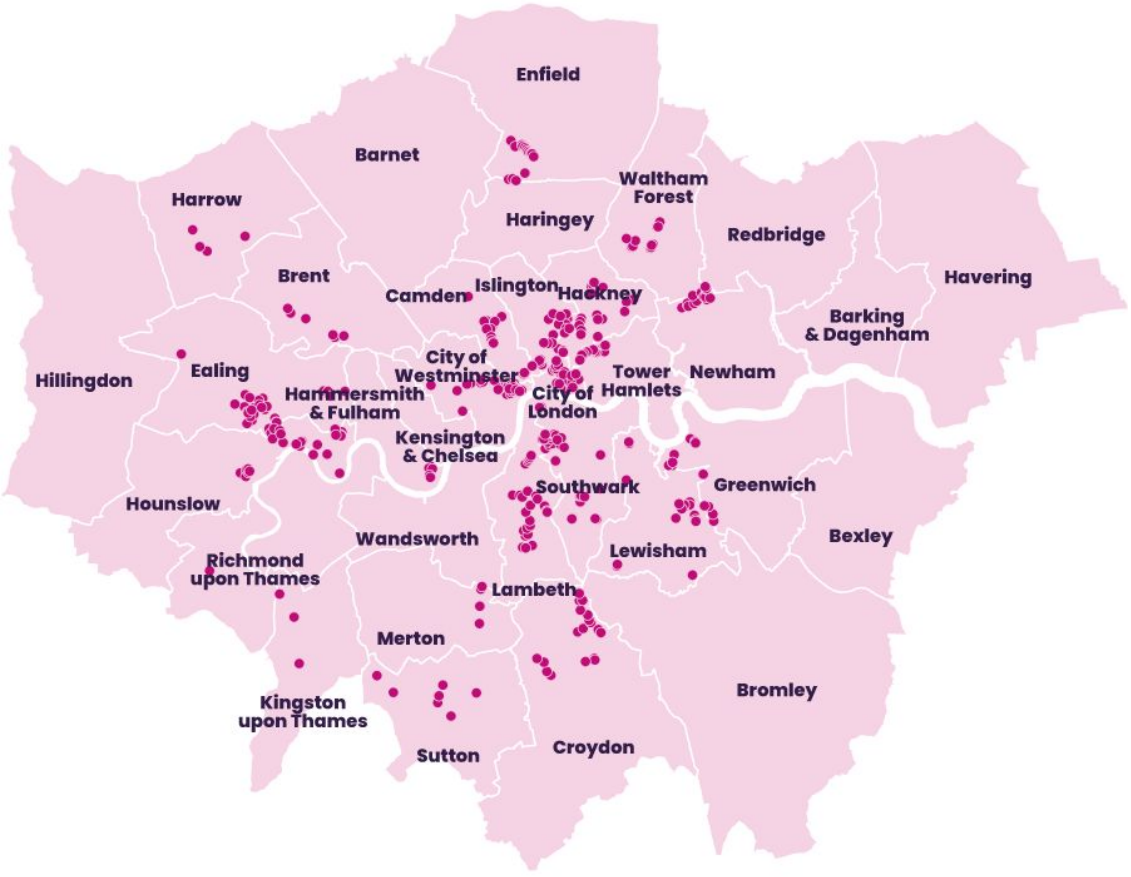
Table 3: Street type for a range of demographic groups in outer London.

Outer London		Main road	High street	Main road or high street	Resid-ential	Other
Age	Under 16	5.5%	2.9%	8.4%	91.3%	0.2%
	16 to 64	6.1%	2.9%	8.9%	90.8%	0.3%
	65 plus	5.5%	1.8%	7.3%	92.5%	0.2%
Ethnicity	White	5.2%	2.1%	7.3%	92.5%	0.2%
	Black	6.1%	2.6%	8.7%	90.6%	0.7%
	Asian	7.2%	3.9%	11.1%	88.7%	0.3%
	Mixed, Other & Arab	8.1%	3.1%	11.2%	88.2%	0.6%
Disability that limits travel	Yes	6.2%	2.1%	8.3%	91.4%	0.3%
	No	5.8%	2.7%	8.6%	91.1%	0.3%
Household income	<£20k	5.9%	3.5%	9.4%	90.2%	0.4%
	£20k -£49k	5.9%	2.7%	8.6%	91.2%	0.3%
	£50k+	5.8%	2.4%	8.2%	91.5%	0.2%
Household car access	No car	7.1%	5.6%	12.7%	86.8%	0.5%
	One car	5.6%	2.3%	7.8%	91.9%	0.3%
	Two or more cars	5.2%	1.1%	6.3%	93.6%	0.0%

Equity in relation to the borough-level distribution of LTNs

We now move on to explore which London boroughs have introduced LTNs, and how this varies. With more than 70 new LTN areas across London, how equally are they distributed at borough-level? And how do they relate to the existing availability of such infrastructure?

Figure 8: Map of new modal filters introduced in March-September 2020.[70]



[70] Contains National Statistics data © Crown copyright and database right 2012

Figure 9: new LTNs introduced in London, March-September 2020 (and still in place by the end of October 2020).

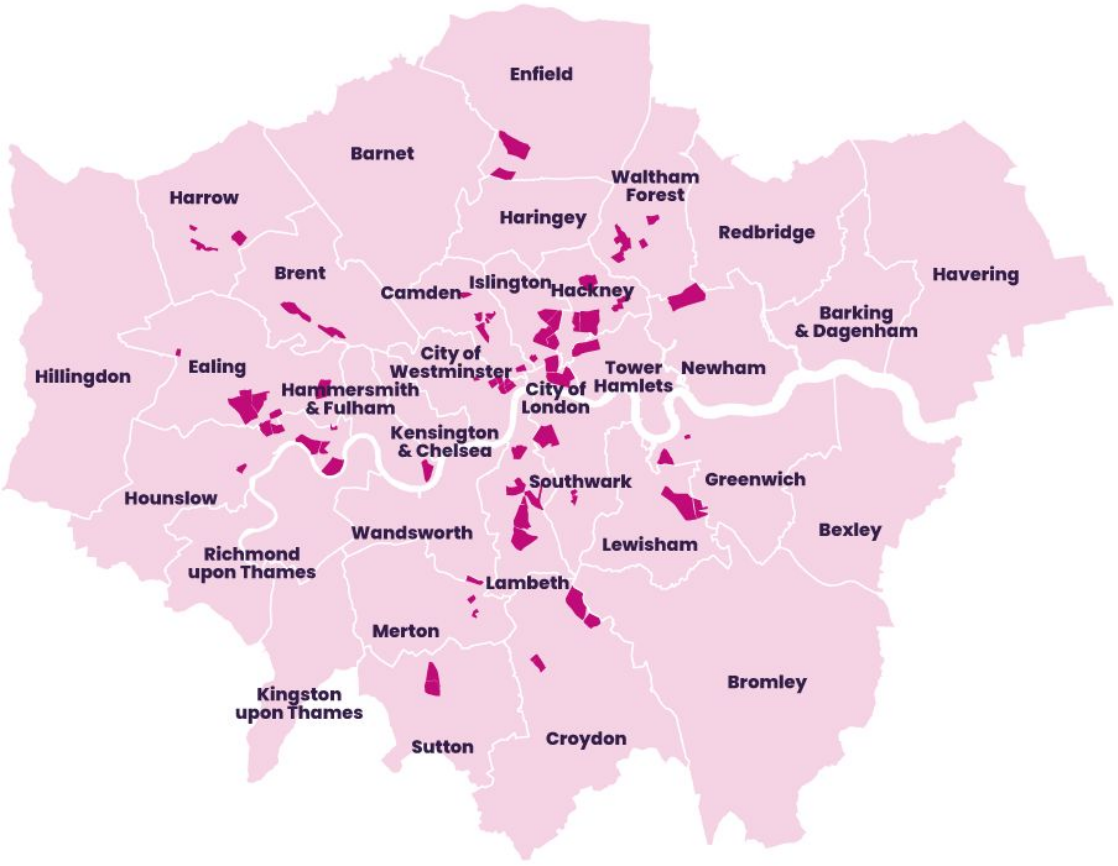
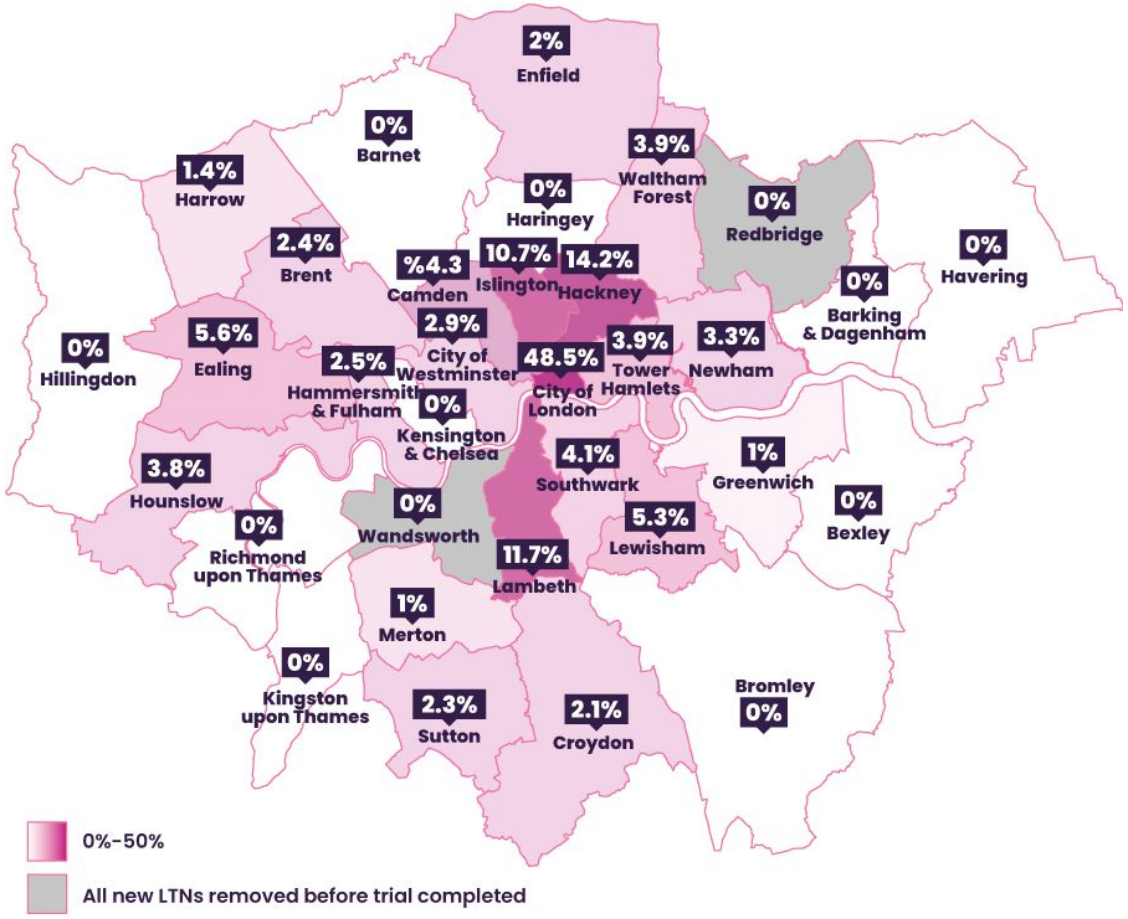


Figure 10: Percentage of borough covered by new LTNs (built March-Sept 2020).



The above figures show firstly, new 'modal filters' and secondly, new LTNs introduced in the different London boroughs between March and September 2020[71]. The borough-level results are then summarised in more detail in Table 3 below.

Gathering this information was not straightforward, but it is complete to the best of our knowledge relating to the time period covered. At the time of writing, spatial data was not held centrally by TfL across all schemes, so had to be compiled from borough records, asking local stakeholders to check and confirm information that we have produced. Estimates of the number of new LTNs in London and elsewhere will vary, because of different methods of describing schemes and counting. We have for instance seen a list which at times counts modal filters as separate LTNs;

[71] This information has been collated for an Active Travel Academy project also involving Megan Sharkey, Irena Itova, and Anna Goodman, which will contribute to a more detailed academic analysis on equity in distribution of active travel infrastructure in London.

but have instead opted for contiguous areas and counted modal filters separately.

While modal filters can be accurately located (although this may change suddenly as schemes are tweaked), it has proved harder to define 'LTN areas'. There are different possible definitions, and here, we have attempted to identify areas where new modal filters are likely to have reduced the amount of through motor traffic. So for instance, we would not include 'boundary roads' without LTN measures; neither would we include a neighbouring pre-existent low traffic neighbourhood. This is not an exact science and does not necessarily reflect the size of maps drawn by local authorities to illustrate their schemes. For instance, Brent's maps highlighted the extent of new 20mph zones, which tended to be larger than its LTN areas as we have defined them.

Other authorities drew their maps primarily with the aim of showing changes in motor traffic access across a neighbourhood, rather than the extent of an LTN. Still other authorities did draw maps of the new LTN but included existing LTNs in the map. This makes sense in terms of capturing the vision for an area but was not the focus of our effort. Local authority LTN maps sometimes covered both areas that had already received interventions by end of September 2020, and other areas where implementation of measures was planned but had not yet happened. In these cases, we only considered in this analysis the areas that had already received interventions.

All of which is to say, that this is one definition of LTNs, which focuses on the 'new' areas covered, as far as we can judge. If an area is outside a new LTN as marked on the map, it may be because it already benefits from such measures, as is the case in some parts of Hackney where LTNs have been introduced over time already.

In some cases, we have not drawn LTN areas, where there are single bollards and it seems likely that the effect relates only to one or two streets rather than being part of a more holistic area-wide reduction in through motor traffic. Still, we hope this information provides an overall summary and gives a sense of the level of implementation in different boroughs and within boroughs.As can be seen on the map, new LTN areas vary substantially in size, from being just a few blocks to as much as a square kilometre.

Table 3: Summary of LTN development by borough.

District	New LTNs (based on measures introduced between March-September 2020, and in place by the end of October 2020)
City of London	While not referring to LTNs, City of London has been implementing an ambitious programme of motor traffic reduction, including bus-bike corridors on major arteries and modal filtering in smaller streets.
Barking and Dagenham	No new LTNs as of September 2020.
Barnet	No new LTNs as of September 2020.
Bexley	No new LTNs as of September 2020.
Brent	In Summer 2020, Brent began implementing LTNs, initially in Stonebridge and Harlesden, and Wembley Central. More are planned.
Bromley	No new LTNs as of September 2020.
Camden	Camden has implemented some LTN schemes around Camden Town, Gospel Oak, and Gray's Inn, as well as some modal filtering around Covent Garden.
Croydon	Croydon has implemented LTN schemes in Norwood and Broad Green.
Ealing	Some LTNs implemented mostly to the South of the borough, around the border with Hounslow (one is a combined scheme).
Enfield	Two LTNs in the South-West of the borough.
Greenwich	A small amount of modal filtering in the North-West of the borough.
Hackney	Hackney has a long-standing programme of modal filtering to reduce through traffic from neighbourhoods, and has continued this, with new LTNs introduced in the North, West, South, and East of the borough as of September 2020. Since then, more have been introduced; for instance, in the Stoke Newington area, and the borough plans to introduce them everywhere longer-term.

District	New LTNs (based on measures introduced between March-September 2020, and in place by the end of October 2020)
Hammersmith and Fulham	Hammersmith and Fulham introduced one 'traffic scheme' in SW6. This has been added to the map although it differs from other LTNs in allowing through all borough residents and all black taxis, among other exemptions and therefore is likely to have less of an impact in reducing through traffic (and hence, in broader motor traffic reduction) than other LTNs. We would therefore consider the case at best borderline as to whether it is or is not an LTN, but include it here for the sake of completeness.
Haringey	No new LTNs as of September 2020.
Harrow	Harrow has introduced several small LTNs around the centre of the borough.
Havering	No new LTNs as of September 2020.
Hillingdon	No new LTNs as of September 2020.
Hounslow	Hounslow has introduced LTNs around the areas of Chiswick and Isleworth, as well as at the borough boundary with Ealing.
Islington	Islington has rolled out a number of LTNs, so far, most around the South of the borough, especially towards the border with Hackney and City of London.
Kensington and Chelsea	No new LTNs as of September 2020.
Kingston upon Thames	Kingston has introduced several modal filters at various points in the borough to reduce through motor traffic; however, we have not drawn them as 'LTNs' as they are separate filters in different neighbourhoods.
Lambeth	Lambeth have introduced LTNs across the centre of the borough, as well as one in the North near Oval.
Lewisham	Lewisham introduced one LTN in Lee Green; they have now announced plans to roll this back, but as of the time of writing it remained in place and so is included on the map.
Merton	In September, Merton introduced three small LTNs in the East of the borough, with more introduced since.
Newham	Newham has implemented one larger LTN around the Wanstead/Stratford area, in partnership with Waltham Forest (the LTN straddles the border).

District	New LTNs (based on measures introduced between March-September 2020, and in place by the end of October 2020)
Redbridge	Redbridge introduced two LTNs towards the West of the borough, but removed them after just over a month after vocal opposition from a group of residents. They have therefore been removed from this map.
Richmond upon Thames	Richmond introduced one modal filter towards the West of the borough.
Southwark	Southwark constructed one larger LTN in Walworth in the North of the borough, and have implemented several smaller schemes in Dulwich.
Sutton	Sutton have created two LTN areas in Central Sutton, and implemented a number of modal filters separately elsewhere in the borough.
Tower Hamlets	At the time of writing a larger LTN had been implemented to the North-West of the borough, by the Hackney border. This formed part of a Liveable Neighbourhood scheme and includes the modal filtering of a B road, with the creation of new pocket parks.
Waltham Forest	Waltham Forest have like Hackney a number of longer-standing schemes, in this case more recent via the Mini-Holland programme. Between March and September, they implemented additional schemes in several areas that had not yet been treated in this way.
Wandsworth	Wandsworth introduced LTNs around the Tooting area. Despite initial evidence of the LTNs reducing local traffic and boosting numbers of cyclists, they were removed after only a few weeks following complaints[72]. They have not been included on this map.
Westminster	Westminster have not so far built anything specifically called an 'LTN' (although plans for one have now been released); however, restrictions on motor traffic entry in some parts of Soho and Covent Garden (often with the aim of supporting businesses such as restaurants in those areas) have here been included as LTNs, as in Camden.

The next table (Table 4) provides more details on the extension of the new LTNs. Of the top ten London districts by size of new LTNs created, five are in Inner, and five in Outer

[72] https://democracy.wandsworth.gov.uk/documents/s77681/20.337%20Transport%20Action%20Plan.pdf

London.[73] As measurement of LTN size is somewhat imprecise, we also give the number of new modal filters installed, and (because borough sizes vary) the proportion of the borough that is covered by new LTNs. Note that some of the borough area will comprise non-LTN-able areas, such as parks; and that in some cases (especially in Hackney and Waltham Forest) boroughs had substantial pre-existing LTN programmes. To some extent the latter is captured by the first column, derived from the Healthy Streets Scorecard produced annually by a coalition of London environment and transport non-governmental organisations[74].

If judged solely on the number of new modal filters, City, Southwark, and Westminster are the top three, with 43, 38, and 36 respectively. If we look at the area of new LTNs, Lambeth is top with over three square km of new LTNs, achieved through 27 new modal filters and covering 12% of the borough, with Ealing just behind. Another way to look at LTN size is in relation to borough area. City of London has new LTNs covering nearly half of its area, but is very unusual in its small size and lack of resident population. Considering the more 'normal' boroughs, Hackney has the highest proportion of its area covered by new LTNs (14%), despite already having many such areas through historical schemes. Islington lies just behind Hackney and Lambeth in the proportion of the borough covered, with over 10%. The map following Table 4 shows how Hackney's new LTNs are part of a long-standing policy within the borough, and the ambition to cover the entire borough.

[73] We are here using the 'statutory' definition of Inner and Outer London: https://www.londoncouncils.gov.uk/node/1938
[74] See more at: https://www.healthystreetsscorecard.london/

Table 4: Boroughs, new LTNs, and existing and new modal filters.

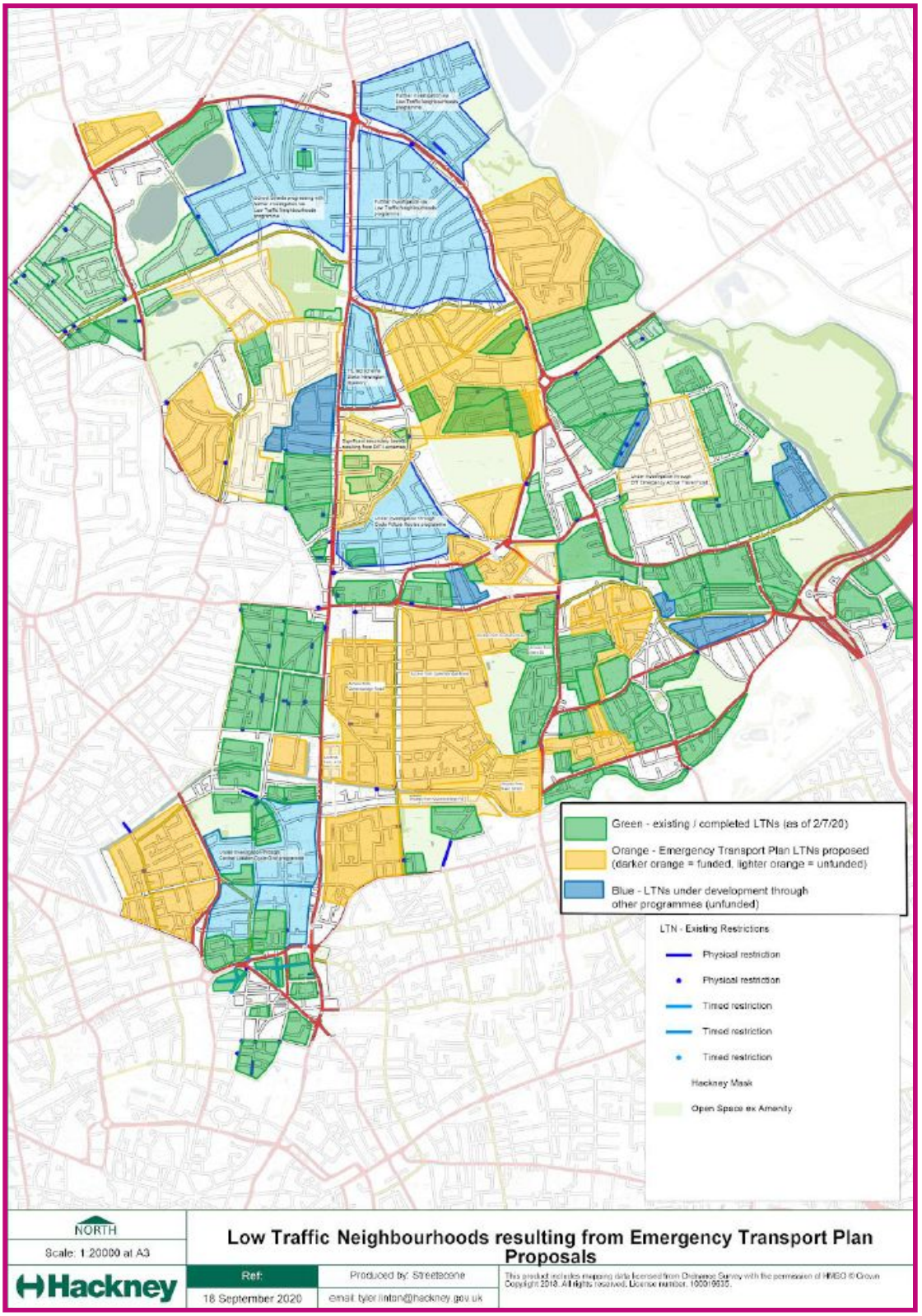
Borough	Existing modal filters, 2020 pre-Covid[75]	New modal filters (March-Sept 2020)	New LTNs (sqkm)	% of borough covered by new LTNs (built March-Sept 2020)
City of London (Inner)	18	43	1.4	48.5
Southwark (Inner)	52	38	1.2	4.1
Westminster (Inner)	28	36	0.6	2.9
Ealing (Outer)	45	31	3.1	5.6
Lambeth (Inner)	38	27	3.2	11.7
Hounslow (Outer)	29	25	2.1	3.8
Camden (Inner)	48	24	0.9	4.3
Hackney (Inner)	126	24	2.7	14.2
Islington (Inner)	39	22	1.6	10.7
Lewisham (Inner)	26	21	1.9	5.3
Croydon (Outer)	26	19	1.8	2.1
Waltham Forest (Outer)	55	18	1.5	3.9
Tower Hamlets (Inner)	73	16	0.8	3.9
Enfield (Outer)	16	15	1.7	2
Newham (Outer)	17	10	1.2	3.3
Greenwich (Inner)	31	9	0.5	1
Sutton (Outer)	25	7	1.0	2.3
Brent (Outer)	26	6	1.0	2.4
Hammersmith and Fulham[76] (Inner)	24	5	0.4	2.5
Harrow (Outer)	12	4	0.7	1.4

[75] Source: Healthy Streets Scorecard 2020
[76] See caveat above about the nature of this scheme.

Borough	Existing modal filters, 2020 pre-Covid[77]	New modal filters (March-Sept 2020)	New LTNs (sqkm)	% of borough covered by new LTNs (built March-Sept 2020)
Merton (Outer)	50	4	0.4	1
Richmond upon Thames (Outer)	27	2	0.0	0
Barking and Dagenham (Outer)	10	0	0.0	0
Barnet (Outer)	20	0	0.0	0
Bexley (Outer)	4	0	0.0	0
Bromley (Outer)	13	0	0.0	0
Haringey (Outer)	38	0	0.0	0
Havering (Outer)	16	0	0.0	0
Hillingdon (Outer)	37	0	0.0	0
Kensington and Chelsea (Inner)	15	0	0.0	0
Kingston upon Thames (Outer)	32	0	0.0	0
Redbridge (Outer)	7	0	0.0	0
Wandsworth (Inner)	26	0	0.0	0

[77] Source: Healthy Streets Scorecard 2020

Fig. 10: Past, present, and proposed LTNs in Hackney. Source: Hackney Council Emergency Transport Plan 2020.[78]



78 https://news.hackney.gov.uk/download/942088/rebuildingagreenerhackney-emergencytransportplan-respondingtotheimpactsofcovid-19onthetransportnetworkseptember2020.pdf

There are ten boroughs that have not to our knowledge introduced new modal filters nor new LTNs between March and September (aside from those removed before our October cut-off), to our knowledge. These boroughs are:

- Barking and Dagenham (Outer)
- Barnet (Outer)
- Bexley (Outer)
- Bromley (Outer)
- Haringey (Outer)
- Havering (Outer)
- Hillingdon (Outer)
- Kensington and Chelsea (Inner)
- Redbridge (Outer)
- Wandsworth (Inner)

Although there are equal numbers of Inner and Outer London boroughs in the 'Top 10', the ten without any LTNs are almost all Outer London boroughs (80%, with Kensington and Chelsea and Wandsworth the only Inner London boroughs without any new LTNs in place).

Are borough-level deprivation and car ownership related to LTN introduction?

The above discussion provides some pointers to answering this question. However, we also provide now, in a series of scatterplots, evidence on relationships across all 32 boroughs. We have decided to leave the City of London out because it is atypical and has so few residents; but we have included it in the tables above so its progress can be seen.

The fact that LTNs can be an equity-promoting intervention does not mean that they will be. Active travel infrastructure, like public transport infrastructure, is often disproportionately found in richer areas[79]. This was found to be the case in a report by Transportation Alternatives, in relation to New York's initial programme of Open Streets[80]. In relation to London cycle hire, stations in the initial roll-out of the scheme tended to be more frequently placed in richer areas, although the subsequent extension to East London boroughs such as

[79] Braun, L., Rodriguez, D. and Gordon-Larsen, P. 2018. 2397 - Social (in)Equity in Access to Cycling Infrastructure: Examining the Distribution of Bike Lanes with Respect to Area-Level Sociodemographic Characteristics in 23 Large U.S. Cities. Journal of Transport & Health. 9, p.S28. https://www.sciencedirect.com/science/article/abs/pii/S2214140518302718

[80] Transportation Alternatives 2020. Open Streets Progress Report. Available from: https://www.transalt.org/open-streets-progress-report.

Tower Hamlets offset this and resulted in a marked increase in the share of trips made by people from more deprived areas[81]. This highlights the importance of providing active travel infrastructure and facilities in poorer areas, where people more often lack car access.

We use a measure of 2019 deprivation that covers all 317 English local authorities[82]. The 'ranked average score' across all domains of deprivation, which gives a measure of how deprived a borough is, compared to all other English local authorities. Under this measure, the most deprived London borough is Barking and Dagenham (ranked 21 out of 317), followed closely by Hackney at 22. This puts them both in the top 25 for deprivation. At the other end of the scale, Richmond upon Thames has a score of 295, making it one of the 25 least deprived local authorities in England under this measure.

When it comes to car ownership levels, there is similarly much diversity across London boroughs. The 2011 Census data recorded seven London boroughs as having 75% or more households owning one or more cars: Hillingdon, Havering, Sutton, Bromley, Harrow, Bexley, and Richmond upon Thames. At the other end of the table, Camden, Westminster, Tower Hamlets, Hackney and Islington all had 60% or more of households living car-free.

The following graphs compare the deprivation and car ownership measures against the amount of existing, new, and total modal filters. 'Total modal filters' was obtained by adding together the 2020 Healthy Streets Scorecard figure with our figures on new filters introduced between March and September 2020. Given that we are now looking at the equity effects of LTN-type interventions over time (and not just on post-Covid measures), we focus on the number of modal filters which at this point we consider to be the more reliable measure of amount of interventions in different boroughs across time than LTN area, and for which we have a pre-existing measure. We have normalised the amount of modal filters to per 100km of non-motorway road length in each borough, as this varies somewhat between boroughs and gives a better sense of realised potential. We use 2019 measures of deprivation, the most recent available.

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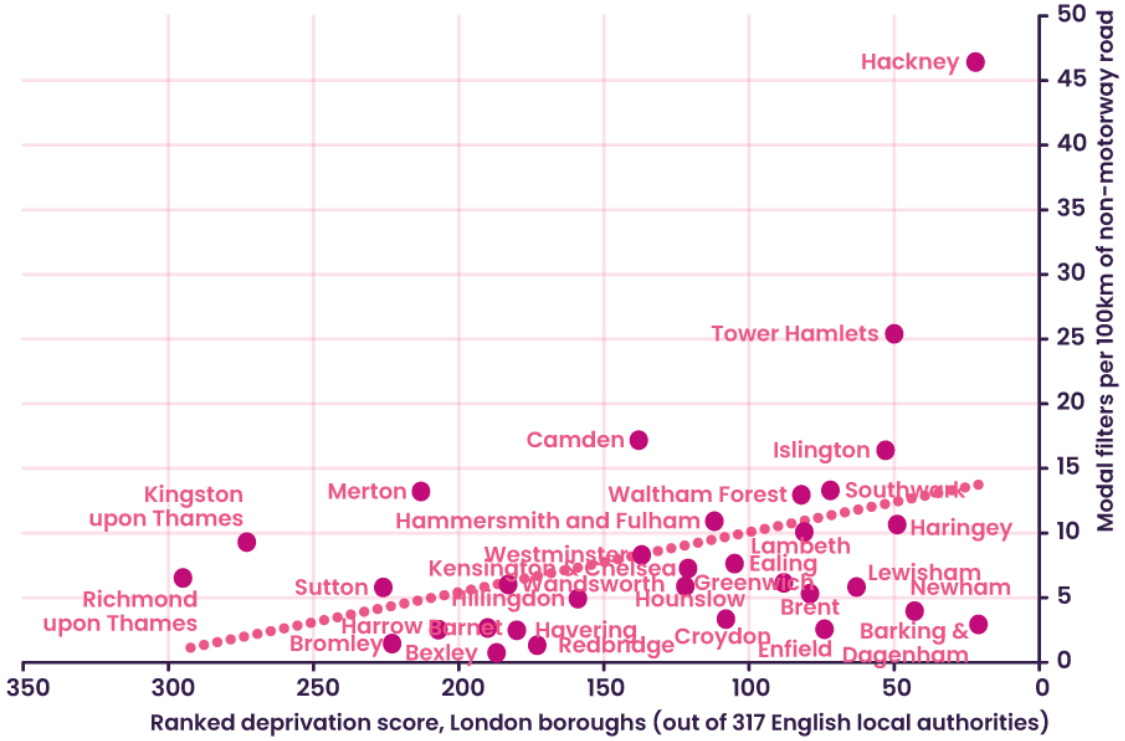
[81]Ogilvie, F. and Goodman, A. 2012. Inequalities in usage of a public bicycle sharing scheme: Socio-demographic predictors of uptake and usage of the London (UK) cycle hire scheme. Preventive Medicine. 55(1), pp.40–45. https://www.sciencedirect.com/science/article/pii/S0091743512001685. Goodman, A. and Cheshire, J. 2014. Inequalities in the London bicycle sharing system revisited: impacts of extending the scheme to poorer areas but then doubling prices. Journal of Transport Geography. 41, pp.272–279. https://www.sciencedirect.com/science/article/abs/pii/S0966692314000659

[82] Ministry of Housing, Communities & Local Government 2019. English indices of deprivation 2019. Available from: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019.

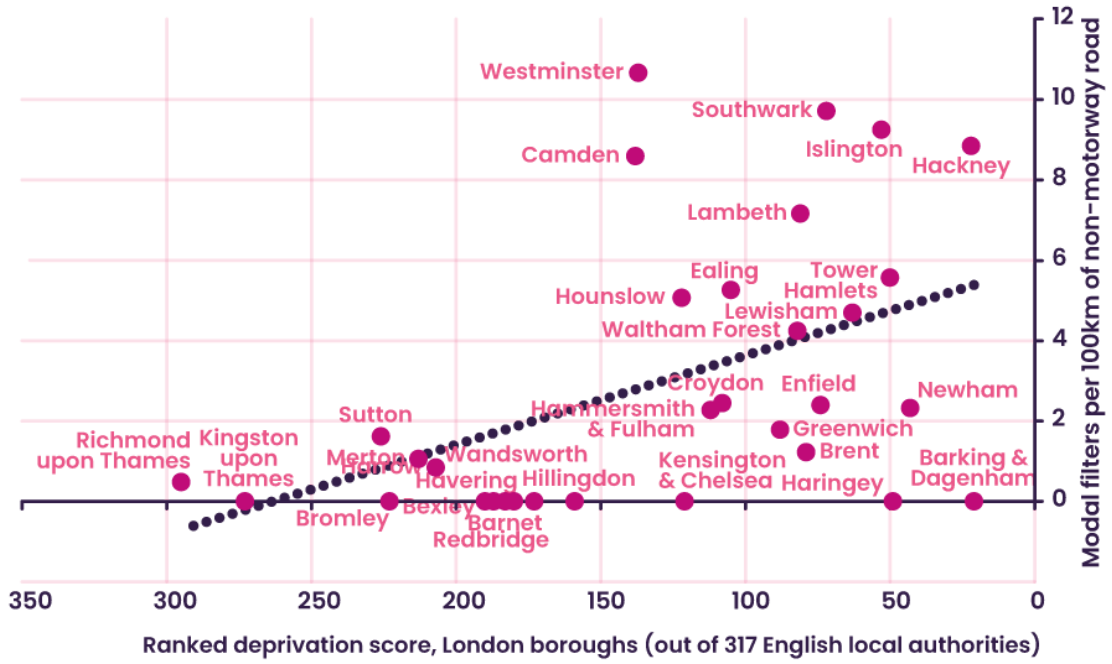
There is a negative relationship between deprivation and amount of filters, i.e. that more deprived boroughs (lower rank, i.e. higher on the list) tend to have more modal filters per 100km of street length. However, the correlation is fairly weak and there are clear exceptions. Highly deprived Hackney and Barking & Dagenham had and continue to have very different levels of modal filters (and the gap has widened).

Fig. 11: pre-Covid modal filters, by borough-level deprivation.



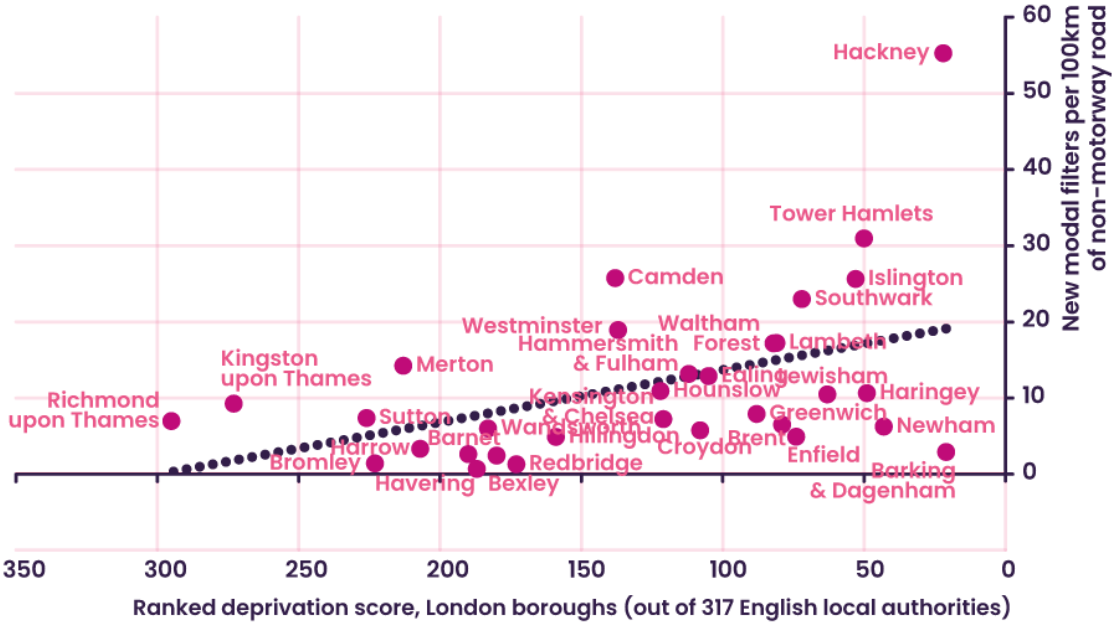
By contrast there is more uniformity among the less deprived boroughs such that most of them have done relatively little in the past, or currently (with a few exceptions). This is particularly noticeable for new filters, where with only a few exceptions (Harrow, Merton, Sutton) boroughs that are among the least deprived half of English authorities have done nothing or very little. However, again there is strong variation among the boroughs in the top half of English boroughs by deprivation, largely but not exclusively related to being in Outer London (Ealing, Hounslow, and Waltham Forest have been strong implementers within Outer London, and Kensington and Chelsea in Inner London has not implemented any new modal filters).

Fig. 12: new filters, by borough-level deprivation.



The final figure here combines the first two to give an overview of the density of modal filters across all boroughs (again excluding the City of London). The relationship remains apparent although as before fairly weak, with for instance the richest few boroughs expected to have few or non modal filters, compared to an expectation of around twenty per 100km of road length for the most deprived boroughs. In practice, Hackney has over fifty per 100km performing way above the line, while there remains substantial variation between different boroughs with similarly high levels of deprivation in particular.

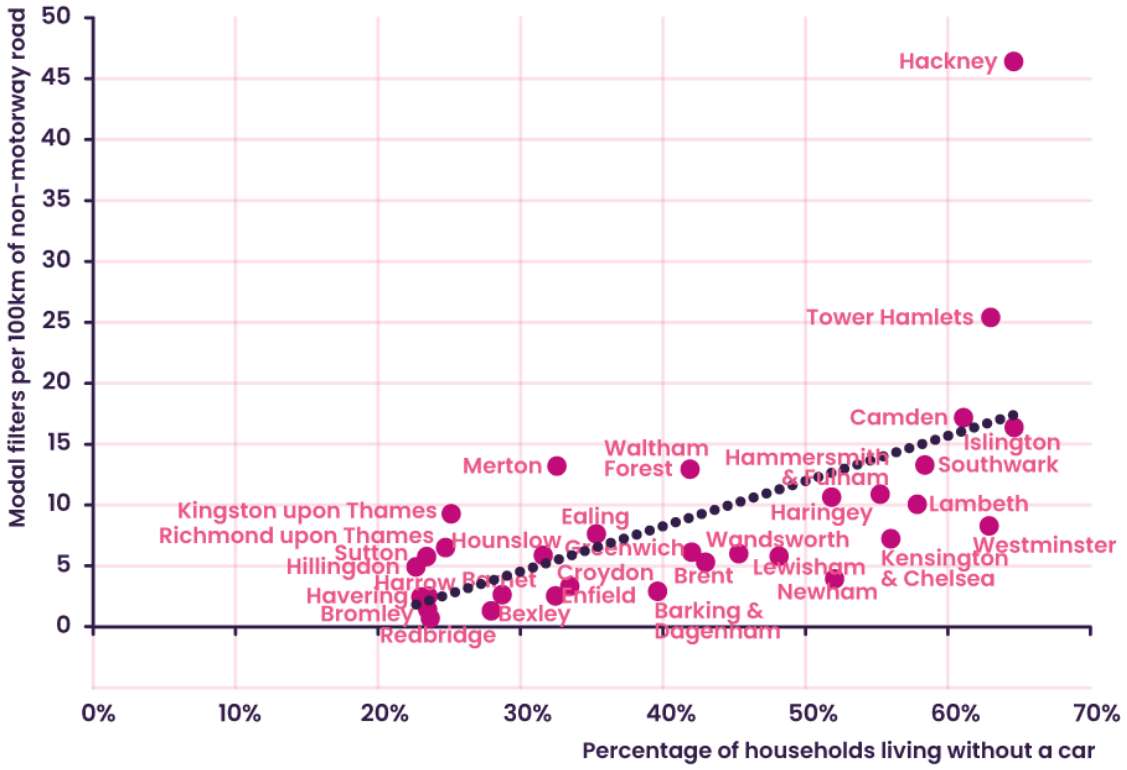
Fig. 13: All modal filters vs. borough-level deprivation.



When we consider car ownership, measured by the % of households without a car, an inverse picture arises – i.e. the boroughs with a higher percentage of car-free households enjoy more interventions, on average[83]. This is perhaps not surprising as boroughs such as Hackney, where many households are car-free, might have higher levels of political support for such interventions. However, there are other boroughs such as Kensington and Chelsea, or Haringey, that also have majority non-car ownership, but have done much less.

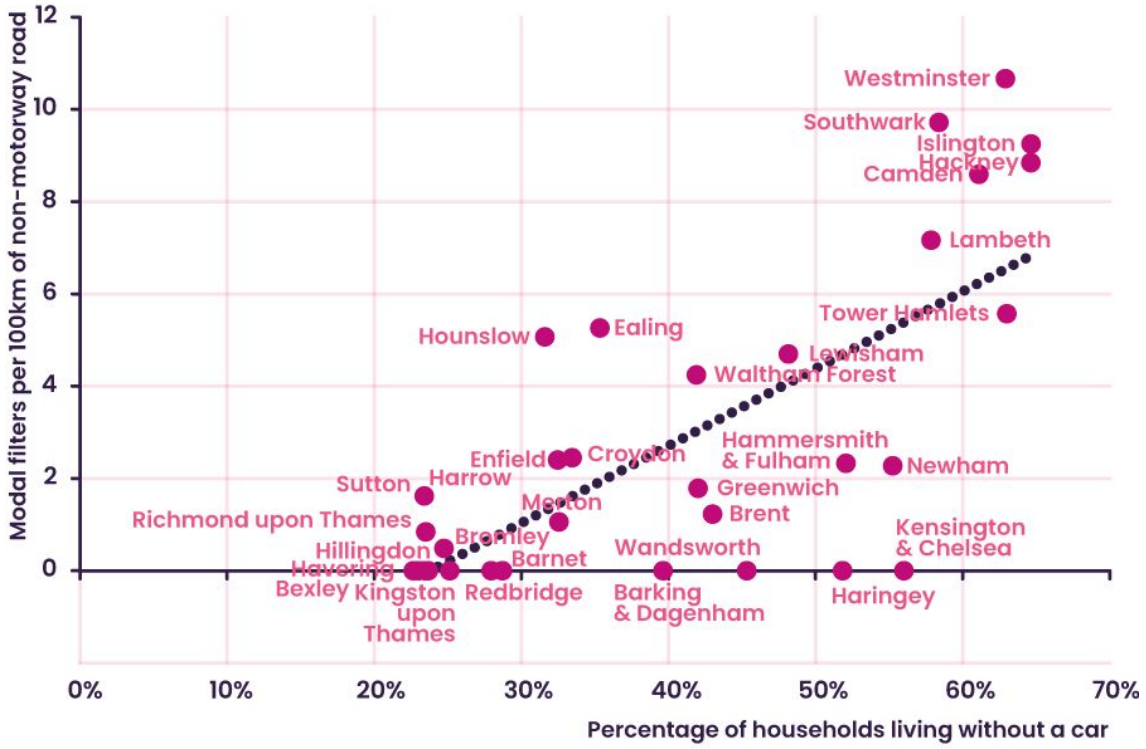
[83] Data on the percentage of households living without a car is from 2011, being Census data via Nomis; note that in London this has risen since then.

Fig. 14: Pre-Covid modal filters by % of car-free households in borough.



While Hackney was a clear outlier in terms of pre-Covid modal filters, for new filters implemented during March-September 2020, some other boroughs with very low car ownership put in similar amounts of new filters to Hackney: specifically, Westminster, Southwark, Islington, Camden, and Lambeth all implemented 7-11 modal filters per 100km of non-motorway road length. Boroughs that implemented very few or no modal filters, however, differ widely in car ownership, highlighting the key role of policy and political leadership in guiding the implementation of LTN-type measures.

Fig. 15: new filters by % of car-free households in borough.



While it may be more politically difficult to introduce these interventions in areas with higher car ownership, this will potentially have greater scope to reduce car use, and may particularly benefit households without cars living in car-dependent boroughs in Outer London (whereas it is easier to live without a car in a borough like Hackney or Islington, where there is less assumption that services will be reached in this way). Even in the most car-dependent boroughs, more than one in five households live without a car. Many of these will be on lower incomes and seven in eight will live on residential streets. There are examples of boroughs with high car ownership that have started introducing LTN schemes, as seen in the chart above. Hounslow and Ealing have majority car ownership yet have introduced substantial numbers of modal filters during March-September 2020, doubling or almost doubling the pre-Covid number.

The final figure illustrates how far behind some boroughs are falling, failing in particular their residents living without cars. Those boroughs with 22-30% of households without a car all have fewer than ten modal filters per 100km of non-motorway road. Even some boroughs which have up to 56% of households car-free are similarly poorly served.

Fig. 16: All filters by % of car-free households in borough.

Having a high proportion of households without a car has in the past been a necessary but insufficient criterion for restricting streets to through motor traffic. It continues to be insufficient; as some councils with a majority living car-free are doing little. However, we are now also seeing some authorities with higher levels of car ownership, both in London and elsewhere, who have chosen to implement LTNs.

Conclusions

It is not surprising that cities across the world have responded to the Covid-19 pandemic with rapid investments to support active travel. For decades citizens, advocates, planners and researchers have been providing evidence of the key importance of safe, car-free or car-lite urban outdoor spaces for citizens' health and wellbeing as well as in the fight against climate change. By allowing slower, more ecological and safer mobilities, as well as easily accessible cleaner and safer spaces for encounter and play, car-free and car-lite areas are becoming a key tool for ensuring healthy urban living both in the short and long term.

The equity distribution of these opportunities has to be taken carefully into account if cities aim to become more equal. Interventions should take into account the differential deprivation levels within each borough and prioritise areas of higher deprivation, given that LTNs can particularly benefit people living without access to private greenspace or local safe public spaces for playing and socialising. As a low cost and easily implementable solution, LTNs can contribute to much needed fast urban transformation and radical reimagining of what - and who - public space is for, and help meet broader environmental goals.

This doesn't mean that the road ahead is easy. The heated debates on the temporary LTNs introduced in London and elsewhere, the failure of some often linked to local political controversies[84] are related to the disruption of the normality of a car-centred society that is inevitable and perhaps necessary if radical change has to be achieved. It is not too long ago that, despite the fierce opposition by local businessmen and shopkeepers, Groningen Council banned cars from the entire city centre effectively overnight, generating a chaos from which emerged one of the European cities with highest quality of life[85] [86].

[84] Zografos, C., Klause, K.A., Connolly, J.J.T., Anguelovski, I., 2020. The everyday politics of urban transformational adaptation: Struggles for authority and the Barcelona superblock project. Cities 99, 102613. https://doi.org/10.1016/j.cities.2020.102613

[85] Zee, R. van der 2015. How Groningen invented a cycling template for cities all over the world. The Guardian. [Online]. [Accessed 5 November 2020]. Available from: https://www.theguardian.com/cities/2015/jul/29/how-groningen-invented-a-cycling-template-for-cities-all-over-the-world.

[86] Gowling, A. 2013. Dutch cities rate highly in quality of life. IamExpat. [Online]. [Accessed 5 November 2020]. Available from: https://www.iamexpat.nl/read-and-discuss/expat-page/news/dutch-cities-high-quality-life.

While a serious and truly participatory democratic debate about the future of London and its neighbourhoods is crucial, complete consensus is an unrealistic objective where such diverse needs, capabilities and ideas coexist. If the road for cars has been paved and protected in a recognisably undemocratic fashion[87], car-dependence itself is not always the result of a 'free choice' and is connected to some of the arguments made against LTNs. In a system designed to make it necessary, the car helps many people get through the day-to-day demands of everyday life, especially when specific mobility or economic needs exist[88]. Radical transformations are a difficult path at a time when many people are struggling economically and socially. These elements should be taken into account in trying to understand the reasons for such fierce conflicts and, at the same time, address unintended consequences of LTN trials and other active travel interventions.

However, the rapid changes in numbers of cyclists and pedestrians that various cities are witnessing, show that support exists when differential needs, capabilities and visions are given a space to be taken into account. LTNs are only one of the many different changes that have to be implemented both at the level of urban infrastructure and in the cultures around mobility to achieve true urban transformations. These changes, as studies around both Barcelona superblocks and New York Open Streets suggested, have to be coordinated and long term. For example, it is key to rapidly link more LTNs to provide a reliable network of footways and cycleways and to intervene on main roads, for instance improving public transport and cycling routes.

[87] Mattioli, Giulio, Cameron Roberts, Julia K. Steinberger, and Andrew Brown 2020. The Political Economy of Car Dependence: A Systems of Provision Approach. Energy Research & Social Science 66: 101486. http://www.sciencedirect.com/science/article/pii/S2214629620300633

[88] Mattioli, Giulio 2017'Forced Car Ownership' in the UK and Germany: Socio-Spatial Patterns and Potential Economic Stress Impacts. Social Inclusion 5(4): 147–160. https://www.cogitatiopress.com/socialinclusion/article/view/1081

Recommendations

- LTNs enjoy majority support as a planning tool and this has been growing. However, they are controversial when introduced, and it is important to get details right as well as to allow trials time to bed in and for monitoring and evaluation. Under Experimental Traffic Orders, consultation is concurrent with implementation. Platforms should be used that allow the speedy identification and resolution of problems, such as re-siting planters whose placement has caused difficulty for disabled pedestrians. For future roll-outs opportunities should be taken to design LTNs inclusively with advice from disabled people's groups, emergency services, and others, to avoid such problems happening in the first place. As boroughs plan LTNs, social equity should be one criterion used.

- Consultations should pick up where LTNs should be extended, as well as where mitigation measures are needed (e.g. adjusting signal timing as traffic patterns change). Authorities should be ready as needed to bring forward the introduction of neighbouring LTNs, or to introduce pop-up measures on local main roads and high streets. Such co-ordinated planning can be difficult in London with its 33 districts each with control of the majority of borough roads. However, it is not impossible, with examples of neighbouring boroughs collaborating on the introduction of cross-borough LTNs (such as Newham and Waltham Forest, or Ealing and Hounslow).

- The London boroughs that have not implemented LTNs, particularly those with high levels of deprivation (such as Haringey) should do so, and this will increase London-wide equity of LTNs. Many boroughs without LTNs are suburban, Outer London boroughs with high car ownership. From an equity perspective, people without cars may be particularly disadvantaged in such settings; for instance as car use is assumed and public transport sparser. It is important that LTNs benefit those residents too, and not only those in deprived areas of Inner London.

- Differences between residential street and main road/high street residents by age group, income group, ethnic group, and disability status are relatively small, and relate more to Outer than to Inner London. Therefore implementing LTNs in itself is not likely to pose major social equity issues (by benefiting those living on

residential streets more than those living on main roads). However, and particularly in Outer London, it is in any case important that the 5% of residents living on main roads and the 5% of residents living on high streets benefit from improvements that reduce the impact of motor traffic and increase their access to safe and pleasant active travel options.

- LTNs should be part of longer-term programmes to improve quality of life across London, and authorities should link LTNs to the Mayor's Transport Strategy 2041 goal that there will be 'at least 3 million fewer daily car trips and one quarter of a million fewer cars owned in London' (despite likely substantial population growth over that period)[89]. Early evidence suggesting that LTNs might reduce car ownership and use by around 20% among residents implies they could contribute strongly to this goal[90].

[89] Mayor of London 2018. Mayor's Transport Strategy.Available from: https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf
[90] Aldred, R. and Goodman, A. 2020. Low Traffic Neighbourhoods, Car Use, and Active Travel: Evidence from the People and Places Survey of Outer London Active Travel Interventions. Findings, September.https://findingspress.org/article/17128-low-traffic-neighbourhoods-car-use-and-active-travel-evidence-from-the-people-and-places-survey-of-outer-london-active-travel-interventions