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Post-lockdown mode shift
scenarios for commuting in
England and Wales

May 2020

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Contents



Executive Summary	5
Introduction	7
Methods	9
Bus and train commuting trips: who, how many, how far?	9
The Negative Scenario: up to a million more cars on the road at peak hour?	14
The Positive Scenario: potential for up to half of all habitual public transport commute trips to shift to active travel	18
Switching car commute trips to active travel modes	24
Policy implications	33

Executive Summary



Content

- As lockdown restrictions ease, commuting and other trips will grow.
- However, many people will seek to avoid public transport, and all are being strongly discouraged from doing so unless they have no alternative.
- Some estimates have suggested that public transport capacity will be cut to a sixth or less of its former rates to accommodate physical distancing.
- Report examines potential scale and impacts of public transport commuting trips shifting to car or to active travel in England and Wales.

Findings – switch to car

- Scope for 2.7 million more people to travel to work by car, a 17% increase in car commuting (from 60% to 70% of all employees) if public transport commuters who can, switch to driving.
- One million more commuter cars on the road, even with more within-household car sharing. Relative growth is most severe in urban areas with high public transport use, e.g. Camden sees a 74% increase in cars used to commute.
- The growth in driving for commuting equates to around 0.6 Mt (million tonnes) of carbon emissions annually in England and Wales. As commuting is only a fifth of trips by distance, if similar shifts are made for other trip purposes this might mean a rise of 3.1MT.
- Even if all public transport commuters with car access switch, though, this would only cover 59% of bus/coach users (who tend to do jobs less amenable to home working), leaving buses still potentially overcrowded in many areas at peak times.

Findings – switch to active travel

- However, a switch to active modes (like walking, cycling, scooting, e-bikes) among people whose commute distance is under 10km could capture up to three-quarters of bus/coach trips, up to a half of public transport commutes overall – in total over two million trips.
- If all this is extra cycling, the resulting four-fold increase avoids over five hundred premature deaths annually, due

to physical activity, with an economic benefit close to a billion pounds a year.

- Avoiding growth in car use is likely to rely on a combination of active travel infrastructure and supporting measures (particularly targeting former bus commuters), and continued home working among those living further from work (mainly train commuters).
- As bus and coach commuters are less likely to have access to a car than train commuters, it is especially important they have access to active travel infrastructure and services.
- Further scope for mode shift to active travel, especially cycling, among those who previously commuted by car, with 8.4 million car commute trips under 10km.

Recommendations for authorities

- Plan strategically – use active transport to take the strain off public transport where most effective
- Install a network of temporary/experimental infrastructure along key bus and local train corridors
- Roll out ‘mini-Hollands’ or ‘low-traffic neighbourhoods’ to support the start and end of journeys, and combinations of journeys
- Identify locations where additional cycle parking may be needed
- Provide subsidised or free access to bikes and e-bikes, repair and maintenance, and cycle training (Bikeability in England)
- Bring forward, enhance, or develop plans to control demand for driving

Introduction



As lockdown eases in the UK and other countries, people are starting to go back to work. However, public transport capacity and demand are likely to be severely depressed for some time. Transport Secretary Grant Shapps has suggested that physical distancing means the public transport network would be reduced to 10% of its former capacity¹. In London, Transport for London have suggested a figure of 15%². Government has told people to avoid public transport if at all possible, suggesting they walk, cycle, or drive³.

Particularly in urban areas where many people commute by public transport, this has alarming implications. Many people lack the choice to drive, without a car in the household. While in theory cycling could serve shorter to medium length commutes, much evidence shows that without networks of cycle infrastructure that offer protection from motor vehicles, many people – and especially women⁴ – are reluctant to get on their bikes. Without better options, those with car access may well choose to drive, with negative impacts for congestion, air pollution, carbon emissions, injuries and physical activity⁵. Others without car access may continue using public transport despite the risks.

This report responds to the challenge by seeking to quantify the scope for behaviour change among usual public transport commuters in the relatively short term. This includes (i) a shift to car use among those who have access to a motor vehicle and (ii) a shift to active travel among those with short to medium distance commutes. We consider both those whose ‘main mode’ of commute is bus, minibus or coach (henceforth ‘bus’ for brevity) and train, underground, metro, light rail or tram (henceforth ‘train’). While there is some overlap (e.g. in London multi-modal public transport commutes are common) these modes nonetheless have distinct characteristics in terms both of car ownership and distance. The report considers carbon impacts of a shift to

¹

<https://www.theguardian.com/world/2020/may/09/back-to-work-capacity-of-transport-network-will-be-down-by-90>

²

<https://news.sky.com/story/coronavirus-commuters-pack-london-tube-platforms-after-pms-lockdown-announcement-11986344>

³

<https://www.manchestereveningnews.co.uk/news/uk-news/everybody-should-avoid-public-transport-18234038>

⁴ <https://www.tandfonline.com/doi/full/10.1080/01441647.2016.1200156>

⁵ <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051462>

the car, and health impacts from physical activity for a shift to active travel.

Methods



Census 2011 data for England and Wales was used for this analysis. While only covering commuting and nine years old, it contains detailed data on almost all commuters, and so can be analysed at sub-regional levels. The population has grown since 2011 without substantial change in how people travel.

Initially we present some background information on commuting to work by bus versus by train. The main body of the analysis is conducted using (i) main method of travel to work by car ownership, and (ii) main method of travel to work by distance category of commute, both at local authority levels. For (ii) we used the Propensity to Cycle Tool model⁶ with assistance from Dr. Anna Goodman.

Two scenarios were generated, each extreme but representing scope for change, both positive and negative. The negative scenario assumes that everyone with a car in the household, who at baseline commuted by public transport, shifts to using a car. We assume that where people are living in one-car households, this generally does not generate a new car trip⁷, but it does so for those 24% of previous public transport commuters with two or more cars in the household.

Estimating the number of new car trips is important for calculating carbon emissions; for the wholly new car trips, we assume an average one-way commute distance of 14km (the English average for all commuting trips⁸), and then a 140g/km fleet average for car CO2 emissions⁹, to calculate the additional carbon emissions on a typical commute day given all these new car trips.

The positive scenario by contrast assumes that all commute trips with a route network distance¹⁰ of under 10km previously made by public transport are instead made by active travel. Again, this is extreme, but gives an estimate of *potential* and how this varies by area and by whether a commute trip was

⁶ See www.pct.bike for more on the PCT, which models cycling potential at area, route, and network level for both commuting and school travel.

⁷ The exception being that relatively small number of authorities where this leads to the local area having an average commuting car occupancy of over 2.0 – i.e. more passengers than drivers – considered implausible especially given physical distancing – in this case the number of drivers and passengers are then equalised.

⁸ <https://www.gov.uk/government/statistical-data-sets/nts04-purpose-of-trips>

⁹ <https://www.gov.uk/government/statistical-data-sets/veh02-licensed-cars>

¹⁰ Calculated using the Cyclestreets 'fast route' algorithm which generates the most direct legally cyclable route.

previously made by train/metro/tram or by bus/coach. Note that to make the scenario more accurate we have used route network, not crow-fly distance: a straight-line distance of 10km may in practice be much longer if it is severed by a motorway or rail line.

From the 4.2 million public transport commuters, 3.9 million (92%) had a fixed workplace. For these, we switched from public transport to cycling if the fastest cycling route distance from the home to the workplace was <10km. This involves switching 1.9 million commuters, or 49%. For the remaining 343,000 public transport commuters (8%) with no fixed workplace, we also switched a proportion of these to cycling. Specifically, we selected those living in MSOAs [middle layer super output areas, a Census geography each with around 7,500 people] where the average estimated distance travelled by cyclists was <5.55km. We selected this threshold as it again yielded 49% of all these public transport being switched to cycling¹¹.

We used the methods developed for the Propensity to Cycle Tool to calculate the health benefit from the physical activity done by the new commuters as part of their commutes. The approach is based on the DfT's Transport Appraisal Guidance¹². It incorporates background levels of mortality risk alongside differences in health impacts by age and gender, for instance. Our calculation here assumes that all the new trips are cycled; in practice some of the shorter trips would be walked, which would generate higher health benefits. Conversely (and depending on policy and legislative support) some trips might switch to micromobility, which would reduce the health benefits somewhat for e-bikes and much more for only marginally active modes like e-scooters.

¹¹ Described in Table 1 in the appendix to Lovelace et al 2017 <https://jtl.u.org/index.php/jtl/article/view/862>.

¹² See <https://www.pct.bike/tabs/manual.html>

Bus and train commuting trips: Who, how many, how far?



There are 4.2 million commuters in England and Wales who would normally travel to work by public transport, compared to 15.8 million who drive. Among public transport commuters, 2.3 million are train users while 1.9 million get the bus.

Among all employed people in England and Wales, only 12.5% live in a household without a car. Unsurprisingly the figure is higher for public transport commuters. Among bus commuters, 41% live in households without a car, while the figure is 29% among train commuters. Among all commuters, 52% live in households with two or more cars, but this is a minority for public transport commuters: 28% of train commuters and only 19.5% of bus commuters.

Figure 1 presents crow-fly distance travelled to work by main commuting mode, for all commuters, and for bus and for train commuters. For bus commuters, distances are notably short compared to train or to all commuters, with a peak in the 2-5km category (38% of bus commutes). For train commuters the picture is different, with a peak in the 10-20km category (29% of train commutes). While 58% of all commutes are under 10km crow-fly distance, this is true for 77% of bus commutes, but only 33% of train commutes.

Distance travelled by main mode of commuting

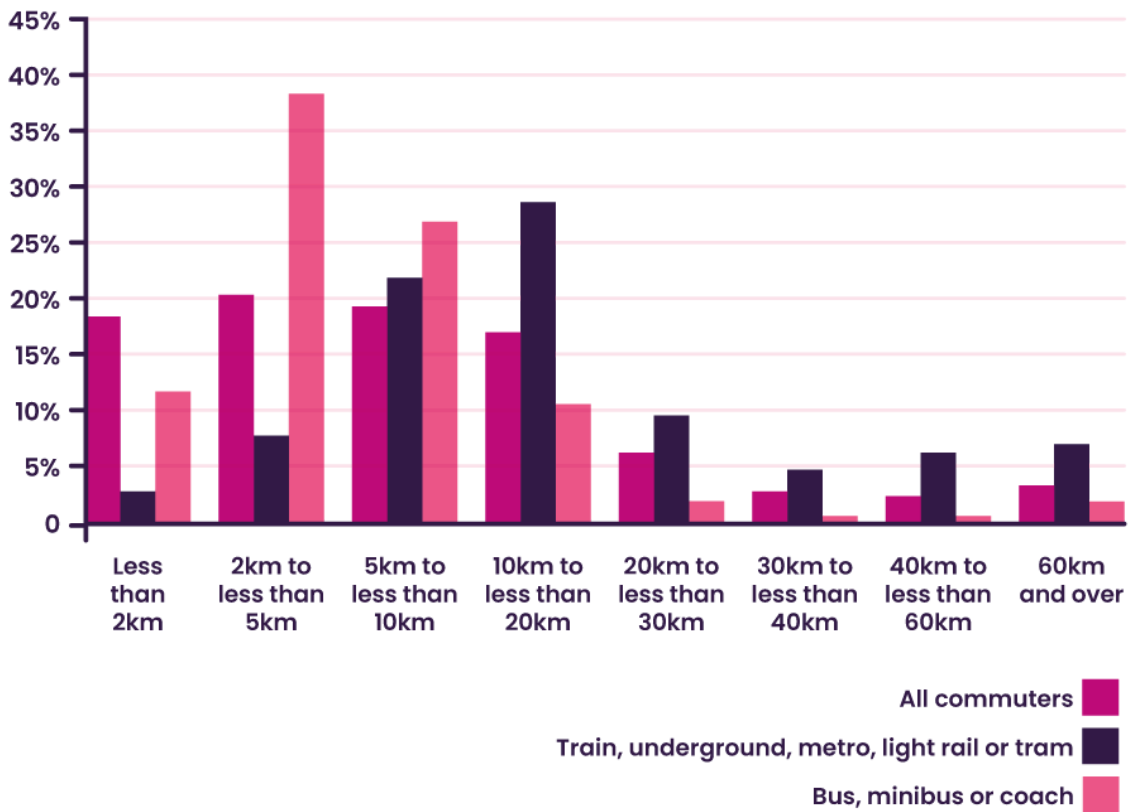


Figure 1: Crow-fly distance travelled to work by main mode (Source: Census 2011, England and Wales data)

Compared to all those in employment, public transport commuters are more likely to be...

- Relatively young (49% for bus or train commuters vs. 35% of all employed)
- Black or minority ethnic (18.5% of all employed, but 40% of train and 35% of bus commuters)
- **For bus commuters:** working in wholesale and retail trade or motor vehicle repair (22% vs. 16% of all employed), in accommodation or food service activities (10% vs. 6% of all employed), or in health or social work (16% vs. 12.5%)
- **For train commuters:** working in finance or insurance (15% vs. 4% of all employed), or in professional, scientific, or technical activities (15% vs. 4% again).
- **Bus commuters** are more likely to be female (62% of bus commuters vs. 47% of all employed and 44% of train commuters)
- **Train commuters** are more likely to be in higher managerial, administrative and professional occupations than all employed (26% vs. 13%), but bus commuters are less likely (6%). The same pattern holds for higher professional occupations (10% of all, 21% of train, but only

5% of bus commuters) and to a lesser extent for lower managerial, professional and administrative occupations (25% of all, 33% of train, but only 18% of bus users). By contrast for semi-routine or routine occupations the pattern is reversed with these groups over-represented in bus commuting and under-represented in train commuting (semi-routine: 14% of all, 7% of train, and 24.5% of bus commuters; routine: 10% of all, 4% of train, and 14% of bus commuters).

Figure 2 illustrates the differing occupational breakdowns: bus commuting has a different social gradient to train commuting, with a higher concentration of people in caring, sales, and 'elementary' occupations, whereas professionals and technicians are over-represented among train commuters.

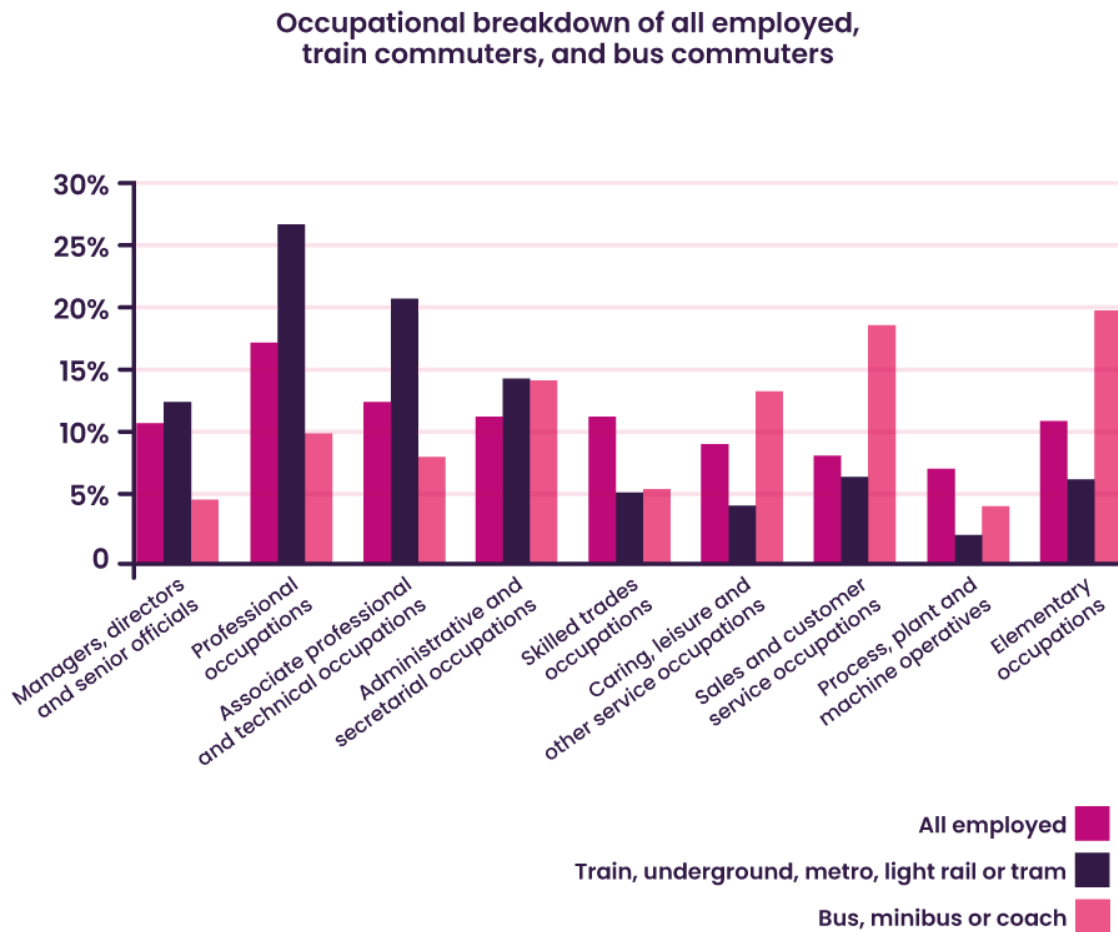


Figure 2: occupational breakdown of all employed vs. public transport commuters (source: Census 2011, England & Wales)

The Negative Scenario: up to a million more cars on the road at peak hour?



Across England and Wales, at baseline (from the Census) 14,481,305 people (55% of all those in employment) drove to work.

The negative scenario adds another 1,060,062 car **drivers**, i.e. 7% more. The total number of new car **commuters** is 2,760,945, or an increase of 17% upon the baseline figure. The scenario incorporates the assumption that in a one car household, most new car commuting trips are as a passenger. Hence under this scenario average car occupancy during the commute rises from 1.1 to 1.2, with much sharper rises (to a maximum of 2.0 in ten Inner London boroughs) in dense urban areas where public transport use is currently high. Car mode share grows by 10 percentage points across England and Wales, from a mode share of 60% of employed people travelling to work by car to an unprecedented 70%, at a time when the government aims to reduce car use.

The 7% rise in cars on the roads is not evenly spread across local authorities. In Camden, a combination of baseline high public transport use but a relatively (for inner London) high proportion of two car households means a relative increase of 74% in the number of car-driver trips, even with average commuter car occupancy¹³ almost doubling to 2.0. All London boroughs see an increase of at least 22% in commuter cars. (Clearly this will be mitigated by lack of car parking in the centre, but it illustrates the potential demand for driving). Other cities see substantial increases, e.g. Brighton and Hove, and Oxford, each with 12% growth in commuter cars, Newcastle with 9%, and Birmingham with 8%. By contrast more rural areas see relatively little change, as commuting is so car dependent at baseline.

Overall, the scenario leads to two-thirds (65%) of baseline public transport commuters shifting to car use (as driver or passenger), while one-third (35%) of public transport commuters do not shift as they do not have a car in the household. This is not evenly split by mode: 71% of train

¹³ Measured for this purpose as the total number of car commuters divided by the total number of car drivers.

commuters have a car in the household, but only 59% of bus commuters.

Figure 3 shows the hotspots for extra commuter cars across England and Wales by local authority, unsurprisingly concentrated in urban areas. Figure 4 shows further detail for London, highlighting for instance just over 5,000 more car driver trips in the London Borough of Hackney switching from public transport, and just over 10,000 more in neighbouring Waltham Forest.

Figure 3: hotspots for extra commuter cars on the road, by local authority

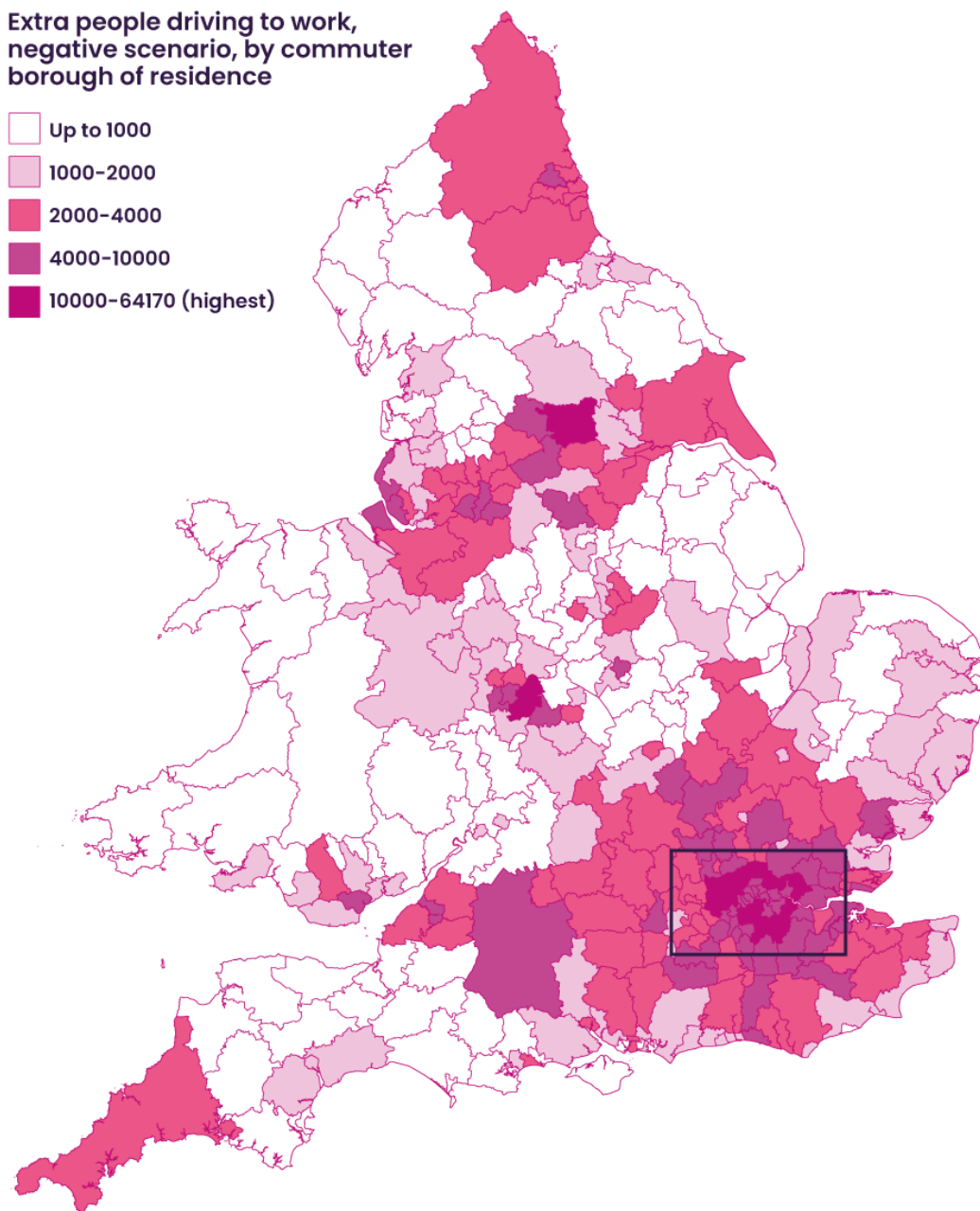
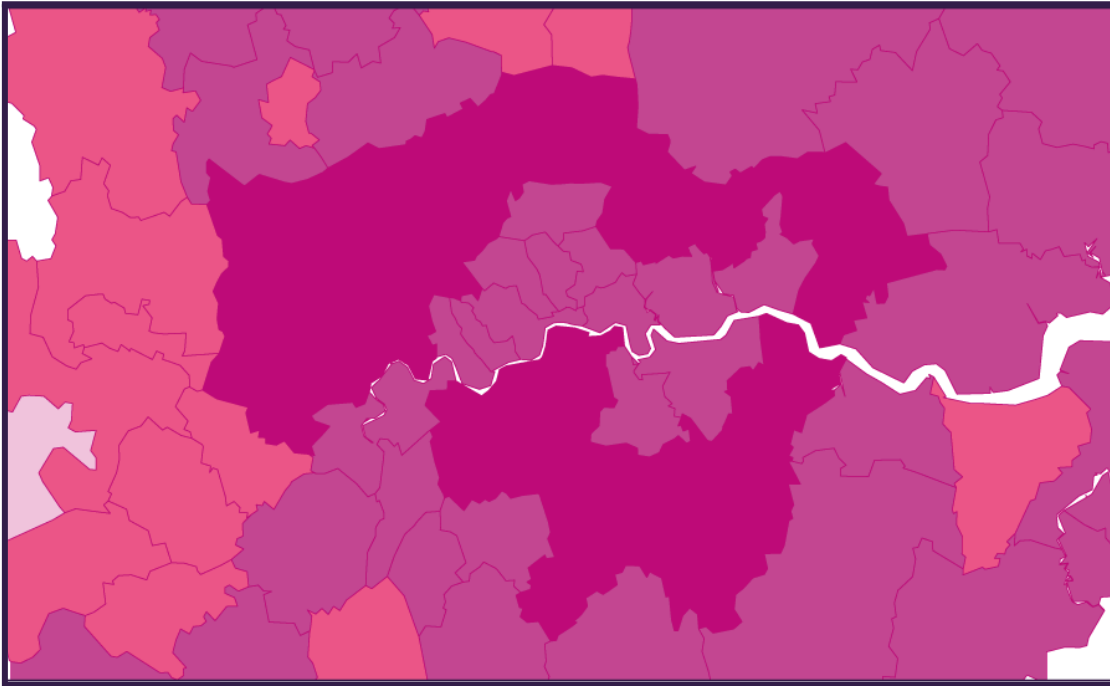


Table 1 illustrates the top twenty local authority districts with the greatest absolute increase in commuter cars under the scenario. Outer London boroughs make up most, having large proportions of residents with two or more cars who currently use public transport. Birmingham and Leeds also lie in the top twenty.

Table 1: local authority districts with the greatest absolute increase in commuter cars under the scenario

Local Authority District	Increase in car users	Increase in commuter cars
Bromley	49,918	20,249
Barnet	51,333	18,982
Birmingham	54,471	18,738
Croydon	52,285	18,176
Redbridge	43,184	17,461
Wandsworth	56,827	17,068
Ealing	49,556	16,107
Harrow	35,924	16,094
Havering	33,245	15,651
Brent	44,229	14,879
Enfield	38,149	14,003
Bexley	32,536	13,930
Lambeth	45,106	13,546
Hillingdon	29,227	12,796
Leeds	36,487	11,688
Hounslow	32,543	11,413
Southwark	36,729	10,370
Merton	36,986	10,247
Waltham Forest	36,653	10,094
Newham	40,301	9,765

Figure 4: London detail, extra commuter cars by local authority



Carbon Impacts

Estimating the carbon impacts of a million extra commuter cars on the roads requires assumptions about commuting frequency, as well as about journey length (not available in the Census table used to calculate the scenario), and typical fleet carbon emissions. These assumptions were set at 5.7 commuting trips per week or 300 one-way trips per year¹⁴, and 140g/km fleet average for car CO₂ emissions. For distance, we used the average commute distance of 14km each way. Bus trips are on average shorter, as per above; but rail trips are on average longer, with national rail commuting trips 20 miles/32km, twice the average car commute.¹⁵

The growth in driving for commuting equates to around 0.62 Mt (million tonnes) of carbon emissions annually in England and Wales (current UK transport carbon emissions are 115 Mt annually). As commuting is only a fifth of trips by distance, if similar shifts are made for other trip purposes this might mean a rise of 3.1Mt.

¹⁴

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877039/commuting-in-england-1988-2015.pdf

¹⁵

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877039/commuting-in-england-1988-2015.pdf

The Positive Scenario: potential for up to half of all habitual public transport commute trips to shift to active travel



In this scenario we assume that commute trips with a route distance under 10km that are currently made by public transport switch to cycling (or other active modes). Across England and Wales just under half (49%) of public transport commutes involve a route distance of under 10km. However, for public transport commutes the length varies strongly by mode, with bus commutes typically of this distance while train commutes are more typically longer (see Figure 1).

If all of the 74% of bus commutes with a route network distance under 10km shifted to cycling¹⁶, plus the 29% of train commutes that fall in this category, this would lead to an extra two million people cycling to work, compared to the current figure of three quarters of a million. Around two-thirds (1.4 million) of the new cycle commuters would be switching from bus, and around a third (670,000) from rail-based modes.

As with the switch to car, the switch to cycling (in absolute and relative terms) is highly variable. Birmingham and Lambeth are top in terms of absolute numbers of new cyclists, around 64,000 apiece. In Birmingham up to seven in ten public transport commuters could switch. Leeds and Manchester both see over 40,000 new cyclists, with Sheffield and Liverpool also showing high potential for cycling to take pressure off public transport.

The variation is due to the differing sizes and numbers of public transport commuters in each local authority, as well as variation in public transport commute distances.

¹⁶ Among currently cycled commutes in England and Wales, 82% are under 10km route network distance.

Table 2: local authority districts with the greatest absolute increase in cycling under the scenario

Local authority district	Absolute increase in cycling	Proportion of public transport users switching to cycling	Annual lives saved (from increased physical activity)
Birmingham	64170	69%	21
Lambeth	63823	61%	22
Southwark	61721	72%	22
Wandsworth	50253	47%	13
Tower Hamlets	47533	70%	7
Islington	45758	78%	15
Westminster	44374	78%	12
Camden	43332	74%	16
Hackney	42592	69%	10
Leeds	42494	69%	11
Manchester	41947	76%	6
Liverpool	38138	78%	12
Brent	37797	49%	13
Hammersmith and Fulham	35407	64%	7
Sheffield	34896	75%	12
Newham	32353	39%	5
Kensington and Chelsea	31722	77%	12
Haringey	31443	43%	6
Lewisham	31213	39%	5
Ealing	29094	38%	5

This variation is due to variation in the number and length of public transport trips. For instance, in Hull, nearly nine in ten (88%) of all public transport commutes are under 10km, whereas in Sevenoaks, fewer than one in ten (9%) are (although nearly half, 47%, of bus/coach commutes in Sevenoaks are under 10km). In Exeter, Hull, and in five London boroughs (City of London, Islington, Westminster, Camden, and Kensington and Chelsea) nine in ten (or more) bus commutes are under 10km.

Table 3 highlights the local authority districts with the greatest relative increase in commuter cycling under this scenario. This does not mean that these areas have the most new cyclists, but that there is the greatest change compared to the usual situation. For instance, Harrow has 18 times more people cycling than at baseline. This gives an indication of places where there may be a particularly strong need for improved infrastructure and capacity for cycling.

Table 3: local authority districts with the greatest relative increase in commuter cycling, comparing total scenario cycling to baseline

Local authority district	Relative increase in cycling
Harrow	18 times greater than baseline
Merthyr Tydfil	17
Newham	16
Barking and Dagenham	14
Croydon	13
Havering	12
Bradford	12
Gateshead	11
Brent	11
Redbridge	11
Birmingham	11
Liverpool	11
Enfield	10
Barnet	10

Westminster	10
Kensington and Chelsea	10
Hillingdon	9
Sheffield	9
Sandwell	9 times greater than baseline

As shown for the negative scenario, two maps highlight how the extra journeys are concentrated. Again, the major cities and towns have strong potential for shift, with Figure 5 showing local authorities with 10,000 or more commuter cyclists under this scenario. Figure 6 shows the North as an example: both Leeds and Manchester have over 40,000 new cyclists each. In Manchester, four in five (81%) of all public transport commuters shift.

Figure 5: national map highlighting authorities with >10,000 extra cyclists

Extra people cycling to work,
positive scenario, by commuter
borough of residence

- Up to 1000
- 1000-2000
- 2000-4000
- 4000-10000
- 10000-64170

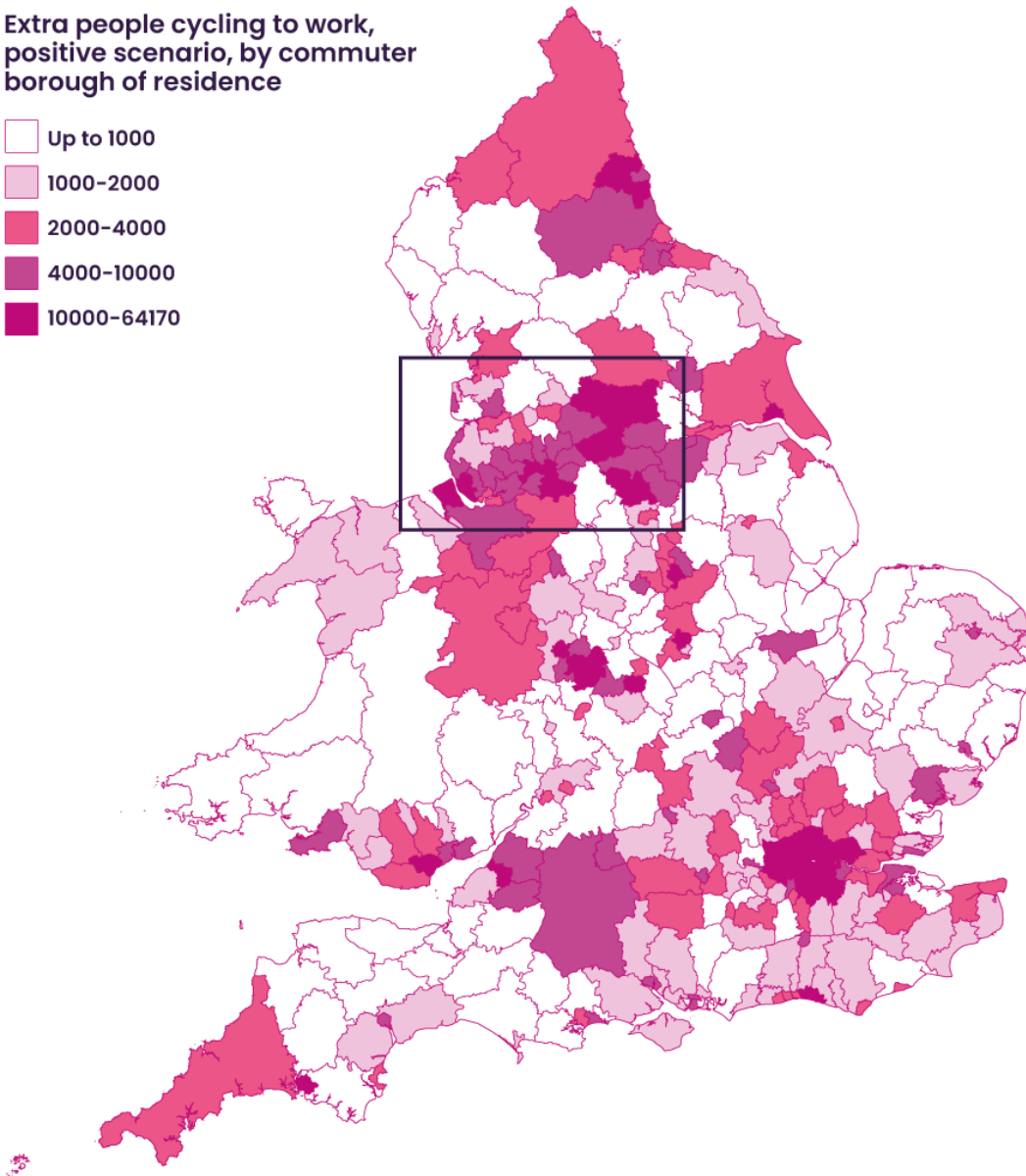
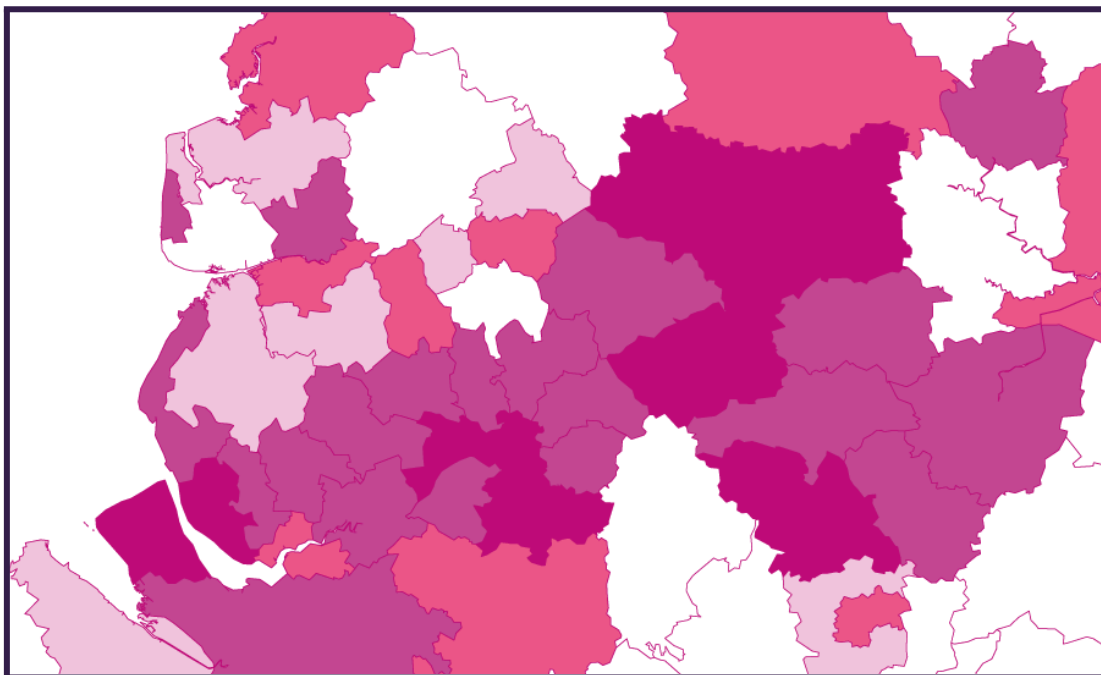


Figure 6: Increases in cyclists in some Northern authorities



Health Impacts

The Propensity to Cycle Tool model (see www.pct.bike) was used to estimate the premature deaths avoided annually under this scenario, using a method based on the DfT's Active Mode Appraisal toolkit and incorporating demographic and health information about different areas rather than generic national figures. Annually, 587 premature deaths are avoided by the increased physical activity generated by the additional cycle commute trips, with 15,539 years of life saved, equating to a health economic benefit of approaching a billion pounds (£901m) each year.

Switching car commute trips to active travel modes



While this report has focused on public transport trips as the immediate priority (given the substantial reduction in capacity and demand, as overall commuter trips start to recover), clearly most benefits and most scope for change comes from shifting car trips. While across England and Wales, there are over 2 million public transport commutes which are up to 10km (and here considered potentially switchable to active modes), the two nations between them have **8.4 million** potentially switchable commute trips, this being over half (53%) of all car commutes. In Barrow-in-Furness, Hull, Blackpool, Exeter and the Scilly Isles, at least three-quarters of car trips are under 10km route network distance. In absolute terms, Birmingham and Leeds top the table of switchable car trips, each generating over 100,000 car commute trips under 10km (148,751 and 119,085, respectively).

Policy implications



The scenarios explored here are clearly extreme, but they show the scale both of potential and of risk as many public transport commuters look for other options. London, for instance, could in the best-case see up to 900,000 new active travellers coming from public transport, taking the strain off the Tube and bus network; or could see many former public transport users commute by car instead, with up to 350,000 more private motor vehicles clogging London's roads in the morning peak.

Without substantial infrastructure and policy change, many people will be unwilling to switch to cycling. While not all those with an under-10km commute would switch, we know that many people would, if conditions were better¹⁷. The Propensity to Cycle Tool¹⁸ has shown that if English and Welsh commuters cycled to work at Dutch rates (based on distance and hilliness), mode share would be one in five rather than one in thirty. Enabling cycling and other active mobilities will help not only those who can switch to cycling shorter distances, but those who can't, by creating space on public transport vehicles and on the roads for them.

Key short term actions for transport authorities would include:

- Plan strategically – use active transport to take the strain off public transport where it can be most effective, especially (but not only) bus trips but also including local train travel which may be relatively short distance in larger cities.
 - In London, TfL has now conducted analysis of public transport trips that may be amenable to switching, identifying key switchable corridors.
- Plan a network of temporary/experimental infrastructure, following current international examples, such as Bogotá which has built temporary bike tracks along key transit corridors during lockdown, or Paris which is doing the same with Metro routes during deconfinement.
 - A good example in the UK is Leicester's 'Key Worker Corridor', cordoning off a lane of a road to create a safe cycle track leading to Leicester Royal Infirmary.
- Roll out 'mini-Hollands' or 'low-traffic neighbourhoods' to support the start and end of journeys, and combinations

¹⁷ <https://www.tandfonline.com/doi/abs/10.1080/01441640701806612>

¹⁸ www.pct.bike

of journeys; for instance, parents may be combining commuting to a city centre with a more local school run trip.

- Many changes can be done using for instance Experimental Traffic Regulation Orders where consultation on changes runs alongside their experimental implementation.
- Identify locations where additional cycle parking may be needed to support new cycle trips, and work with employers as needed to provide these.
- Provide subsidised or free access to bikes and e-bikes (particularly important for medium-distance commutes, such as between Outer and Central London, and trips that may replace train travel)
- Provide subsidised access to repair and maintenance services, and to cycle training, offered in England through Bikeability.
- Bringing forward, enhancing, or developing plans to control demand for driving, particularly where these generate space or resources that can be allocated to active and sustainable travel, for instance, workplace parking levies and clean air zones.

These actions urgently need to be supported by central government, including changing the balance of investment to place much more emphasis on sustainable travel and much less on car travel, alongside technical and policy support for transport authorities, and legislative and other changes as necessary.