

Transport Modelling Ltd

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

Prepared for the Department for Transport In Association with  
Allanfield Consulting

## **Document Control**

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# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

## 1 Introduction

### 1.1 Purpose

1.1.1 This note reviews available evidence of changes in travel demand and associated data that have occurred during and following the Covid-19 Pandemic. It considers possible causes of these changes and, thus, suggests areas where it may be appropriate to develop UK transport modelling and appraisal practice.

### 1.2 Limitations

1.2.1 Travel demand derives from the choices individuals make about where they live and how and where they spend their time, together with organisational choices about their operation, and how they procure, supply and distribute products. In turn these choices are based on factors, or demand drivers, comprising: socio-demographic and organisational characteristics, macro-economic, the cost of using and level of service offered by the transport networks and finally attitudes and preferences. Actions taken by organisations influence the choice of whether to travel to particular destinations and their location decisions are in turn influenced by accessibility. Finally, transport networks have limited capacity; crowding and congestion affect the level of service offered and emissions generated by travel affect the environment and influence location decisions.

1.2.2 These complex interactions make the task of distinguishing specific impacts arising from any particular influence challenging.

1.2.3 Furthermore, in addition to the Covid-19 Pandemic there have been other exceptional events over the past four years that will have influenced travel demand. Impacts associated with Brexit in January 2020 will include changes to international trade and the associated freight movements as supply chains have changed. The Russian invasion of Ukraine in February 2022 had a profound impact on fuel prices, increasing the cost of travel. The increase in the inflation rate through 2022 and 2023, and associated 'cost of living' crisis has affected disposable incomes.

### 1.3 Report Structure

1.3.1 Section 2 first presents direct evidence from traffic counts, public transport ticket sales and from the National Travel Survey to demonstrate the nature of changes in travel demand that have occurred.

1.3.2 Section 3 then considered the behaviours and choices individuals and organisations make and drawing on complementary data sources sets out

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hypotheses of how the choices made are likely to have resulted in these demand changes. In some instances these are linked to longer term trends that the interventions taken to manage the Covid-19 Pandemic may have accelerated.

- 1.3.3 At this point in the decade transport modellers would normally be starting to make use of data from the most recent Census of Population. But the England & Wales Census 2021 was carried out during the Covid-19 pandemic. Section 4 reviews the impacts on the Census results, and the implications of those impacts.
- 1.3.4 Finally Section 5 considers the extent to which these behaviours and changes are currently reflected in Transport Appraisal Guidance and the areas where there may be merit in considering changes to improve modelling and appraisal practice.

## 2 What has changed

### 2.1 Aggregate Travel Demand

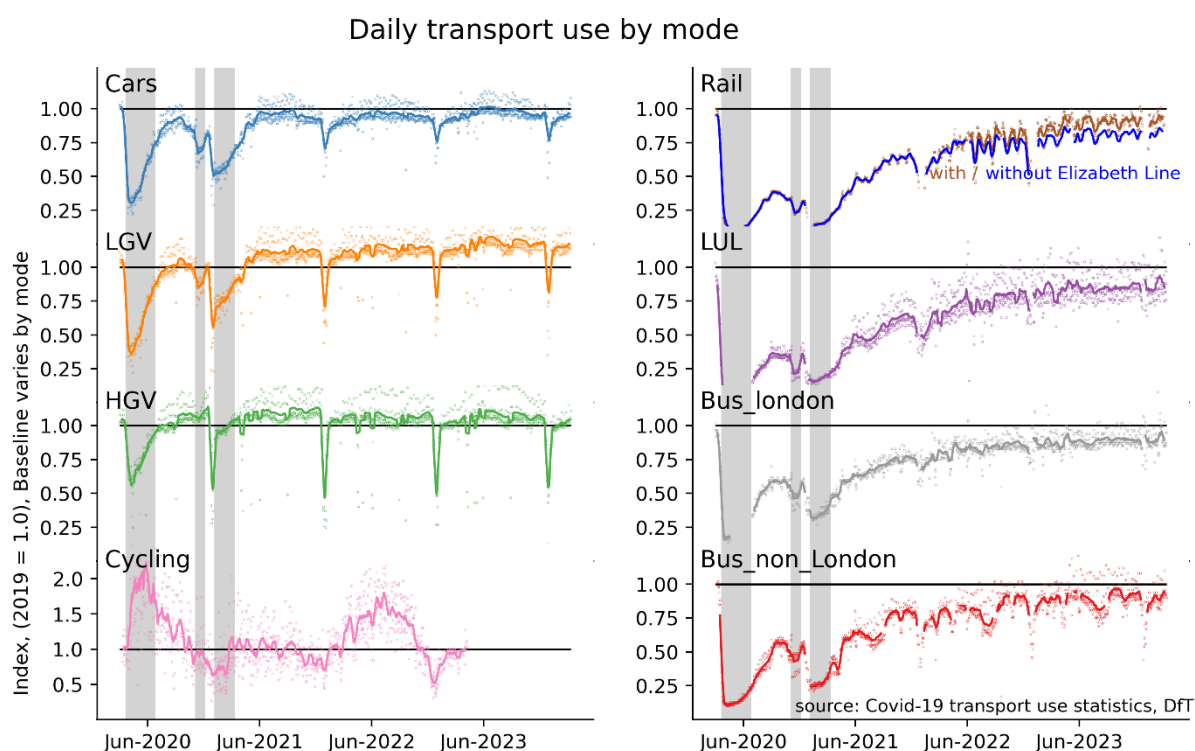
- 2.1.1 This section draws on aggregate data about total use of the transport networks to indicate whether and how travel demand changed following the Covid-19 Pandemic.
- 2.1.2 Covid affected individuals' perceptions of safety and the 'lockdown' interventions directly suppressed travel demand for certain purposes and caused companies to invest in their communications capacity to allow individuals to work from home. The DfT 'daily tracker'<sup>1</sup> collates traffic counts and public transport ticketing data. The illustration below adds a (2 weekly) moving average to the daily values to illustrate broad trends.
  - As illustrated below, car and LGV traffic was suppressed by, respectively, about 70% and 60% at the start of the first lockdown in March 2020 and 50% and 40% at the start of the third lockdown in January 2021. There was a gradual recovery, both during and following the lockdown periods with traffic levels for car returning close to and for LGV exceeding the 2019 baseline about 6 months after the lockdown periods finished. There has subsequently been a slight increase in car and LGV traffic since summer 2021.
  - At the start of the first and third lockdown periods HGV traffic was suppressed by around 40%. Traffic volumes recovered within the lockdown periods and exceeded 2019 levels at their end. LGV and HGV traffic has exceeded 2019 levels since spring 2021 (note: baseline for traffic is a week in October).

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<sup>1</sup> <https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic>

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- Public transport demand was more strongly affected, with reductions of around 80% for all modes at the start of the first lockdown. Whilst demand subsequently increased, this has been a slower change than that for car traffic with trends indicating that this continued throughout 2022. Throughout 2023 and the start of 2024 public transport demand in total has remained broadly 20% below 2019 levels.
- Cycling demand showed a marked increase, roughly doubling, during the first lockdown and subsequently declining. Whilst care is needed in respect of the baseline and seasonal variations of demand, levels fluctuated around the 2019 baseline following the lockdown interventions throughout 2021.



**Figure 1: Daily Transport Use by Mode**

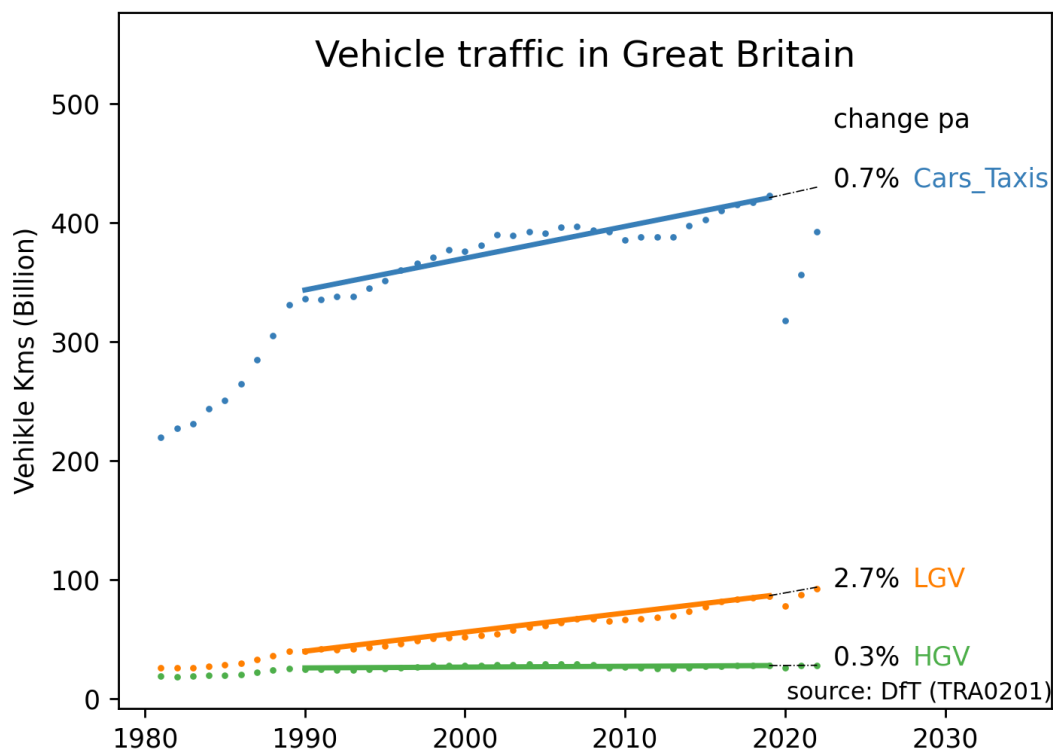
## 2.2 Road Traffic Trends

2.2.1 Annual road traffic statistics<sup>2</sup> are assembled from a broader range of traffic counts but are not yet published for 2023. The following figure illustrates the changes in car, LGV and HGV traffic in the context of historic traffic trends. It indicates that

<sup>2</sup> <https://roadtraffic.dft.gov.uk/summary>

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- annual car traffic reduced by about 25% in 2020 and that there was recovery towards, while remaining below, historic levels though both 2021 and the 2022/3 financial year);
- there was a relatively modest suppression of LGV traffic in 2020 and that volumes had recovered to long term trend rates by 2022; and
- that HGV traffic volumes were closely aligned with longer term trends throughout 2020, 2021 and 2023.



**Figure 2: Vehicle traffic in Great Britain**

2.2.2 Similar trends are evident for different types of road (motorway, urban, etc).

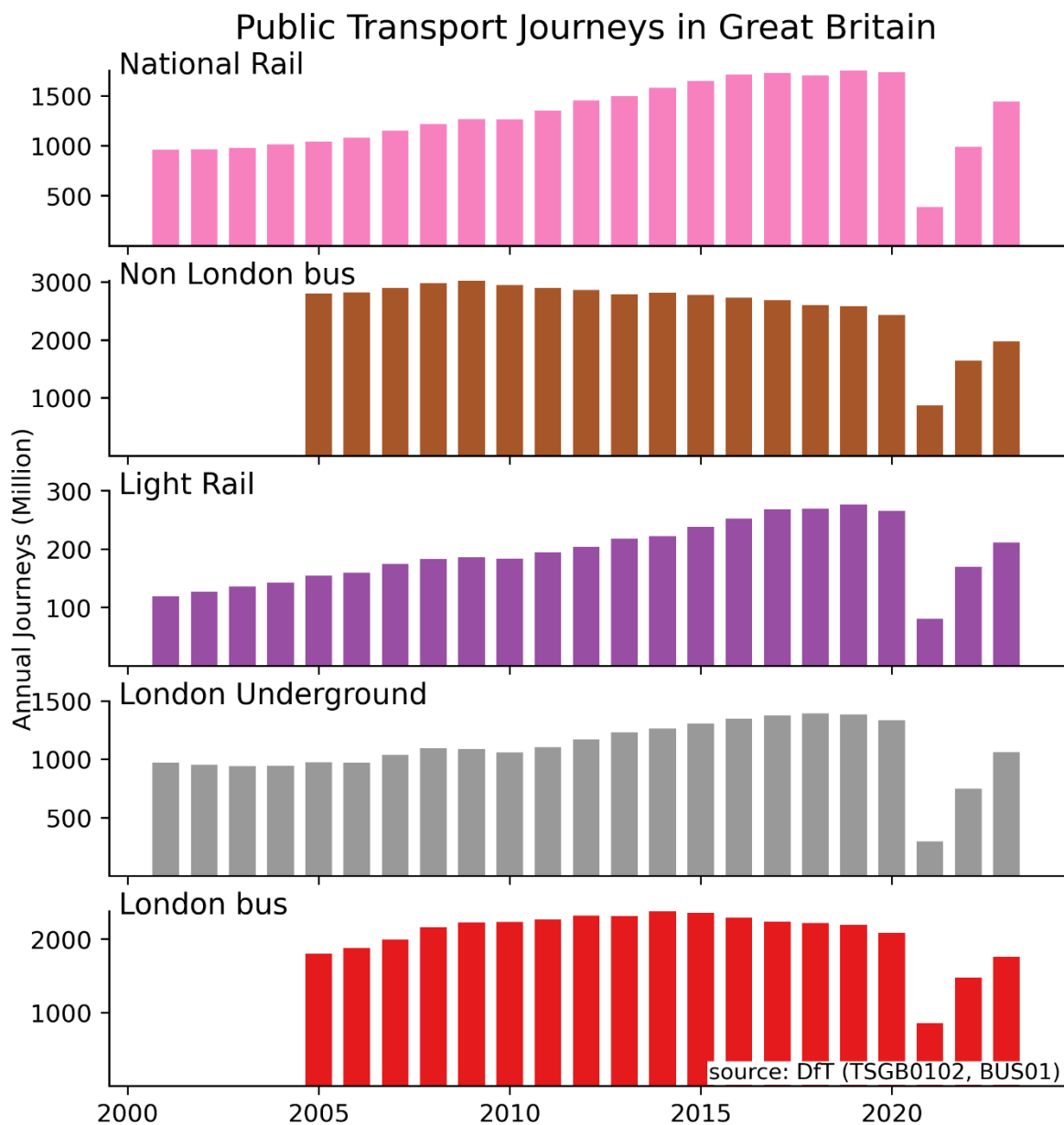
## 2.3 Public Transport Trends

2.3.1 Demand for public transport<sup>3</sup> has varied over the past decades as illustrated below, with the main changes being the marked increase in national rail and use of light rail, together with a decline in non London bus journeys. In London while there may have been a transfer between bus and Underground use, the overall level of public transport use had varied relatively little in the decade to 2019-20 (financial year).

<sup>3</sup> <https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons>

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2.3.2 As previously illustrated in the daily tracker data, there was a substantial reduction in demand during the Pandemic and has subsequently been a recovery towards 2019 levels of demand across all public transport modes.



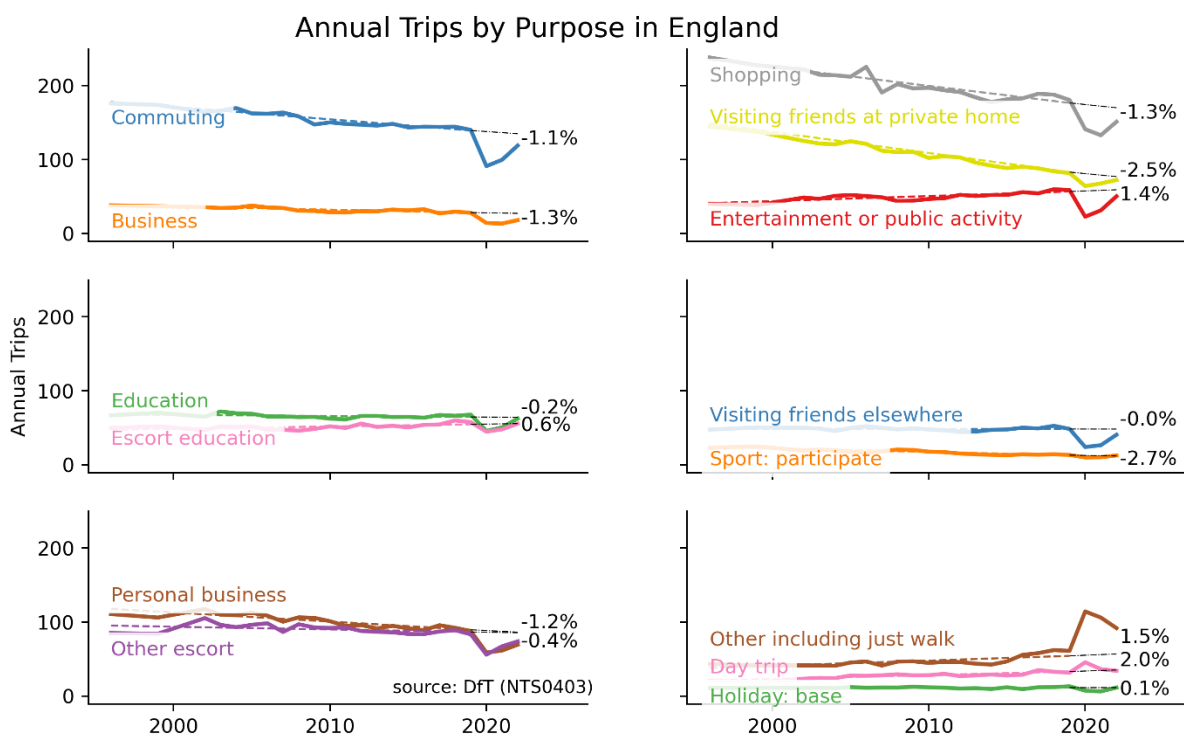
**Figure 3: Public Transport journeys in Great Britain**

## 2.4 Changes by Purpose

2.4.1 There were challenges undertaking social surveys during the Covid Pandemic with reduced sample sizes, nevertheless the figure below shows a reduction in trip rates by all purposes (including short walk) during 2020 with the exception of 'day trips' and 'other including just walk' which appear consistent with the increase in cycling count data set out above.

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2.4.2 The figure also shows that there has been a consistent trend in trip rates and sets out change (as annual trips per individual per annum) observed between the mid 1990s and 2019. In the context of these long term trends the changes during 2020 are in the same direction at the long term trends and, following the periods when lockdown policies directly affected demand, it is reasonable to ask whether the subsequent suppression of demand is caused by similar reasons.



**Figure 4: Annual Trips by Purpose in England**

2.4.3 Analysis of NTS data undertaken by the DfT is summarised below showing the change in trip rates between 2015 and 2022 by purpose and mode. In addition to the differential variations in trip rates by purpose noted above, this table shows that for all purposes there was a larger reduction in bus and rail demand than for car (driver) demand.



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**Table 1: Change in trip rate by mode and purpose (2015-19 - 2022)**

	Commute	Business	Education + escort	Shopping/ PB	Leisure	ALL
Walk	-6.0%	-28.2%	10.7%	-1.2%	54.1%	<b>21.6%</b>
Cycle	-22.8%	-22.7%	20.8%	-18.3%	2.1%	<b>-9.7%</b>
Car driver	-12.1%	-41.7%	4.7%	-15.3%	-2.9%	<b>-11.8%</b>
Car pass	-24.4%	-36.6%	-9.7%	-25.8%	-14.3%	<b>-19.2%</b>
Bus	-34.4%	-56.4%	-8.1%	-53.6%	-39.9%	<b>-38.8%</b>
Rail	-32.7%	-51.4%	-12.1%	-20.4%	6.3%	<b>-21.9%</b>
<b>ALL</b>	<b>-17.1%</b>	<b>-42.0%</b>	<b>2.5%</b>	<b>-17.5%</b>	<b>8.9%</b>	<b>-7.7%</b>

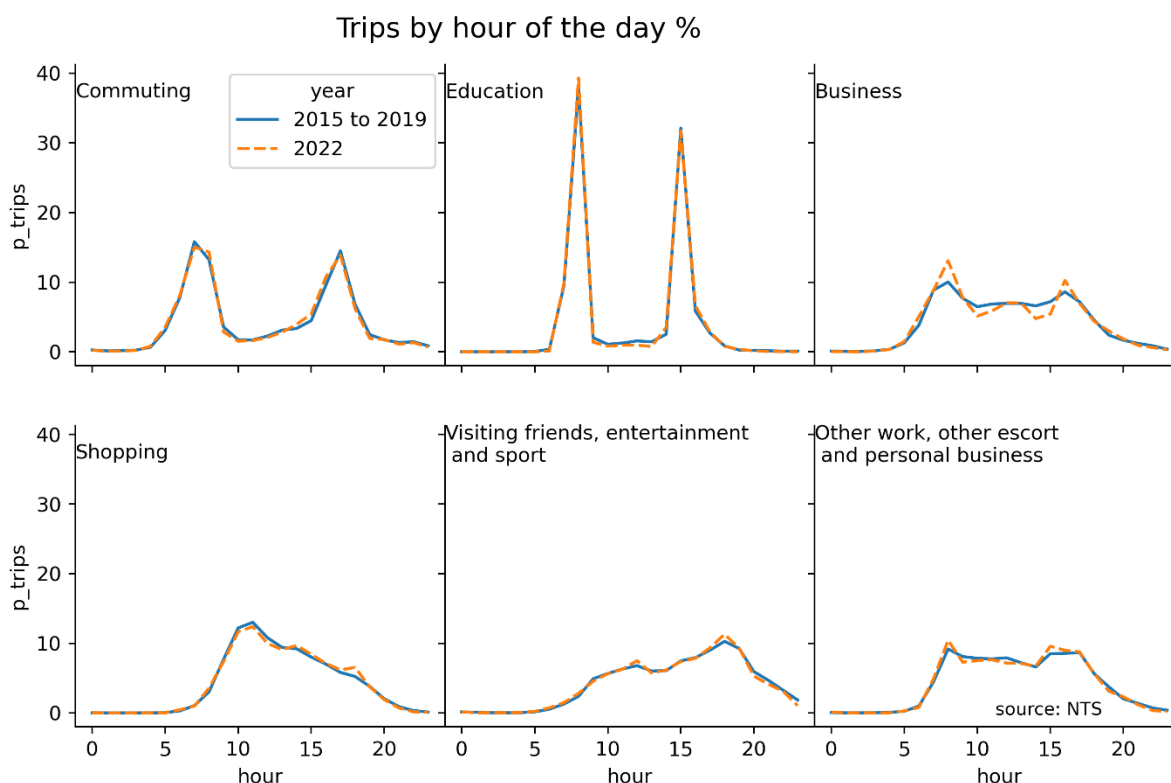
Source: DfT analysis of NTS

2.4.4 The NTS data indicate that for most purposes there was no change in average trip length. Nevertheless for commuting to work, while there had been a gradual increase in average distance (from 8.2 to 9 miles) over the 15 years preceding 2019, this reduced to 8.2 and 8.5 miles in 2021 and 2022 respectively, which could reflect individuals with longer commuting distances choosing to travel to work less frequently.

## 2.5 Changes by time of day

2.5.1 The following figure compares the proportion of trips by purpose by hour of day before the pandemic (2015-2019) and in 2022 (calendar year) derived from NTS data. There is no evidence of any marked changes in when trips by individual purposes are made. (For business where there might appear to be a larger proportion in morning and evening peaks, the differences are not statistically significant at a 95% confidence level.)

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**Figure 5: Trips by hour of day (%)**

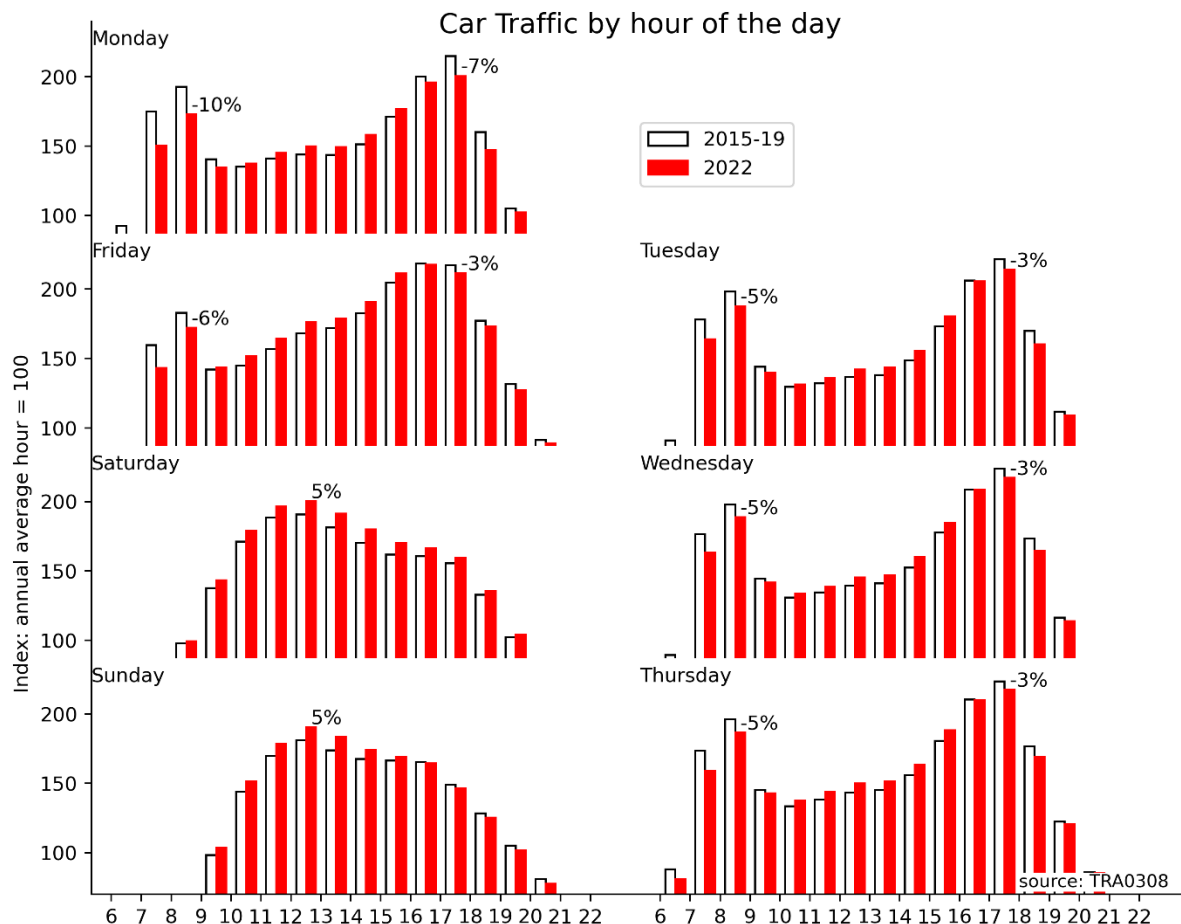
2.5.2 Counts<sup>4</sup> of passengers at major rail stations indicate a reduction in the proportion arriving or departing at between 8 and 9 am at regional stations, falling from over 10% of daily passengers in 2019 to below 9% in 2022 and a similar one percentage point reduction in the pm peak hour of between 5 and 6pm. At London termini the proportion of passengers arriving or departing between 8 and 9 am reduced from roundly 15% to 12% in the morning peak hour, with a one percentage point decrease between 5 and 6 pm. Given the evidence from NTS it is likely that the flattening of peak rail demand is caused by differential changes in demand by purpose rather than a systematic change in when individuals choose to travel for a given purpose; as summarised below there has been a reduction in commuting trips that tend to dominate working weekday peak hours on rail and an increase in leisure travel which are less dominant at these times of day.

2.5.3 There has been a slight flattening of the daily profile of car traffic on weekdays in 2022 relative to the 2015-19 period preceding the Covid Pandemic as illustrated below. This is most evident on Mondays with morning and peak hour flows reducing, respectively, by 10% and 7%. On Fridays the reductions of 6% and 3% may be slightly larger than other days of the week

<sup>4</sup> [https://www.gov.uk/government/statistics/rail-factsheet-2023/rail-factsheet-2023#:~:text=Despite%20seeing%20a%2039.9%25%20increase,this%20peak%2C%20at%201%2C385%20million.&text=Note%3A%20For%20more%20information%20please,station%20usage%20\(Table%201410\).](https://www.gov.uk/government/statistics/rail-factsheet-2023/rail-factsheet-2023#:~:text=Despite%20seeing%20a%2039.9%25%20increase,this%20peak%2C%20at%201%2C385%20million.&text=Note%3A%20For%20more%20information%20please,station%20usage%20(Table%201410).)

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with peak hour reductions of 5% and 3%. On Saturdays and Sunday there has been a 5% increase in the proportion of traffic travelling in the middle of the day relative to the average 2015-2019.



**Figure 6: Car Traffic by hour of the day**

2.5.4 Between 11 and 12 am on Saturdays the car traffic flows (all roads) were about 7% lower than those experienced between 5 and 7pm on Tuesday-Friday weekdays, and 16% greater than those experienced between 7 and 9am on Tuesday-Friday weekdays. Given the hourly profile of demand by purpose revealed by NTS it is likely that these changes can be attributed to changes in the mix of demand by purpose and possibly associated with a differential change in trip rates on particular days of the week.

## 2.6 Other demand divers

2.6.1 There have been a range of changes to factors, or demand drivers, that influence travel demand. The financial, economic and societal costs of managing the Covid-19 Pandemic will have affected the national economy. The actions by public transport operators to reduce their costs by operating

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fewer services (to moderate their financial losses arising from reduced ticketing revenues) will have been related to the Covid-19 Pandemic. However the Russian invasion of Ukraine and its effects on oil prices, amongst a broader range of factors will also have had effects. The changes in a range of demand drivers between 2019 and 2022<sup>5</sup> together with the likely consequences for travel demand are summarised below.

**Table 2: Effect of demand drivers on travel demand 2019-22**

<b>Demand Driver</b>	<b>change 2019-22</b>	<b>Likely Impact on travel demand</b>
Population	1.2%	~1% Increase
GDP / Capita	0.2%	negligible
Inflation (cost of living)	>10%	small reduction; there is limited research evidence available on the effects of short term disposable income
Fuel Prices	18.8%	2-4% reduction (applying a long term elasticity of -0.3 and reducing by 30-50% to indicate response over about a year)
Bus fares	7.7%	2-3% reduction (short run fare elasticities tend to be in the region of -0.3 to -0.4 <sup>6</sup> )
Rail fares	-0.9%	negligible (short term elasticity may be in region of -0.5 to -0.7)
Bus miles operated	-12.0%	3-5% reduction (short run elasticities to the reduced vehicle miles operated in the region of 0.3 <sup>7</sup> .)
Rail miles operated	-15%	4-6% reduction, while this includes reduced services operated during strikes, the strikes themselves may have had additional impacts

2.6.2 Based on the overall change derived from these demand drivers we might expect car traffic to have reduced by around 2%, bus demand to have reduced by 5-7%, and rail by 3-5%. Between 2019 and 2022 Transport Statistics Great Britain reported a 6% reduction in car traffic (from 417 to 392 billion vehicle Kms), a 22% reduction in local bus passenger journeys (from 4786 to 3745 million) and an 18% reduction in rail journeys (from 1753 to 1446 million). This implies that has been about a 4% reduction in car traffic, 16% reduction in bus traffic and 14% reduction in rail traffic that (is not related

<sup>5</sup> Source in appendix

<sup>6</sup> <https://assets.publishing.service.gov.uk/media/5b320789e5274a55d7a54aa0/bus-fare-journey-time-elasticities.pdf>

<sup>7</sup> <https://trl.co.uk/uploads/trl/documents/TRL593%20-%20The%20Demand%20for%20Public%20Transport.pdf>

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to other factors that would influence travel demand and) is likely to be a direct consequence of the Covid Pandemic.

- 2.6.3 The NTS data (section 2.4.3) showed a larger reduction in public transport than car driver trips for each travel purpose, which implies that there has been both suppression of demand overall as well as reduced use of public transport modes.
- 2.6.4 Taking the residual reduction in car traffic set out above would suggest the residual direct effect of the Covid Pandemic was about a 5% reduction. However the 11% reduction in car driver trips per person and 15% reduction in car driver miles between 2019 and 2022 recorded in NTS are larger; and adjusting these to reflect changes in fuel prices, would suggest the impact of Covid on trip rates could be as much as 10%. It seems reasonable to conclude that the direct impacts of the Covid Pandemic on reducing trip rates was between 5 and 10% in aggregate across all travel purposes.
- 2.6.5 The roundly 20% reduction in public transport demand that is not attributed to other demand drivers is larger than this range, which implies that there was an additional 5-15% reduction in travel by public transport modes. The daily tracker data might indicate that the size of this may have reduced marginally during 2023.

### 2.7 Synthesis

- 2.7.1 The data summarised in this section has indicated that it is likely that the consequences of the Covid-19 Pandemic:
- have included a reduction in car traffic of around 5-10%; given fairly stable demand over the past two or three years this change also appears likely to persist into the future;
  - there may have been a larger reduction in public transport use; changes in incomes, cost and service provision will also be contributory causes;
  - there was a short term increase in cycling activity during the pandemic, but demand appears to have revert to pre-pandemic levels during 2021, suggesting that there may be no longer term persistent influence; and
  - demand for goods vehicles appears to be in line with historic trends and forecasts; given that the economic changes and that Brexit will have affected freight, there is insufficient change to conclude that the Covid-19 Pandemic may have had long term implications for traffic by these types of vehicles.
- 2.7.2 There has been a differential change in demand patterns across the days of the week with less peak hour travel, particularly on Mondays and an increase at weekends.

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2.7.3 Analysis of NTS data has shown that, relative to travel before the pandemic, business trip rates in 2022 were 42% lower, commuting and shopping trip rates were 17% lower and that leisure trip rates were about 8% higher, with, overall about a 9% reduction in trip rates over all purposes. The NTS data indicate that the time of day at which trips for a given purpose are undertaken have not changed. This implies that changes in demand volumes by time of day arise from changes in demand by purpose or changes in which days of the week the activities are undertaken.

## 3 What may have caused these changes?

### 3.1 Demand drivers

3.1.1 This section explores hypotheses of how the Covid-19 Pandemic may have influenced behaviours. The implications of these are considered to indicate the extent to which these behavioural changes may have caused the aggregate impacts set out in the preceding section.

3.1.2 Transport modelling methods have evolved over several decades and represent the influence of a range of demand drivers. Economic factors are particularly represented in the UK GBFM affecting freight demand, in NATCOP affecting car ownership, and in NTEM affecting trip rates. Forecast changes in GDP are applied to adjust values of time which is combined with fares and other travel costs which are represented in elasticity models and variable demand models, together with other endogenous measures of the level and quality of transport service. Differential socio-demographic characteristics are similarly considered in these models.

3.1.3 Planning data representing the scale and nature of residential, commercial and public land uses are mainly applied to forecast changes in the distribution of travel.

3.1.4 The decline in trip rates for many purposes that has been observed over the past decade is not adequately explained by these demand drivers and this has been the subject of a number of research studies and hypotheses.

### 3.2 Technology

3.2.1 A critical effect of the lockdown policies that were used to manage the pandemic was the requirement to increase reliance on telecommunications technologies rather than direct contact. Reproduced from Ofcom's Online Nation 2021 report<sup>8</sup> below, one response during the Covid lockdown periods was a substantial increase in the use of video conferencing facilities; The

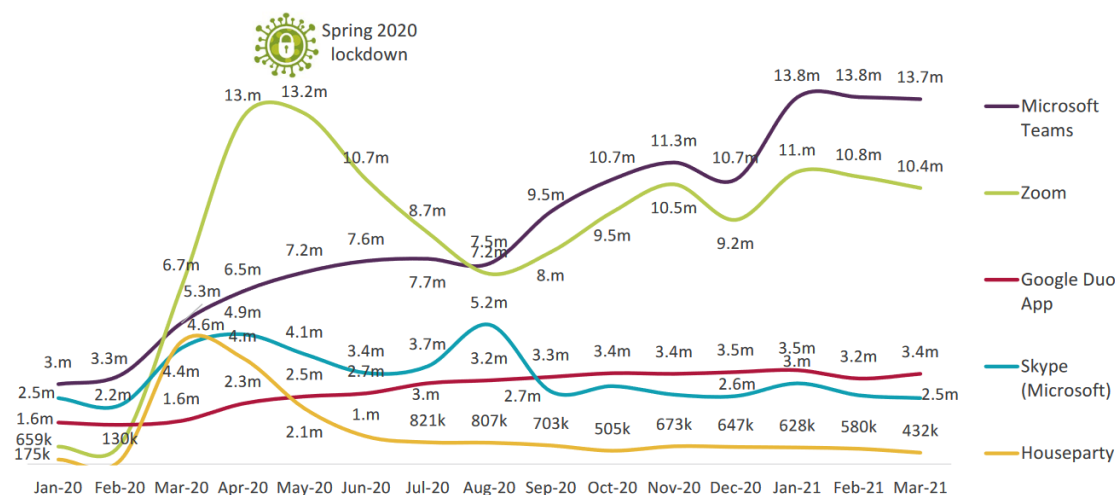
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<sup>8</sup> [https://www.ofcom.org.uk/\\_\\_data/assets/pdf\\_file/0013/220414/online-nation-2021-report.pdf](https://www.ofcom.org.uk/__data/assets/pdf_file/0013/220414/online-nation-2021-report.pdf)

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commercial advertising source used by Ofcom reported an increase from about 8 million ‘users’ of the various platforms at the end of 2019 to over 30 million during April and May 2020. Ofcom reports that the elevated use of video conferencing persisted through 2022<sup>9</sup>.

**Figure 1.27: UK adults using selected communication services with video-calling features: January 2020 – March 2021**



Source: Comscore MMX Multi-Platform, Age: 18+, Jan 2020 - Mar 2021, UK

Note: Custom list of entities defined by Ofcom.

## Figure 7: Use of video calling services

3.2.2 This section explores implications of this change for travel behaviour.

### Home-working

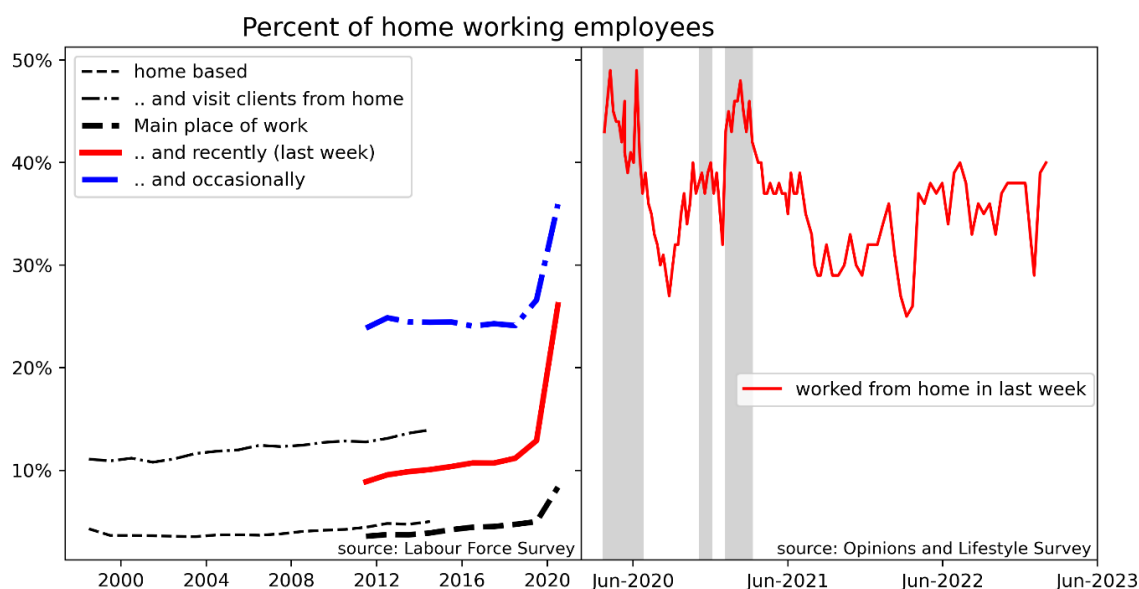
3.2.3 Communication technologies have developed over the past decades, with substantially reduced cost, and enhanced quality. There was, as is illustrated below, a steady increase in the proportion of employees categorised as working at home. When relevant questions were added at the end of the 1990’s, the Labour Force Survey recorded about 4% of employees as being formally home based and working from home, and a further 7% as home based but travelling to meet clients and customers. These increased to about 5% and 9% respectively by 2014. A revised definition of employment categories recorded that the proportion of employees that mainly worked from home increased from 4% in 2011 to 5% in 2019, and that those who had worked from home recently (ie in the reference survey week) increased from 5% to 8%, and occasionally reduced from 15% to 14%, with the ‘mainly’ and ‘recently’ categories comprising 13% of employees in 2019.

3.2.4 The annual Labour Force Summary shows a substantial increase in these proportions in 2020. Bi-weekly data from the Opinions and Lifestyle Survey,

<sup>9</sup> [https://www.ofcom.org.uk/data/assets/pdf\\_file/0028/255844/adults-media-use-and-attitudes-report-2023.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0028/255844/adults-media-use-and-attitudes-report-2023.pdf) (page 14)

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which uses a consistent definition, illustrates that the proportion of employees 'mainly' or 'recently' working from home was around 45% during the lockdown periods and that while there was a reduction following the lockdown interventions, the proportion was around 30% in 2021 and increased to around 35% in 2022.



**Figure 8: Home working by employees (%)**

- 3.2.5 The online time use survey (OTUS)<sup>10</sup> recorded a reduction in time spent working not from home of around 50 minutes per day and an increase of nearly 50 minutes a day working from home between the 2014-5 time use survey and a survey undertaken during March and April 2020. (Given that on average employees work a little over 30 hours per week, and these changes apply to all people, not just employees, these reported 50 minute changes may indicate a shift of perhaps a quarter or a third of working time, ie of comparable scale to the change in regularly working from home.)
- 3.2.6 OBR reported in October 2021<sup>11</sup> that "The pandemic has prompted a sharp rise in the number of people regularly working from home, which rose from 12 per cent before the pandemic to a peak of 50 per cent in April 2020. Despite then falling back, it remained at 31 per cent in October. Moreover, 85 per cent of those who worked from home in May 2021 expected to continue to do so for at least part of the week even after they are able to return to their usual workplace, while in a more recent survey from October [2021], 16 per cent of

<sup>10</sup>

<https://www.ons.gov.uk/economy/nationalaccounts/satelliteaccounts/bulletins/coronavirusandhowpeoplespenttheirtimeunderrestrictions/28marchto26april2020>

<sup>11</sup> OBR, October 2021, *Economic and Fiscal Outlook*, chapter on "The behavioural legacy of the pandemic"



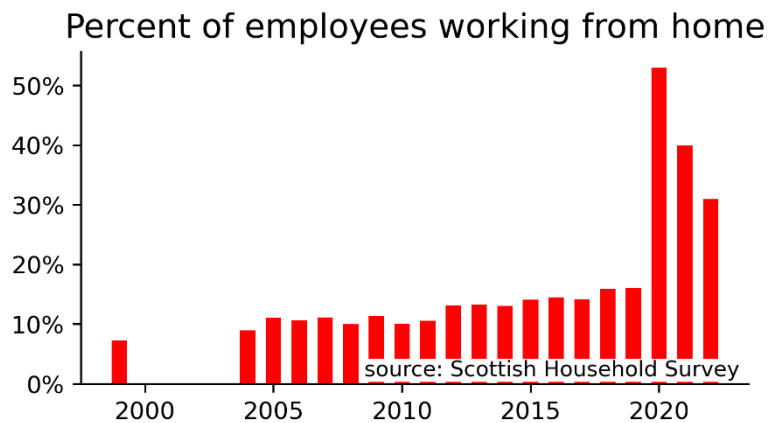
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businesses intended to use increased homeworking as a permanent business model going forward.”

3.2.7 The categories used to describe home working in these surveys are quite broad from the context of understanding travel behaviour. An individual responding that they regularly work from home might have worked from home just one day or for several days in the reference week in their response, and there are some jobs

where employees are site or client based and rarely use their office or home base; the decision of how much to work from home is more nuanced. The Scottish Household Survey is one example of a UK

survey that has directly asked respondent whether they chose to work at home or not on the day surveyed. As illustrated this recorded an increase from 7% in 1999 to 16% in 2019. The survey was conducted during the lockdown periods in 2020, recording 53% as working at home on a given day, and this subsequently reduced to 40% and 31% in 2021 and 2022 respectively.



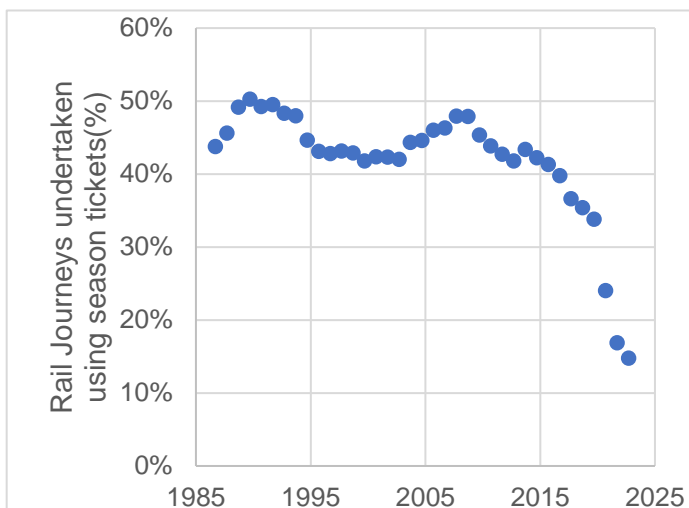
**Figure 9: Working at home (%)**

3.2.8 Ad-hoc analysis of NTS data<sup>12</sup> identifies a marked increase in the proportion of employees who work from home three or more times a week from 3% in 2019 to 11% in 2020 and 2021. Taking the maximum and minimum boundaries of the categories used for this ad-hoc NTS analysis the data indicate that between 7% and 13% worked from home on a typical day in 2019 and that this range increased to between 20% and 31% in 2020, falling back to between 19% and 29% in 2021.

<sup>12</sup> <https://www.gov.uk/government/statistics/national-travel-survey-2021/national-travel-survey-2021-working-from-home>

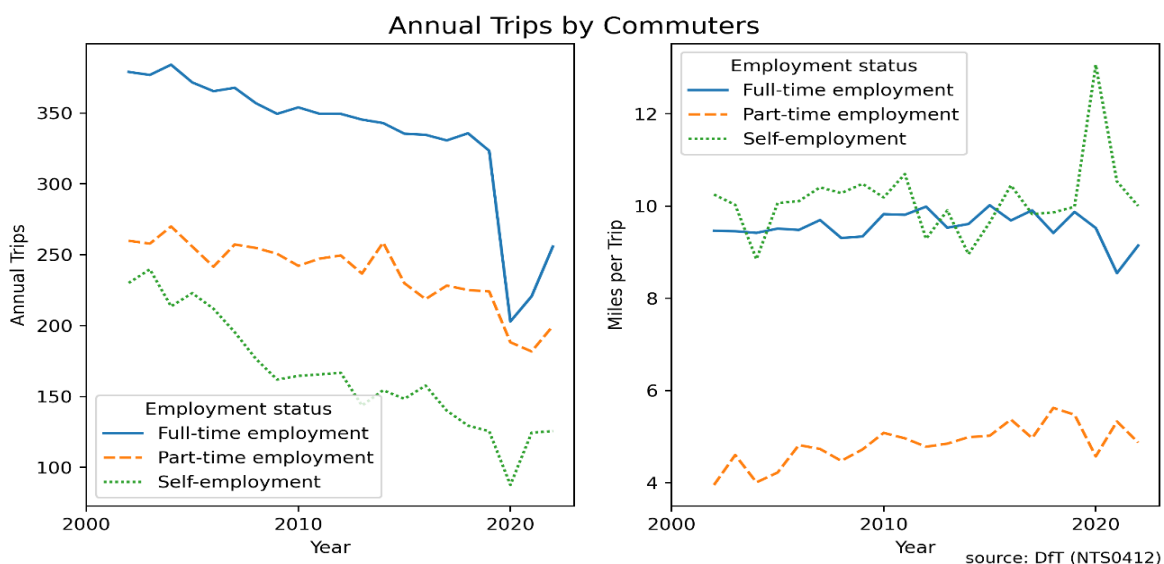
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3.2.9 ORR statistics<sup>13</sup> show that the proportion of journeys made using season tickets declined from between 45 and 50% at the end of the 1980s to 35% by 2019 and comprised about 15% of journeys in the 2022/3 financial year. The purchase of season tickets is influenced by ticket price differentials and other factors; nevertheless these data also are indicative a reduction in the number of commuters making four or five journeys to work per week.



**Figure 10: season ticket rail use (%)**

3.2.10 The NTS data records a steady decline in the average number of commuting trips with full time employees reducing by 15% (1% pa) from 379 in 2002 to 323 in 2019. For part time employees there was a 14% reduction from 260 to 224 and for self employed a 45% reduction from 230 to 126. The proportion of employees self employed increased from around 12% to 15% of the workforce over this period<sup>14</sup>; overall the number of commuting trips per employee reduced by 17% (1.1% pa) over this period.



**Figure 11: Annual trips by commuters**

<sup>13</sup> <https://dataportal.orr.gov.uk/statistics/usage/passenger-rail-usage/table-1222-passenger-journeys-by-ticket-type/>

<sup>14</sup>

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/trendsinselfemploymentintheuk/2018-02-07>

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3.2.11 It is clear that the increased proportion of employees who have chosen to work (some days per week) at home rather than at a workplace must have contributed to the decline in commuting trip rates preceding and following the Pandemic. There are challenges with the definitions used in recording home working that require judgement to interpret; it is likely that increase in the proportion of employees choosing to work at home on a particular day rather than their normal workplace accounts for more than half the reduction in commuting trip rates in the decades preceding 2019, and largely explains the reduction observed following the Covid-19 Pandemic. There have been other changes in employment in the UK that will have influenced this decline in average daily commuting trips preceding 2019. These are likely to include trends towards more flexible working arrangements, parental and general leave entitlement, and changes in the nature and extent of 'shift' working. (There has however been no marked change to the average hours worked per employee and absence from injuries, etc has declined.)

### On-line Shopping

3.2.12 Data on the proportion of retail sales made online<sup>15</sup> evidence a steady increase from around 3% in 2007 to 27% in 2023. There was a decline, in real terms, of the value of retail sales not made using the internet. While there was a spike to about 35% during 2020, the proportion of internet sales has broadly reverted to the pre-covid trendline during 2022, with subsequently a flat or slight increase in 2023.

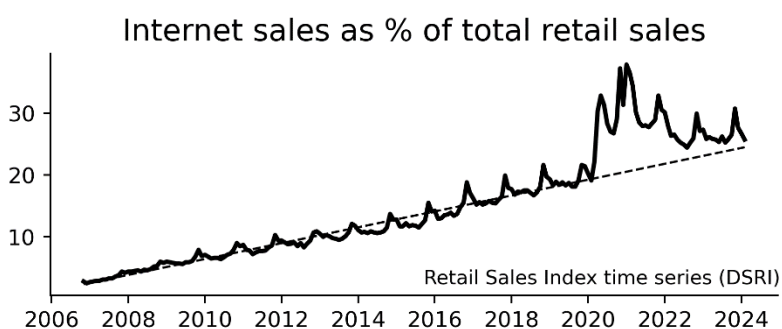


Figure 12: Internet sales (%)

3.2.13 Ofcom records<sup>16</sup> show both an increase in the proportion of UK adult population with home internet access increasing from 64% in 2007 to 91% in 2023, together with the proportion of individuals with internet access who shop weekly increasing from 37% in 2012 to 46% in 2019. Their data also evidences increases in uptake of broadband and access to higher connection speeds, and that individuals with better connectivity make more frequent use of shopping, banking and similar services.

<sup>15</sup> <https://www.ons.gov.uk/businessindustryandtrade/retailindustry/timeseries/j4mc/drsl>

<sup>16</sup> <https://www.ofcom.org.uk/research-and-data/multi-sector-research/cmr>

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- 3.2.14 OBR reported in October 2021<sup>17</sup> that “The pandemic has accelerated the shift in the share of households’ retail spending taking place online. The share rose from below 3 per cent in 2006 to 20 per cent on the eve of the pandemic in 2019, then leapt to a peak of 37 per cent in January 2021.”
- 3.2.15 The internet sales data and internet purchasing are not recording a direct substitute for individual shopping trip. It may be that larger value items are less likely to be bought without physically inspecting them and that as these are bought less frequently the impact on regular weekly shopping travel may be larger. It is, however, evident from these aggregate trends that a choice is being made between making a journey to a shop to buy something and using the internet (at home) to buy the product. There has been a progressive change in behaviour over the past decades that accelerated during the Covid-19 Pandemic. The 16% reduction<sup>17</sup> in shopping trip rates observed in NTS (Section 2.4.2) between 2007 and 2019 before the Pandemic is of similar magnitude to the increase in share of on-line sales over that period. The extent of change in shopping trip rates and on-line sales during 2021 and 2022 are also of comparable magnitude. It may be, therefore, that the development of on-line retail is the dominant factor causing changes in shopping trip rates.

### Synthesis

- 3.2.16 Over the last two or three decades there has been a progressive reduction in cost, increase in speed and reliability and improvement in the experience offered by telecommunication technologies. Ofcom records show a steady increase in the uptake of home internet facilities and their use for a range of services such as banking and health (as a potential substitute for personal business travel), online interactive gaming (leisure / visiting friends), social media (visiting friends and family).
- 3.2.17 It is reasonable to hypothesise that these have also evolved as substitutes for physically travelling. There was a marked increase in use of internet enabled telecommunication facilities during Covid-19 that correlates with changes in travel demand.
- 3.2.18 It may, therefore, reasonably be concluded that the recent development of telecommunication technologies has acted as a substitute for travel and is a causal factor in the reduction of travel for commuting, business, shopping business, visiting friends and personal business purposes. The theories and experience about the introduction of new technologies and their adoption by the population relate to learning and variations in individual attitudes to change, together with aspects of inertia. Enforcing greater exposure to telecommunications technologies and their capabilities through the lockdown

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<sup>17</sup> OBR, October 2021, *Economic and Fiscal Outlook*, chapter on “The behavioural legacy of the pandemic”

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policy interventions is to be expected to have accelerated these trends in the way that the data appear to demonstrate. It may also have stimulated more rapid innovation in developing the technologies as an indirect consequence of increasing the demand for them.

3.2.19 In addition to acting as a substitute for travelling to undertake an activity, there are further ways that the advances in telecommunication technologies may influence travel demand.

- First, if an individual saves time by not making a journey, the time must be used for some other purpose. That new use is likely, in some cases, to be outside the home and thereby generate additional travel demand.
- Secondly, the technologies provide access to information which can, analogous to deliberate marketing, stimulate demand.

3.2.20 It may be, therefore, also be the case that changes in telecommunication technology have also been a factor influencing the increasing trip rate for leisure related purposes such as 'day trips', 'entertainment or public activity' and 'other including just walk'. This also aligns with the changes that can be observed during and since the Covid-19 Pandemic for 'day trips' and 'other'.

3.2.21 With the singular exception of 'entertainment or public activity' purpose where trip rates remained suppressed through 2021 and 2022, it appears reasonable to hypothesise that the primary impact of the experiences during the Covid-19 Pandemic on the decision whether to travel or not was an acceleration of trends related to access and use of telecommunication technologies. The 'entertainment' trip purpose comprised less than 7% of all trips in 2022 and represents a range of distinct activities.

## 3.3 Residential location

3.3.1 The objective of this section is ideally to review changes in residential location arising from the pandemic and associated changes. However, there is little direct data on this. The UK does not have any form of compulsory population registration to track residents (nor in many cases to track immigration or emigration); and whilst it may be that "the NHS is the closest thing the English have to a religion", and one ritual of that religion is to register with a GP, not everyone is devout enough to keep that registration up to date. Official estimates of population (the "Mid-Year Estimates" or MYEs) are produced annually; once in each decade they are rebased using the most recent Census (which takes place in the spring, not at mid-year). The pandemic started about seven months into the 2019-20 cycle of mid-year estimates; the

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available documentation<sup>18</sup> identifies a range of additional problems affecting the sources of data used during the pandemic period, and does not give confidence that the MYEs provide a reliable basis for estimating the effects of the pandemic and of pandemic-related changes. The 2021 Census of Population was affected in different ways (because it is an actual survey, whilst the MYEs are estimates based on administrative and other data); given the important part that the Census usually plays in planning (of all kinds, not just transport) it is discussed separately in Section 4.

- 3.3.2 In the absence of detailed data on household movements, econometric analysis of house prices can give some insight into changing preferences. Analysis of house prices by the Bank of England using data up to the end of 2022 showed that the pandemic (or more precisely, the lockdown and resulting changes) led to increased demand for larger dwellings (the “race for space”)<sup>19</sup>. This increase in demand for larger properties is consistent with households seeking additional space for home working where they expect to continue working from home; it can (in our view) probably be expected to persist as a consequence of permanent (if limited) increases in remote working. (The BoE authors are very cautious in their conclusions, and only say that the changes observed may reverse if for example remote working falls off again.)
- 3.3.3 The BoE analysis also identified an increased preference for locations outside London but that (or more precisely its impact on prices) seems to have been weak and short-lived, even within the period up to the end of 2022. Increased demand for not-too-remote small town and rural locations was much talked about during the pandemic, but may have been largely a case of boosterism by selling agents in those locations based on sales which would have happened anyhow.
- 3.3.4 During the pandemic there was a noticeable redistribution of earnings from lower-income to higher-income employees<sup>20</sup>. This will have continuing implications for car ownership, value of time, etc. Along with the increase in demand for larger properties to accommodate working at home (to some extent among the same higher-income groups), this will lead to differential changes in house prices and to added profit incentives for developers to provide larger dwellings in locations attractive to higher-income buyers. This

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<sup>18</sup> ONS: Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2020, released 25 June 2021. Available at <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2020#movement-of-people-within-the-uk>

<sup>19</sup> Source: Martina Fazio and Gary Harper (2022): How much of the housing price increase during the Covid pandemic was driven by a change in household preferences? Bank of England Financial Stability Paper No.49, 30 September 2022.

<sup>20</sup> See <https://obr.uk/box/tax-implications-of-pandemic-induced-changes-in-the-income-distribution/> and also <https://obr.uk/publications/forecast-evaluation-report-december-2021/>

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effect will be modest (given the profitability of housebuilding in general) and is likely to be constrained by planning policy (unless a future government imposes dramatic changes in policy). There will also be some sorting effects within the existing housing stock, with those on lower incomes or not valuing space for homeworking slightly more likely to find themselves in smaller dwellings. Given that larger dwellings in attractive locations are generally more likely to be in outer suburban, freestanding towns or rural areas, whilst higher-income office workers are rather more likely to work in city centres, the effect may be to generate rather longer commuting trips (compared with the same remote working without the spatial sorting), though this might also be more, albeit less frequently, by train (given the markets best served by rail commuting).

- 3.3.5 Nationwide Building Society has recently (April 2024) announced that mortgage approvals are running some 15% down from pre-pandemic rates. The most obvious reason for this would be higher interest rates and the resulting reluctance of potential buyers to take on large (or larger) mortgages., but it may imply that the owner-occupied housing market will be slower than it might have been in adjusting to any post-Covid “new normal”. It is also reported<sup>21</sup> that the proportion of house purchases made by first-time buyers is at a record level (29% in 2023 and 33% in early 2024, compared with 17% in 2014), implying that there has been reduction in moves, and hence in adjustment to changing circumstances, by existing owner-occupiers.

## 3.4 Business location

- 3.4.1 This section reviews changes in employment location. As for residents, data on employment itself is affected by issues of timing and of temporary changes in circumstances; we therefore focus on changes in the commercial property market and their implications.

### Office location

- 3.4.2 This section focuses primarily on offices, as office employment is (to date) most affected by remote working – though future developments in automation may have significant impacts on other sectors in future (and these might be brought forward rapidly in response to a future pandemic or other disruption, as happened with office jobs in 2020).
- 3.4.3 Most of the available data on change since the pandemic is from commercial property agents, drawing on their own work or on industry-wide databases; in either case this means that the data is biased towards (or exclusively about) “investment grade” property. This also means that it is focused on large, high-rent office locations and on new or refurbished properties in and around those locations, and may ignore what else is happening, particularly to older

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<sup>21</sup> <https://www.hamptons.co.uk/articles/market-milestone-first-time-buyers#/>

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offices outside those locations. Collectively, these other properties/other locations may be important to the pattern of travel demand.

3.4.4 The evidence from property agents and from direct surveys of occupiers is clear that many office-based firms are aiming (or have already started) to reduce the ratio of the office floorspace they occupy to the number of employees nominally working there, in the light of the marked increase in remote working. There are however significant variations in how this is being done.

- Some firms are looking at high levels of remote working and pro rata reductions in office space – which implies that they are expecting, and possibly requiring, remote working to be evenly spread across the week.
- Others are considering only limited reductions, but putting more emphasis on repurposing space, particularly by providing more meeting space so that staff, or staff and clients, can readily interact in person when they are in the office.

3.4.5 The latter approach is more consistent with hybrid-working policies that aim both to ensure fairly high levels of in-person interaction (for productivity reasons) and to respect worker preferences for home or office working (for employee satisfaction and staff retention reasons). The evidence that commuting is closest to pre-pandemic levels on mid-week days and less on Mondays and perhaps Fridays suggests that the latter approach is more prevalent, at least in the centres and at the times of day where traffic or passenger flows can be most clearly associated with commuting. The former, cost-minimising approach may nevertheless be dominant for establishments dominated by routine, “back-office” functions (such as call centres) where there is limited value to be gained from interaction between staff, and little or no scope for in-person interaction with clients. Specific data on call (or contact) centres is scarce<sup>22</sup>, but one survey<sup>23</sup> estimated that 23% of staff dealing with calls were expected to be working wholly at home in 2024, and 59% expected to be hybrid workers (and hence 18% expected to be working wholly in the office). 8% of firms responding to that particular survey expected all staff to be working remotely, and 6% expected all staff to be working full-time in the contact centre. No reasons were suggested for the last group requiring all work to be done in the centre, though issues of security or confidentiality could play a part.

3.4.6 Numerous agents’ reports describe present trends as featuring a “flight to quality” i.e. the observation that occupiers want better quality offices and

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<sup>22</sup> Partly because a significant number are out-sourced – those that are will appear in statistics as part of the general business services sector, whilst in-house centres will be counted as part of the sector they are serving (e.g. an electricity or telecomms supplier)

<sup>23</sup> <https://www.engagecustomer.com/blog/uk-contact-centre-trends-for-2024#>



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surroundings. Cluttons noted early this year<sup>24</sup> that “the structural change in the office market is ongoing, with strong appetite for best-in-class office space which meets high net-zero requirements and insipid demand for secondary or tertiary space”. They also noted that vacancy rates were continuing to rise not only due to weak demand (for general economic and hybrid-working reasons) but also because “the delivery of office stock remains high compared to historic levels”.

3.4.7 This is consistent with the modelled tendency for CBDs and major office centres to retain fairly high occupancy levels at the expense of secondary locations (e.g. standalone office blocks in non-central, otherwise residential locations, or office space above suburban shopping parades)<sup>25</sup>. This is emphasised by the Local Data Company, whose recent report on retail and leisure trends<sup>26</sup> shows (but does not fully explain) measures of amenity for the office-working population by sub-market, and suggests that the increased share of office take-up in the traditional City and West End markets is due to the greater attractiveness of key locations in those areas in terms of such amenities. The possible decline in demand for secondary locations is less likely to show up in commercial analysis because much of that stock isn't investment-grade and therefore tends to be ignored. Rightmove (whose activities appear to cover the full range of the office markets) reported<sup>27</sup> that “indicated demand” (enquiries from potential tenants looking to lease office space) was still 9% higher in the period January to April 2023 than in the equivalent months of 2019, though 8% down on January-April 2022. However, this may include enquiries from firms wishing to move to smaller offices as well as those looking to set up or expand, so it is difficult to draw any conclusion about overall demand for space.

3.4.8 An element of uncertainty amongst office tenants is suggested by the trend to shorter (or even shorter) leases. According to the *Financial Times*<sup>28</sup>, “The length of UK office leases has fallen to the lowest level on record while vacancies rates have soared close to a decade high as the shift to working from home shakes up the market. It highlights big changes since the pandemic as staff who adopted remote working in lockdowns rarely come into the office five days a week, while companies have cut costs and headcount in the economic slowdown. Average lease lengths dropped to two years and 10 months in the first quarter, the lowest level since data was first collected in 2018, according to commercial property management platform Re-Leased. It is down from nearly four and a half years at the start of 2019 before the

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<sup>24</sup> <https://www.cluttons.com/property-market-research/research-articles/office-market-update-spring-2024/>

<sup>25</sup> from unpublished DELTA-based work in 2021/22

<sup>26</sup> See p24 in Local Data Company (2024) *FY 2023 Retail and Leisure Trends Analysis*. <https://www.localdatacompany.com/insights/reports>

<sup>27</sup> Rightmove/EG, July 2023, <https://www.rightmove.co.uk/press-centre/demand-to-lease-office-space-still-higher-than-pre-pandemic/>

<sup>28</sup> <https://www.ft.com/content/5cc8ae2e-765c-43be-9f84-9426408e9609>

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Covid-19 Pandemic as the uncertain economic outlook and changing working patterns fuel a reluctance to commit to long-term contracts. Letting contracts of a year or less accounted for nearly half of all leases in the first quarter, a more than threefold jump since 2019... Analysts say the commercial real estate market has split, with strong demand for high-quality buildings in desirable locations that meet environmental requirements while there is a lack of interest for others.”

- 3.4.9 We would add that whilst the FT article specifically refers to Covid and to changing working patterns, other economic factors are undoubtedly contributing to the prevailing uncertainties.
- 3.4.10 **Other industries:** quoting again from the OBR October 2021 *Economic and Fiscal Outlook*, “Both the pandemic and Brexit have prompted firms to consider building greater resilience into their supply chains, reversing a decades-long trend toward internationalisation of production and ‘just-in-time’ logistics. Having risen from 24 per cent in 1965 to 63 per cent in 2018, the trade intensity of UK output has fallen to a twelve-year low of 55 per cent in the second quarter of 2021. A survey of 353 companies across 77 countries found that, post-pandemic, two thirds of businesses were planning to source more locally and 20 per cent planned to hold more inventories.”
- 3.4.11 If these changes are materialising, they will imply less goods traffic through the ports, and more (or different) domestic production with implications for goods and passenger traffic (NB less trade will probably mean reductions in exports as well as in imports). However, it will be difficult to distinguish the effects on industrial production and trade of Covid-related changes as distinct from Brexit effects, the economic consequences of Russia’s war against Ukraine, disruption to traffic through the Suez and Panama canals, and renewed violence in the Middle East.

### Retail location

- 3.4.12 The Local Data Company’s report *FY 2023 Retail and Leisure Trends Analysis* by (March 2024)<sup>29</sup> provides some of the best evidence on retail location trends, in that it is based on a time series of physical surveys (site visits) covering over 5,000 retail locations grouped into four categories: high streets, shopping centres, retail parks, and standalone locations. (These are not formally defined in the published report, but the content suggests that “high streets” includes all “traditional” shopping streets whether in large cities or small towns.) Note also that whatever the expression “FY 2023” means in the title, annual data in the report is for calendar years<sup>30</sup>.

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<sup>29</sup> <https://www.localdatacompany.com/insights/reports>

<sup>30</sup> Based on email from contact at LDC

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- 3.4.13 The report includes data on vacancy rates for retail and leisure premises separately and combined, from 2013 to 2023 [p9]. The vacancy rate for leisure premises rose slowly over the six years before the pandemic, from 7.4% to 9.2%, and more rapidly to a peak of 11.3% during the pandemic years, since when it has stabilised but not recovered, with a most recent vacancy level of 10.9%. Retail vacancy rates fell from 14% in 2013 to a low of just above 12% in 2014, but rose slightly before the pandemic and more rapidly during it, to a peak of 15.8%. Since then they have recovered but only to 15.3%. Both retail and leisure vacancy rates therefore remain a little above pre-pandemic levels, but the trends to increasing vacancy has perhaps been halted. However, it seems quite possible (to the present author) that the stabilisation of vacancy rates may be temporary and the result of closures of unprofitable businesses or branches being accelerated during the pandemic, giving other businesses/branches a respite before the trend resumes.
- 3.4.14 The LDC report gives national changes in numbers of retail units by the four types of location already mentioned. Retail parks are doing best, partly because they are seen to match consumer preferences, but also because units on retail parks are generally better than the other locations for use also as online fulfilment centres. (The Rightmove/EG “indicated demand” data quoted earlier for offices reports that enquiries for retail space were up 11% from 2019 to 2023, but enquiries for leisure and hospitality were down 8%.)
- 3.4.15 Within larger town and city centres, the large unit vacancies created by the closures of the Debenhams, BHS and Arcadia chains are all gradually being either reoccupied or repurposed, with over 50% of each chain’s units now in retail or other use. The proportions repurposed to non-retail use vary dramatically, from less than 4% of the reoccupied Arcadia units being in non-retail use, to over 40% of the equivalent Debenhams units. (See also discussion on floorspace stocks, at 3.4.30 below.)
- 3.4.16 All of these changes in retail by location are at least partly the result of changes in retailing itself which do not seem to be related to the pandemic. The number of retail units occupied by comparison shops<sup>31</sup> fell in every year reported (2012 to 2023), and the fall accelerated in every year from 2015 to 2020, then slowed in 2021 and 2022. This category includes fashion, footwear, furniture and other general retail, and is therefore the one most obviously affected by the growth of online shopping.
- 3.4.17 This is to some extent confirmed by the data given on more detailed categories. The ten retail categories that increased most rapidly in 2023 (measured by the absolute change in the number of such units) were all categories that either require personal presence by definition (e.g. barbers) or

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<sup>31</sup> i.e. shops selling types of goods where typical consumers compare what is available from different retailers before buying; shoe shops are a classic example. The opposite is convenience shops, for goods where there is little or no advantage to the consumer in making such comparisons.

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that serve “urgent” requirements (e.g. fast food takeaway – where to some extent the retail units are complementary to food delivery services). Of the ten categories that decreased most rapidly (on the same absolute measure) some were obviously under pressure from online shopping (notably fashion shops) or from online alternatives to traditional services (banks, betting shops, estate agents, and newsagents).

3.4.18 However, the most rapidly declining categories also included some that cannot be exactly matched by online services: the largest single category being public houses and inns (-924, “a greater yearly decrease than was observed during the pandemic”<sup>32</sup>), but also including hairdressers (the second largest absolute decline, -752) and “hair & beauty salons”. There are however some alternatives for undertaking or organising analogous activities at home that may be associated with these particular trends.

3.4.19 As mentioned earlier (see 3.4.7), the retail and leisure offer in city centres clearly has an amenity value for workers, though it is not clear how this translates into workers’ welfare and/or into productivity (as a form of agglomeration effect). The increase in remote working has widely been reported as having negatively affected these sectors in major office employment locations; how great this effect is, and how much it matters, is unclear. A specific if partial view of this is provided the “Pret index” published by ONS using data from the Pret a Manger chain. This reports weekly till transactions at certain groups of Pret a Manger stores, indexed relative to the average weekly transactions in those stores in the four weeks from 3 January 2020 to 30 January 2020<sup>33</sup>. It consists of separate indices for a range of locations including “London City Worker” (stores in the City of London), London West End, London Suburbs and London Stations; there is no overall national or regional index. It is included in ONS’ real-time indicators bulletin “as a proxy of consumer spending, high street footfall and passenger movement around the UK”.

3.4.20 The “London Stations” index is for stores at “three large train stations in London”. “London Suburbs” is described as “outside Zones 1 and 2; predominantly in residential areas of London” though casual observation and the Pret store locator indicate that most of these are in larger suburban “town” centres, some of which would themselves be centres of medium-sized cities if not within the London conurbation. The values of the index for these four London categories are shown in the graph below. Note that whilst the index is based on January 2020 (i.e. immediately pre-pandemic) the graph starts from

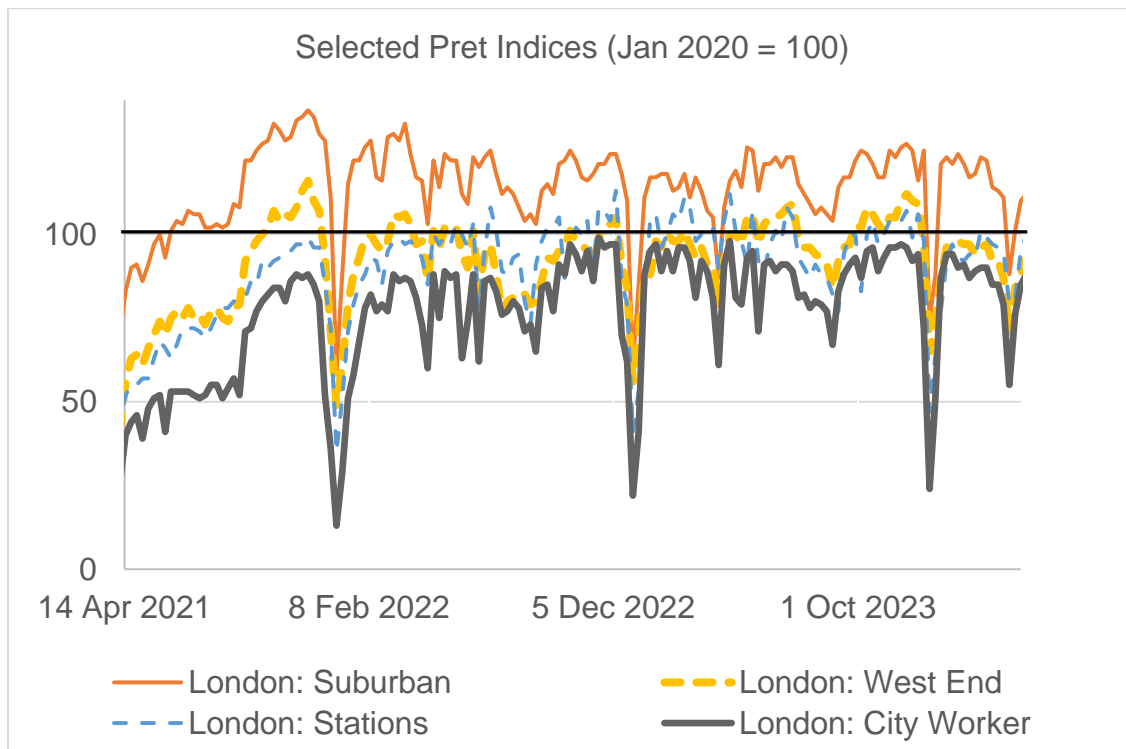
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<sup>32</sup> This is a very long-standing trend: one source suggests a loss of 28,000 pubs over 40 years before the pandemic, or 700 a year for four decades (<https://www.wholesalecoffeecompany.co.uk/blog/uk-set-to-have-more-coffee-shops-than-pubs-by-2030/>)

<sup>33</sup> Definitions and quotes in this and following paragraphs from <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/methodologies/coronavirusandthelatestindicatorsfortheukeconomyandsocietymethodology#business-and-workforce-indicators>

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April 2021 (and runs to March 2024, which makes it one of the most up-to-date indicators available and relevant to this study).



**Figure 13: Pret index for selected London locations**

3.4.21 The graph bears out the negative headline previously quoted in that it shows that the sales in the “suburban” stores have increased, and outside holiday periods seem to have settled around 20% higher than immediately before the pandemic; whilst sales in the (much more numerous) central stores are generally down, with the most “office oriented” group (“London City Worker”) being consistently below 100 (unlike West End and Stations) which were each above 100 at times in 2023) and often below 80.

3.4.22 However, comparison with available figures on peak hour passengers at London stations also suggests that Pret sales in Central London recovered more quickly than (rail) commuting in general, as suggested by the table below.

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**Table 3: retail and rail demand indices**

	Pret index	Pret index	Pret index	AM peak passengers at		
	London: West End	London: Stations	London: City Worker	London Bridge	Fenchurch Street	All London stations
2019	100	100	100	100	100	100
2020	#N/A	#N/A	#N/A	20	21	19
2021	102	90	81	48	46	48
2022	96	97	88	67	58	75
2023	103	96	92	#N/A	#N/A	#N/A

Note: The passenger numbers on the right are DfT figures for “a typical autumn weekday”, 2019-23, for two stations judged to be particularly commuter-dominated, and for London stations in total<sup>34</sup>. The Pret index only goes back to January 2020; the base value of 100 is therefore shown in the 2019 row. No Pret data is available for autumn 2020; the values for 2021, 2022 and 2023 are for the last two weeks of September and the first two of October

3.4.23 The figures (and the graph) suggest that (a) Pret sales moved to something resembling a “new normal” more quickly than rail commuting (so who is buying all the sandwiches?) and (b) that unless the base period (January 2020) was particularly bad, the “new normal” may be rather better in Pret sales than in commuter rail demand.

3.4.24 Whilst these figures are useful (and ONS<sup>35</sup> considers them valuable enough to publish as “real-time” indicators), they are obviously not a full story of what is happen to the services available to workers in a competitive market<sup>36</sup>. At least one other chain serving a similar market is expanding and seems to be doing so mainly in traditional city centres<sup>37</sup>.

## Development patterns and total floorspace stocks

3.4.25 Given the time lags involved in development, and in the collection of data about development, it is too soon to say much in relation to the present brief. DLUHC’s land-use change monitoring, for example, currently covers changes that occurred up to March 2022. Data based on monitoring planning applications might give a more up-to-date though partial picture, but identifying the longer-term impacts of specifically Covid-related changes will be difficult, as investment decisions are likely to have been disturbed by other

<sup>34</sup> <https://www.gov.uk/government/statistical-data-sets/rai02-capacity-and-overcrowding#passenger-numbers-by-city-and-central-london-station>

<sup>35</sup>

<https://www.ons.gov.uk/economy/economicoutputandproductivity/output/datasets/transactionsatpretamanger>

<sup>36</sup> It is not clear whether the recorded “till transactions” include free drinks under Pret’s subscription service, so the index may not be the full story even of what is being delivered over the counter.

<sup>37</sup> <https://leavetheherdbehind.com/blogs/locations/tagged/country-england?page=3>

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

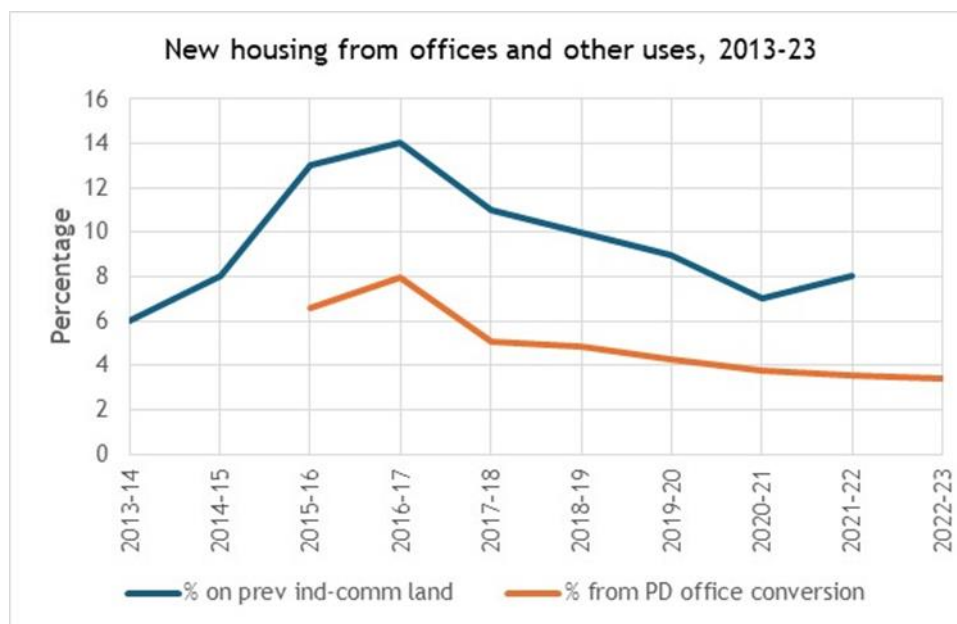
economic shocks particularly the energy price changes resulting from Russian invasion of Ukraine.

- 3.4.26 Other work for the Department has discussed the uncertainties and complexities in the relationship between land-use plans or allocations, planning applications and completed developments. Monitoring of applications for planning permission cannot be taken as a guarantee that the corresponding development will be completed within the time period one would typically expect. However, applications to redevelop offices for residential or other purposes, or to convert offices to residential [which under GDPO in England may not need specific planning permission, but local planning authorities have to be informed], would be a fairly good indicator that office employment is unlikely to return to those sites.
- 3.4.27 We have looked at the available data on office-to-residential changes. The graph below shows in blue the proportion of new residential addresses on land that was previously in industrial or commercial use (extracted from the DLUHC “Land Use Change Statistics – new residential addresses” dashboard). The orange line shows the proportion of new dwellings resulting specifically from permitted development office-to-residential conversion<sup>38</sup>. This suggests that conversion of offices to residential use has been making a significant contribution to the amount of new housing on brownfield land that was previously (immediately prior to conversion/redevelopment) in industrial/commercial use, and that the rate of such conversions has varied considerable over the past decade. Such conversions were defined as permitted development from 2013; if the data were available the orange line would probably show growth from a low value on the left-hand edge of the graph.

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<sup>38</sup> from Table LT120, <https://www.gov.uk/government/statistical-data-sets/live-tables-on-net-supply-of-housing>

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal



**Figure 14: New housing from offices and other industrial-commercial use, 2013-23** (for definitions see text above)

3.4.28 The other point to note is that the permitted development rights for office conversion introduced in 2013 were made more restrictive in 2021 but have recently (March 2024) been relaxed again<sup>39</sup>. The restriction may have contributed to the divergence of the two lines in 2021-22. The new relaxation may contribute to a further increase in the rate of conversion; this will leave it impossible to tell how much (if any) of the rate of conversion is due to office space being left redundant by reductions in demand resulting from remote working (which of course is itself only one of the drivers of occupier demand) and how much is due to change in planning regulations.

3.4.29 This does not disprove the hypothesis that office space in second-rank or standalone locations is more likely to become redundant as firms adjust their occupancy to higher levels of remote working; but it does mean that it will be never be possible to test that hypothesis by looking at data on conversion and redevelopment, even if it was available in sufficient spatial detail.

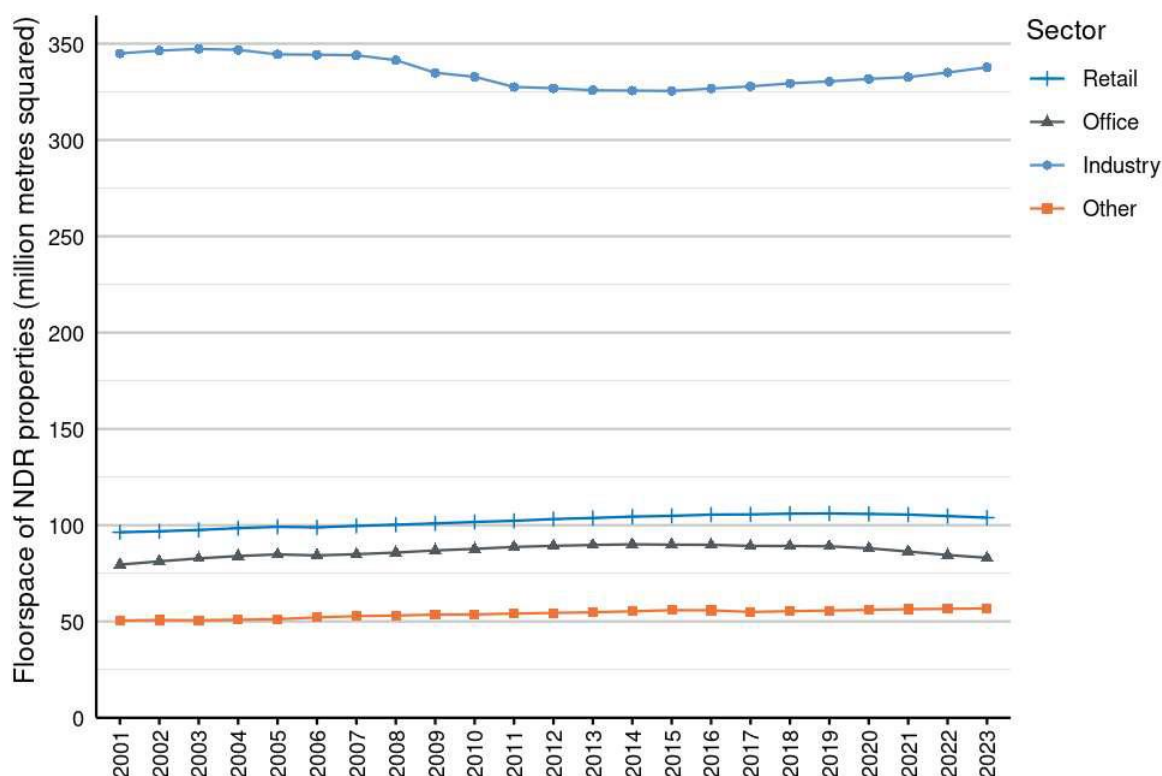
3.4.30 With reference to non-residential floorspace, the one source of information on stocks which covers the whole range of properties, from the highest-quality buildings in the best locations to other end of the spectrum, is the Valuation Office Agency's Non-Domestic Rating database. We reproduce below a

<sup>39</sup> <https://www.savills.co.uk/insight-and-opinion/savills-news/356947-0/why-now-is-a-good-time-to-revisit-office-to-residential-permitted-development-rights>; <https://www.alltop.co.uk/insights/large-scale-commercial-to-residential-conversion-via-permitted-development-it-s-back-is-it-the-same-as-before/>



## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

graph of total stocks by floorspace type from the turn of the century up to 2023. This shows that over the last few years, industrial and “Other” floorspace has been increasing, whilst retail and (more markedly) office floorspace have been decreasing. There is little if any sign of any change resulting from the Covid-19 pandemic, though of course the timelags in development processes mean it may be just be too soon to see any such effect.



**Figure 15: Total floorspace by VOA sector, England & Wales<sup>40</sup>**

**3.4.31 Conclusion:** just as one of the clearest behavioural consequences of the pandemic is that there has been a lasting increase in the proportion of workers working at home (recognizing that this is a continuation of an established trend, and that a “new equilibrium” has not necessarily been, and may never be found), the clearest “land-use” effects are those related to the increase in remote working: some increase in the preference for larger dwellings, and a decrease in the demand for office floorspace. The latter is a gradual effect, as businesses decide not to renew leases, and as they establish new working practices (or conclude that they cannot insist on all staff working in the office every day).

<sup>40</sup> Source: VOA: *Non-domestic rating: stock of properties including business floorspace statistical commentary*. Published 25 May 2023. <https://www.gov.uk/government/statistics/non-domestic-rating-stock-of-properties-including-business-floorspace-2023/non-domestic-rating-stock-of-properties-including-business-floorspace-background-information>

## **Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal**

- 3.4.32 These effects have spatial consequences (rather than Covid having lasting spatial impacts in itself): there may be lasting increase in the demand for, and potentially the development of, housing in areas where larger dwellings are a reasonable proposition; and the demand for office floorspace is concentrating on “higher quality”, most obviously in terms of the buildings themselves but also apparently in terms of amenities for workers which are more likely to be found in central business districts and major office parks. Not all of the office space even in the best locations is of the highest quality, not least because many of the “best” locations have a substantial proportion of older stock (some of it in listed buildings or other protection). The reduced demand for the “less-than-best” stock in may allow businesses that were previously priced out of more expensive locations to now move in.
- 3.4.33 This could be good news for train operators (and for a more sustainable modal split), in that rail commuter demand is concentrated on major city centre destinations. However, non-office trends may work against that. Traditional retailing is losing out to online retailing, again continuing an established trend that showed a spike during the pandemic; this poses a problem for city centre shops, which are generally ill-suited for the additional function of serving as fulfilment centres for online sales. The outcome for city centre services, such as coffee shops and pubs, is therefore uncertain – though such services face major difficulties of labour supply and input costs as well as the changing pattern of demand – and this may affect the attractiveness of city centres in the longer term.

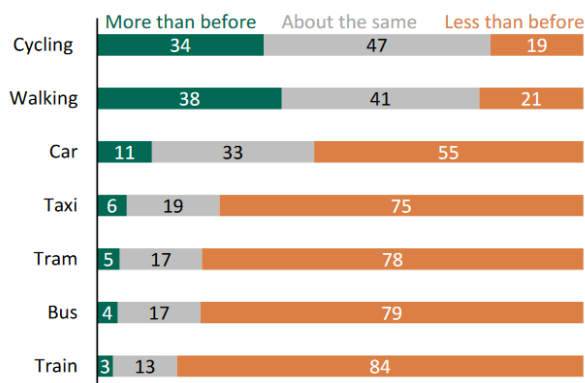
### **3.5 Modal attitudes and perceptions**

- 3.5.1 The economic principles that underpin transport models are focused on cost minimisation; travellers seek to minimise generalised cost incurred in making a journey to undertake activities.
- 3.5.2 Perceptions of safety and comfort while travelling is reflected in many transport models through modal preferences or ‘constants’, and through specific ‘weights’ such as rail crowding penalties and is reflected in economic appraisal as affecting journey ambience.
- 3.5.3 Transmission of the Covid-19 virus arises from proximity or contact with infected individuals. The heightened anxiety associated with being in crowded locations was identified through a range of attitudinal surveys both associated with public transport and more generally. The national travel attitudes survey

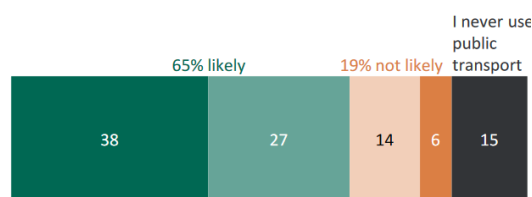
# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

wave 4<sup>41</sup>, conducted two phases (May-July and August-September 2020), identified respondents' showing greater reduction in their use of public transport modes and that their heightened concern for their safety of travel in crowded conditions would persist. Wave 5 of the survey undertaken during the third lockdown in January to February 2021 showed a similar pattern, albeit with respondents indicating a larger reduction in their travel at that time. Wave 6 of the national attitudes survey<sup>42</sup>, shown for rail below, returned to the issue about health concerns while travelling, and while the issue had moderated by September 2021, relative to summer 2020, the majority of respondents expressed concern, with only 12% indicating no concerns. Transport focus<sup>43</sup> also reported that there was a steady reduction individuals citing 'personal safety' or 'avoiding' as reasons for not using public transport reducing from 25-30% during the third lockdown (Jan-Mar 2021) to respectively 16% and 15% by December 2021.

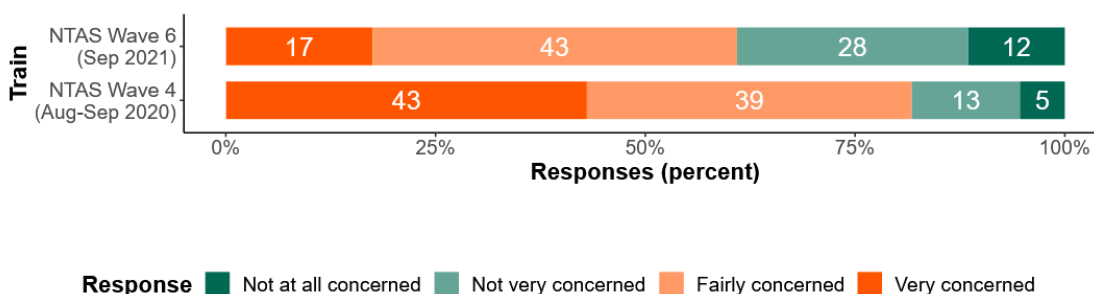
**Chart 10: "Comparing now to before there was a confirmed case of coronavirus in the UK, how much are you using the following modes:" (Sample 1+2; only referring to existing users of respective modes)**



**Chart 12: "After travel restrictions and social distancing are removed how likely, if at all, are you to avoid using public transport if it is crowded?" (Sample 1+2)**



**Figure 16: attitudes to public transport**



**Figure 17: Attitude to travel by rail during and following lockdown**

<sup>41</sup> <https://assets.publishing.service.gov.uk/media/601160d48fa8f56553673b13/national-travel-attitudes-study-wave-4-final.pdf>

<sup>42</sup> <https://www.gov.uk/government/statistics/national-travel-attitudes-study-wave-6/national-travel-attitudes-study-ntas-wave-6>

<sup>43</sup> <https://d3cez36w5wymxj.cloudfront.net/wp-content/uploads/2021/12/09172055/Travel-during-Covid-19-survey-%E2%80%93-10-December-2021.pdf>

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

- 3.5.4 There were studies (such as Shelat, 2021<sup>44</sup> and Aghabayk, 2021<sup>45</sup>) that conducted stated preference experiments to assess and concluded that perceptions of crowding had changed during the Covid Pandemic. There have also been some studies (eg Yap, 2023<sup>46</sup>) reviewing public transport crowding parameters that have directly demonstrated that the disinclination to travel in crowded conditions has increased since the Covid-19 Pandemic. It is likely that there was a change in the perception of public transport, which caused a reduction in use of bus, rail and LRT. The NTS 2022 mode share data demonstrate that this moderated and the daily tracker data suggests some further increase in public transport mode shares. Nevertheless this change in attitudes towards using public transport modes does not appear to have reverted fully to pre-Covid attitudes during 2022 and possibly through 2023.
- 3.5.5 The physical proximity associated with disease transmission makes it likely that the strongest impacts on travel behaviour will have been associated with use of public transport (where passengers are in enclosed space with others) and particularly where the vehicles are heavily used or crowded. There is clear evidence both from changes in mode share by purpose demonstrated by NTS and by the outcomes of stated preference experiments that attitudes related to the use of public transport changed and are gradually reverting towards pre-pandemic norms. Nevertheless that does not exclude the possibility of other impacts, it just indicates that other impacts are likely to be of smaller magnitude. It is also unclear at this time whether the changes in perception will persist.

### 3.6 Other Implications

- 3.6.1 The interventions taken to manage the pandemic had differential impacts on some particular segments of the population.
- 3.6.2 Commentary from education charities and teaching professions<sup>47</sup> expresses ongoing concern for the academic and social attainment gap. The medical profession<sup>48</sup> express ongoing concerns over provision of mental and physical health services and about differential impacts across different population segments. There may be an associated increase in variation in transport

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<sup>44</sup> Avoiding the Crowd: Traveller Behaviour in Public Transport in the Age of COVID-19, 2021, Shelat et al, [https://www.researchgate.net/publication/342392070\\_Avoiding\\_the\\_Crowd\\_Traveller\\_Behaviour\\_in\\_Public\\_Transport\\_in\\_the\\_Age\\_of\\_COVID-19](https://www.researchgate.net/publication/342392070_Avoiding_the_Crowd_Traveller_Behaviour_in_Public_Transport_in_the_Age_of_COVID-19)

<sup>45</sup> Effects of COVID-19 on rail passengers' crowding perceptions, 2021, Aghabayk et al, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8531255/>

<sup>46</sup> Public transport crowding valuation in a post-pandemic era, 2023, Yap et al, [https://pure.tudelft.nl/ws/portalfiles/portal/159235163/s11116\\_023\\_10420\\_1.pdf](https://pure.tudelft.nl/ws/portalfiles/portal/159235163/s11116_023_10420_1.pdf)

<sup>47</sup> <https://www.savethechildren.org.uk/news/media-centre/press-releases/teachers-reveal-deep-problems-in-schools-4-years-on-from-lockdown>

<sup>48</sup> <https://www.bma.org.uk/advice-and-support/covid-19/what-the-bma-is-doing/the-impact-of-the-pandemic-on-population-health-and-health-inequalities>

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

behaviours and there may be a cohort of children and young adults with distinct behaviours.

## 4 Issues affecting possible use of data from Census of Population 2021

### 4.1 Introduction

4.1.1 This is a summary of the information found about the consequences of the England & Wales 2021 Census being conducted during the pandemic (and, in principle, about any other problems with Census data – though none have been identified in our reading so far).

4.1.2 Issues in Scotland will be different as a result of the one-year postponement of the Scottish Census, and no attempt is made to consider those here.

### 4.2 Context of the Census

4.2.1 Census Day was 21 March 2021. On that date, ONS record that<sup>49</sup> a nationwide lockdown was still in place, with government guidance requiring people to work from home wherever possible;

- those key workers who were working outside of their homes were encouraged to avoid public transport where possible to reduce transmission;
- non-essential retail and businesses were closed;
- up to 5.6 million people in England and Wales were supported by a national job support scheme known as furlough;
- households were not able to meet with others outside of their bubble;
- the roadmap for moving out of lockdown had just been released, with children and students beginning to return to educational establishments;
- the Coronavirus Infection Survey (CIS) estimated up to 170,000 people were infected with COVID-19 in England and Wales;
- approximately 7% of the population of Great Britain (3 million people) were self-isolating with symptoms consistent with COVID-19.

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<sup>49</sup> Based on ONS: Travel to work quality information for Census 2021, last revised 8 December 2022. See <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/traveltoworkqualityinformationforcensus2021#processing-furlough-responses>

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

## 4.3 Population data<sup>50</sup>

- 4.3.1 ONS do not appear to have produced their own estimates of how far the population data recorded by the Census was distorted by temporary living arrangements during the pandemic.
- 4.3.2 They refer to GLA analysis (reference not found) which “concluded that there had been a fall in London's population over the first year of the coronavirus pandemic, but that the population is likely to have started growing again since”. The GLA work suggested this was attributable to:
- many young adults leaving London during lockdown, most likely linked to the temporary closure of the hospitality and tourism sectors;
  - higher mortality, mainly in those aged 75 years and over, and the continuation of a downward trend in the number of births;
  - an increased loss of other age groups to surrounding regions, as evidenced by house-price and registration data – seen as a potentially more persistent trend.
- 4.3.3 GLA highlighted the potentially temporary nature of this change [presumably referring to the first of the above bullets, and some of the third], and pointed to evidence of many young adults returning to London during the spring and summer of 2021, following the recovery of the hospitality and tourism sectors. Several local authorities also referenced similar trends during the quality assurance process.
- 4.3.4 The GLA analysis appears to have been limited to the impact on London as a whole; temporary relocation may also have taken place within London. Anecdotal evidence suggests that younger adults returned to living with their parents not only because they lost jobs in hospitality and tourism, but also because although fully employed they were required to work at home and, if living alone or in shared flats with near-strangers, they had no social life either at work or outside it. Some also moved to care for older family members.
- 4.3.5 Anecdotal evidence also suggests that some elderly people normally living alone moved in with family (typically with grown-up children) for the duration of each lockdown, rather than staying in a situation where they would have virtually no contact with other people. Whilst the displacement of younger adults would probably be (on balance) from city centres to suburbs and from

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<sup>50</sup> Based on ONS: Quality and methodology information (QMI) for Census 2021. Last revised 23 November 2023. See <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/methodologies/qualityandmethodologyinformationqmiforcensus2021>

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

larger urban areas to smaller ones, the displacement of elderly adults would not necessarily follow that pattern.

- 4.3.6 The ONS review says that “The census counts students at their term-time address” but mentions is evidence that a proportion (possibly one-third) of students were not resident at their term-time address on Census date. The review does not make it entirely clear whether the “missing” students were imputed at their term-time address or counted at their other address.
- 4.3.7 The Census population data therefore have an unknown element of temporary displacement, affecting both location and the mix of household sizes (since the tendency was probably more for single-person households to move in with others, which would suppress the number of single-person households and make other households larger). This probably most affects young single persons (though these might well have been living in households with others) and older single persons. Some of the displacement will have been to or from places outside England and Wales. Some of the displacement will have meant that dwellings were simply left empty while occupiers were displaced; in other cases, those displaced may have given up tenancies and later moved back into different accommodation.
- 4.3.8 Any use of the Census 2021 migration data in land-use modelling will need to consider how these and other issues affecting migration during the year before the Census. Census Day was 21 March 2021, or approximately the anniversary of the “official” pandemic in England and Wales: the Prime Minister’s statement that “now is the time for everyone to stop non-essential contact and travel” was made on 16 March 2020, and the first lockdown was announced on 23 March 2020<sup>51</sup>.

### 4.4 Work, workplace and travel to work data<sup>52</sup>

- 4.4.1 ONS guidance on answering the Census questions said that people on furlough should identify themselves as “temporarily away from work”, which would ensure they were still included in the economically active population. ONS say they “are unable to determine how furloughed people followed guidance”, but that their research “suggests that there are inconsistencies between the number of people answering “Temporarily away from work” in Census 2021 and the equivalent in other administrative data sources”, which “may result in scattering of furloughed responses through other labour market categories.”

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<sup>51</sup> Dates from <https://www.instituteforgovernment.org.uk/data-visualisation/timeline-coronavirus-lockdowns>

<sup>52</sup> Based on ONS: Travel to work quality information for Census 2021. Last revised 8 December 2022. See

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/traveltoworkqualityinformationforcensus2021>

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

- 4.4.2 People on furlough were also asked to provide travel to work information for the last time that they went to work before their behaviours changed.
- 4.4.3 ONS note that “There was an increase in home working from 10.3% in 2011 to 31.2% in 2021”, but the Census did not ask how many of those were working at home rather than commuting to their workplace (i.e. working remotely) as a result of Government advice (or employer instructions) to do so. (At the time, it would have been difficult to distinguish between “working remotely for pandemic reasons” and “working remotely as part of the new normal”.)
- 4.4.4 People working from home were not asked for their usual workplace address, but people on furlough apparently were. ONS comment that “This could lead to increased average distance travelled in industries or occupations with concentrations of people on furlough. For those occupations and industries where there are both furloughed and home workers, these changes may cancel each other out”. It seems to us rather over-optimistic to rely on errors cancelling out.
- 4.4.5 ONS report that after the question on work status, “All economically active people were then shown the travel to work question “How do you usually travel to work”. On-screen text stated: “answer for the longest part, by distance, of your current journey to work. If the coronavirus pandemic has affected your journey to work, please select the answer that best describes your current circumstances”. The specific guidance document for this question included the instruction: “if you are away from work on furlough, in isolation or in quarantine, answer about how you used to travel to work before your circumstances changed”.
- 4.4.6 The on-screen text and the guidance document seem to us contradictory. Not surprisingly, ONS report that “we cannot be sure how the questions for travel to work were interpreted by those on furlough”. They have found indications of “inconsistencies between the “temporarily away from work” group and data from other administrative sources”. They conclude that “census travel to work data are a mixture of pandemic and pre-pandemic travel behaviours. The data will also include a substantial number of responses from those who were furloughed, and it is not clear how these furloughed responses were intended”.

### Travel to work areas

- 4.4.7 ONS say that “At the moment<sup>53</sup>, we advise users to continue to make use of the 2011 Travel to Work Areas for analytical and statistical work, and we will continue to update users on future developments.”

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<sup>53</sup> This guidance was last updated on 8 December 2022



# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

## 4.5 Conclusions and Recommendations

4.5.1 We conclude that the 2021 Census is affected by at least the following:

- in so far as the Covid-19 pandemic produced any step changes in location or behaviour, they may or may not have fully occurred by Census date;
- where changes (such as relocation) were brought forward or delayed by the pandemic, the Census may have been taken before, at or after the point where those effects were greatest;
- there was an unknown amount of temporary displacement at Census date.

4.5.2 From the point of view of using the **residence** data as a starting point for future transport models, this means that we would want to:

- retain the step changes (if any);
- allow for slower- faster-than-usual changes where these had been brought forward or held back; and
- undo the “temporary” displacements.

4.5.3 The number of residents in work will have been distorted by temporary (real) unemployment (including people who had to give up work in order to care for others) and by the people on furlough who appear as economically active but not working (nor, presumably, looking for work?).

4.5.4 Thinking about **workplaces**:

- people temporarily working at home were not asked for their workplace address; and
- people on furlough were asked for the workplace address but may not have given it; some of them will have been temporarily displaced and hence may have (correctly) given a workplace address far outside commuting range.

4.5.5 The data on **mode of travel to work** will therefore be lacking some people, will relate to a “normal” journey starting from a different place of residence for some other people, and may simply be incorrect for others because the guidance wasn’t clear.

4.5.6 We therefore **recommend** that:

- transport models should not be directly based on 2021 Census data;
- instead, a concerted effort should be made by DfT, DLUHC, ONS and others to generate a detailed database for transport (and LUTI) modelling for 2024 from a range of sources, including selective use of the Census outputs where they are judged (or better still, can be shown) to be robust.

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

4.5.7 The detailed specification of this database, and of the exercise needed to produce it, are beyond the scope of this note, but the work should make full use of ONS' long-term investment in using administrative and other data to develop alternatives to the conventional questionnaire-based, one-point-in-time census. It would be highly desirable for it also to develop and implement a clear definition and measure of remote working (considering both who is working at home on an "average day" who also commutes elsewhere, and where they commute to) which could be used (and forecast) in future transport modelling.

## 5 Implications and Recommendations

### 5.1 Introduction

5.1.1 The forgoing sections have summarised the nature of changes in travel demand, discussed their potential causes and identified emerging land use trends. This section reflects on potential weaknesses in transport modelling and appraisal and suggests actions that may be taken to address them.

5.1.2 Section 3.2 illustrated how increased use of telecommunications technology was associated with reduction in travel demand. It seems unlikely that these will be no further advances in these technologies.

- Section 5.2 discusses how this demand driver may be introduced into transport modelling.
- In addition to better representing a choice of whether to travel, there may be implications for choice behaviour of where and possibly how to travel currently represented using variable demand models. Section 5.3 discusses potential implications for demand modelling.

5.1.3 The consequences of changes in attitudes (explained in section 3.5) to and the use of public transport are next considered in section 5.4.

5.1.4 Section 3.4 summarised changes in land use and section 4 summarised issues arising from undertaking the census during the Covid Pandemic. An approach to resolve limitations of the 2021 census and to respond to increased uncertainties arising for land use forecasting are discussed in section 5.5.

5.1.5 While not directly a consequence of the Covid Pandemic, this review of relevant data has identifies a number of other issues that would merit consideration in undertaking transport modelling and appraisal. These are discussed in section 5.6.

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

## 5.2 Technology related demand drivers

5.2.1 While the decline in trip rates over the past 20 years has been studied, no clear conclusions about its cause have hitherto been reached.

5.2.2 The 'Behavioural Change' Common Analytic Scenario assumes a continuation of the trend of reducing trip rates for a further 20 years, and thus embraces a range in contrast with the other scenarios which assume no further continuation of this declining trend in trip rates. Nevertheless this approach of merely expressing uncertainty is unsatisfactory:

- where the 'core scenario' (which assumes no further decline in trip rates) is expressed as a central view in business cases it is likely that demand and associated benefits will be overstated;
- in merely expressing uncertainty, it abrogates responsibility for considering the nature and extent of any future reduction in trip rates to a decision maker, without providing any support to inform that judgement; and
- the size of the change, if continued, is material in judging the merits of transport interventions.

5.2.3 The increased use of internet-enabled telecommunications technology for home working (section 3.2.3) and internet shopping (section 3.2.12) has affected travel demand, and it is highly likely that the increased access together with progressive reductions in cost and improvements in quality of internet based substitutes have influenced travel demand for most purposes. It seems unlikely that the trend towards increased exploitation of these technologies has played out and that there will be no further change that materially affects travel demand.

5.2.4 It is recommended, therefore, that technology is introduced as a demand driver for travel demand forecasts. One approach would be analogous to the use of established demand drivers such as demographic and economic forecasts. The remainder of this sub-section suggests three steps towards achieving this aim. Other approaches are likely to include interaction with variable demand choices, discussed in the next section.

### 1: Define suitable metrics

5.2.5 The banding definitions of home working currently used in the UK surveys, including the National Travel Survey, is a poor indicator of whether an individual travels to work or not on a given day (Section 3.2.7). Engagement with Ofcom and other Government departments to develop and agree metrics on the quality, cost and use of telecommunication technologies would provide a critical foundation to:

- understand trends from analysis of existing surveys;

## Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

- add consistent questions in conducting surveys in the future to enable subsequent analysis;
- support statistical analysis of relationships with travel demand; and
- provide a framework to investigate and formulate forecasts of these trends.

5.2.6 This should not be limited to home working where a suitable metric is likely to be the likelihood of working at home on a given day. For shopping a metric reflecting the extent to which goods are bought on-line is likely to be suitable. Considering a granular purpose segmentation, such as distinguishing health, banking, etc purposes within 'personal business' is likely to help identify on-line substitutes and potential telecommunication metrics.

Engage with Ofcom to:

- define communication technology metrics (quality, cost and use)
- source forecasts on anticipated developments

5.2.7 There will be uncertainties about future development of communication and associated technologies, particularly over the longer term typically required for transport forecasts. Whilst, to date, for example, remote working has mainly been for office based occupations, adoption of AI technologies is likely to change the nature, mix and number of jobs and may increase the proportion of the workforce able to work from home. Expressing explicit forecasting scenario assumptions would provide a framework to help decision makers understand the context and reach better informed judgements.

### **2: Interpret how technological change influences demand**

5.2.8 A broad interpretation of the extent to which home working and internet sales metrics has been made for commuting and shopping travel purposes (sections 3.2.11, 3.2.15). Making similar interpretations for other travel purposes would provide a basis to interpret and apply technology related demand drivers to develop scenario based travel demand forecasts.

5.2.9 Previous research using NTS<sup>54</sup> to relate changes in travel behaviour to technology have demonstrated that success of this type of approach is contingent on first collecting more relevant and accurate metrics. It may be feasible to exploit the activity surveys (UK Time Use Surveys were conducted in 2000, 2014/15 and since 2020) that explicitly record time spent undertaking in and out of home activities and also record information on use of internet based technologies to investigate the factors influencing this choice.

5.2.10 The algorithms used to interpret tracking data – sourced from GPS and mobile phone devices – depend on parameters such as the regularity of

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<sup>54</sup> <https://assets.publishing.service.gov.uk/media/5a82b3ca40f0b6230269c413/trip-rates.pdf>

# Implications arising from the Covid-19 Pandemic for Transport Modelling and Appraisal

travel to specific locations to interpret travel purpose; accordingly these sources are unlikely to be suitable for this type of investigation.

## 3: Introduce technological change as a demand driver

Apply (scenario specific) telecommunication related demand drivers to prepare travel demand forecasts.

- 5.2.11 TEMPro is used to ensure some consistency between appraisal of transport interventions in different locations. The trip rate model predominantly applies a time-trend term which will include technology related effects. Given adequate understanding of the association between technology metrics and travel demand, it would be feasible to interpret this time trend term to develop forecasts.
- 5.2.12 One example is the forecasting undertaken for Transport Scotland's Strategic Transport Projects Review 2 (STPR2)<sup>55</sup>. In that study, projections of home working and video conferencing as a substitute for travel were used, based on a land-use model forecasting zonal jobs by occupation and industry, to forecast the level and pattern of commuting to work and business travel.
- 5.2.13 It would also be possible to develop demand models explicitly representing the choice of undertaking activities at home or not, as discussed further in paragraph 5.3.12.

## 5.3 Variable Demand modelling

- 5.3.1 The 'standard' transport model described in TAG first applies demand drivers to forecast total travel demand and then sets out 'variable demand' processes to represent choices of when, where and how (which mode) to make those journeys.
- 5.3.2 This staged approach, and its associated modelling processes and parameters, was conceived some decades ago when trip rates were stable over time and the generalised cost of travel had, demonstrably in most contexts, an immaterial influence on total travel demand. The reduction in trip rates over the past two decades suggests that perhaps about a fifth of former demand (across all travel purposes) may now have substituted to use telecommunication technology. This raises questions both about the adequacy of assuming that the choice of whether to make a journey is insensitive to generalised costs and about whether other behaviours have changed. It will be important to understand the nature and scale of any such

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<sup>55</sup> <https://www.transport.gov.scot/media/50900/appendix-f-scenario-definitions-and-purpose-draft-technical-report-stpr2.pdf>

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behavioural change to judge appropriate changes to modelling travel demand.

Undertake research to determine whether:

- travel costs significantly influence the choice of whether activities are undertaken at home or not; and
- mode and destination choice sensitivity to generalised cost has changed.

5.3.3 The first question is whether travel costs materially influence the choice of whether to travel or to use telecommunications technology. It is reasonable, for example, to hypothesise that individuals making long commuting trips will choose to work from home more often than those making short journeys, other things being equal, because of the higher generalised costs involved. If generalised costs have little influence there would be low value (in terms of improved forecasting accuracy) in investing in developing and changing variable demand modelling methods.

5.3.4 Academic research into telecommuting has tended to focus on situational factors, distinguishing, for example, higher telecommuting rates amongst managerial and administrative (back office) job roles. Nevertheless some literature evidence is available that provides an indication of the extent to which travel distance (or other measures of generalised cost) influence this choice and there are transport models implemented (mainly in the USA) that represent this choice. Nevertheless there is unlikely to be sufficient UK evidence and evidence for other purposes than to reach a definitive answer to this critical question. (For example, recent work updating elasticities for TAG M2.1 found limited evidence to update parameters.)

5.3.5 The National Travel Survey was used to estimate the trip rate models applies in TEMPro. It would be feasible with moderate effort to introduce measures of generalised cost into these models to assess the sensitivity. The National Transport Model (v5) parameters were estimated using NTS and in London similar use was made of the Travel in London survey. Given the continuous nature of these surveys, some modest statistical analysis to test whether mode and destination choice model coefficients have varied over time would be one approach to provide an indication whether there has been a material change.

### **If variable demand behaviour has not changed.**

5.3.6 The preceding sub-section discussed introducing technology as a demand driver. Currently demand modelling guidance [Unit M2.1, Section 4.6] indicates that a trip frequency response may only be required where active modes are not modelled explicitly. Should it be concluded that generalised cost still have a marginal influence on total demand (for all modes including

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walk and cycle), then the further consideration for variable demand modelling should focus on the interpretation of planning data on the distribution of travel. For example, the propensity for home working is larger amongst office based workers, and accordingly, forecasts of jobs by industry segment and by job role would help interpret how many commuting journeys will be made to which model zones (an example is summarised in paragraph 5.2.12).

### If variable demand behaviours have changed

If generalised cost materially influences travel demand, introduce processes to represent this choice and revise associated demand modelling guidance.

5.3.7 Most variable demand models used to represent travel demand choices apply logit models to implement utility maximisation behavioural theory. The coefficients (scale parameters) of these models weight the importance of measurable influences such as travel time and cost for the discrete choices represented against residual variation, of fixed or defined scale, representing the unknown or unmeasured factors influencing individual behaviour.

5.3.8 There are two ways in which the increased use of telecommunications technologies may influence these models. The first is directly about the choice of whether to undertake an activity at home or elsewhere. The second is whether the change in context introduced by this choice has affected the parameters that represent the influence of travel time and cost on other mode, time and destination choices.

### Representing whether to travel to undertake an activity

5.3.9 The choice of whether to undertake an activity at home or not has some contextual analogies to the choice of mode or destination. Logit models typically applied carry implicit theoretical assumptions. Initially, at least, this should be considered as a distinct choice until demonstrated that the choice behaviour can be adequately represented as an alternative mode or destination.

5.3.10 Current guidance sets out how to include a trip frequency response through applying an elasticity to the composite costs of travel. Should the sensitivity of the choice between undertaking an activity at home or elsewhere be relatively small (ie less than modal choice sensitivity) such an approach would be consistent with hierarchical logit theory and, once suitable sensitivity parameters are established, require little change to existing variable demand modelling practice.

5.3.11 That said, current guidance (Unit M2.1, section 4.9.10) also advocates the use of doubly constrained methods for commuting and education purposes. This has the purpose of ensuring consistency – that the commuting demand

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is consistent with the number of jobs forecast for each zone. If the choice of whether to travel to work or to work at home is sensitive to travel cost, then imposing such a constraint would be inconsistent with travel behaviour and should be discontinued. For education, particularly primary and secondary, however, there is little evidence to suggest a change in this regard.

5.3.12 There are other methods that could also be developed to represent the choice between undertaking activities at home or elsewhere. Activity based models provide such a framework. In practice, the definition of activities used for activity based transport models are, in some cases, implicitly or explicitly non-home based (for example 'eat out'). It should not, therefore, be blithely assumed that an activity based models are suitable; care would be required to ensure that the model used does represent the relevant choice behaviour. One particular reason to consider adopting activity based models would that they provide integration in representing the choice of whether to undertake an activity with choices of where it is undertaken and between travel modes. In principle, therefore, this also provides a framework suited to represent technology related demand drivers.

### **Stability and suitability of model parameters**

5.3.13 As explained in paragraph 5.3.8, it is possible that an increased tendency to undertake activities without travel has changed the choice context and thereby changed how travel costs and journey times influence mode and destination choices. It would require calibration of choice model parameters to determine whether this is the case, although as previously noted (paragraph 5.3.5), an indication of the scale of any change may be indicated through analysis of NTS.

5.3.14 One of the key principles applied to prepare forecasts is an assumption of how behaviours change over time. Currently the assumption taken for variable demand modelling is generally that behaviours are stable. That is a 10 minute change in travel time will have the same influence on travel choices now and in 20 years' time. Should there be evidence that this behaviour has been changing materially then consideration would need to be given to how it would change further into the future.

## **5.4 Consequences of reduced Public Transport Use**

5.4.1 The daily tracking data suggests a slight change in public transport use through 2023 and this should be reviewed by purpose once NTS 2023 data are available. At this point it is not sufficiently clear that behaviour has stabilised. If it has not stabilised the current advise simply to rebase models using data collected in 2023 may be premature and lead to forecasts and benefits that understate the need for and value of public transport investments.



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- 5.4.2 While research has been undertaken (section 3.5.4) that show a change in public transport crowding parameters, these were undertaken during a transitional period and it is likely therefore that perceptions may have subsequently reverted back closer to those experienced before the Covid-19 Pandemic. The changes in mode share indicate that there has been a change in attitude and perception of public transport modes; nevertheless it is not self-evident that a legacy of the Pandemic will be other changes to perceptions and associated model parameters. Scoping work undertaken in the Netherlands to update their national values of time<sup>56</sup> has indicated that there may be a reduced business value of time and attributed this to change in the composition of travellers rather than a change in attitudes and perceptions.
- 5.4.3 If it is clear that when behaviours have stabilised it would be appropriate to revisit and potentially update evidence on passengers perceptions of travelling on public transport to update model and appraisal parameters. Some of the relevant evidence is likely to be generated by industry bodies such as RDG in updating PDFH and current guidance already sets out the need for research where changes in public transport quality is of material consideration.

### 5.5 Land-use data, projections and modelling

- 5.5.1 We set out here our recommendations related to (i) base land-use data describing the present or recent past, for input to transport modelling and appraisal; (ii) projecting future land-use data for input to transport modelling and appraisal; (iii) aspects of LUTI models and other SEMs (including their possible use in producing those projections), including appraisal of agglomeration (and other wider economic) benefits.

#### Land-use data: Census 2021

- 5.5.2 Reflecting the direct impacts of the lockdown on residential location at the time of the 2021 Census, and other biases noted by ONS we have concluded that the 2021 Census should not be used directly for transport models. The wording drafted in the, as yet unpublished, update to TAG M1.2 expresses appropriate caveats in respect of potential use of these data, but in the light of the analyses summarised in Section 4 above, those caveats might also be strengthened to advise that users should not make any direct use of the data.
- 5.5.3 This leaves a gap in the normal supply of data, both because most land-use modelling and projection is normally based on the most recent census, and because the issues with the 2021 census will affect mid-year estimates and projections for future years. Given the importance of land-use data and

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<sup>56</sup> [https://aetransport.org/private/downloads/5DfnDIZUsW9XyE4i-pPyvruDR\\_A/ETC%20-%20New%20Dutch%20VTT%20-%20SP%20design%20-%20data%20collection%20-%20analysis%20v3.pdf](https://aetransport.org/private/downloads/5DfnDIZUsW9XyE4i-pPyvruDR_A/ETC%20-%20New%20Dutch%20VTT%20-%20SP%20design%20-%20data%20collection%20-%20analysis%20v3.pdf)

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projections for transport planning, this gap will need to be filled. Work to fill the gap should take account not only of the conventional “planning data” requirements of transport models but also of [a] the requirements of LUTI and other SEM models (see paragraphs on LUTI modelling, below); and [b] the additional detail necessary to represent the effects of technological developments, especially in terms of disaggregated employment by sector and occupation (see section 3.4.2).

A concerted effort should be made by DfT, DLUHC, ONS and others to generate a detailed database for transport (and LUTI) modelling for 2024 from a range of sources, including selective use of the Census outputs where they are judged (or better still, can be shown) to be robust.

### Land-use projections : TEMPro

5.5.4 Planning data is a conventional demand driver for transport forecasts. While there is some use of LUTI models to explore how planning constraints and accessibility will influence land use patterns over the long term, it is more common in the UK to draw on Local Authority planning databases to refine spatially the TEMPro projections. Local authorities’ information tends to be better in relation to land-uses for which they are required to plan proactively (housing and general “employment land” (mainly for offices, factories or warehousing)) and less good for uses where they tend to be more reactive (notably retailing). As a result, it is questionable whether TEMPro practice has, in the past, adequately reflected the scale of ‘out of town’ development and decline in town centres as a retail hub, a trend, in part, which has been driven by the relative cost and accessibility of different locations<sup>57</sup>. The growth in internet sales with the need for large scale accessible warehouses is an aspect where emerging technological change interplays with existing trends. Drawing together better clarity of the demand drivers and their impacts would thus provide a foundation for more reliable travel demand forecasts.

A practice of collating trend data or drawing on land use models may provide a richer basis to project longer term planning forecasts and better represent future travel patterns.

5.5.5 Given the limited extent to which the influences affecting land use are represented in TEMPro inputs, consideration should be given to the spatial

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<sup>57</sup> We recognize that (a) the British planning system is not a deterministic “zoning” system but something much less certain; (b) changes envisaged in plans may not happen, and unexpected land-use changes may occur (on very significant scales); and (c) in any case, the time horizons of transport planning and modelling are generally much longer than those of urban planning. For further discussion see section 7.6 in Allanfield Consulting (2024): *Review of land-use/transport interaction models*; report to DfT.

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granularity at which TEMPro land use projections are judged to be sufficiently accurate to be used; their availability at MSOA level, together with pressures to keep study costs to a minimum are likely, currently, to result in undue reliance being placed on these data. It may be appropriate to publish TEMPro statistics only at a more aggregate spatial resolution.

- 5.5.6 Should that conclusion be reached, it would be appropriate to provide complementary support to minimise additional costs in generating the more spatially disaggregate planning forecasts required. One approach, where a suitable land use model is available, would be to place greater reliance on its outputs to disaggregate TEMPro outputs. As set out in paragraph 5.5.4, structured monitoring evidence on land use trends and advice on how the dominant factors influence the development of land use would help practitioners better interpret local factors.

### **LUTI and other SEMs modelling**

- 5.5.7 We recognize that Supplementary Economic Models (SEMs) are outside the main focus of this project, and that DfT is currently involved both in reviewing SEMs and in reviewing the scope for further refinement of agglomeration calculations. However, we should point out that it is important that SEMs should be able to represent remote working and its potential consequences for residents' housing and location preferences, for business space demands, and for other effects in workplace zones. The significance of remote working (and the range of possible scenarios for its future growth) requires a greater level of detail and realism in SEM work; for example, the more radically simplified spatial-economic models which assume every household has one worker who travels to work every day are no longer defensible, if indeed they ever were.
- 5.5.8 As summarised in Section 1.2, the transport system involves numerous subtle interactions. Home-work arrangements and other internet-based activities will continue to evolve, and will have impacts on land use patterns and the offer made by employers, retail and leisure providers, which will in turn influence travel behaviour. Understanding and modelling may require more nuanced understanding of variations in individual circumstances; for commuting this may be the type of industry and the job function, and age is currently associated with the tendency to engage with and use telecommunications technologies. Understanding of the importance of these variations in behaviours and significance for transport forecasting and appraisal will develop over time and should be monitored as it evolves. There are some indications that the rates of relocation of households have decreased (section 3.3) whilst those of office firms have potentially increased (section 3.4.8); these effects, and the potential for future changes in these rates, will need to be kept in mind in future land-use forecasting.

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5.5.9 SEMs are commonly used in the assessment of Wider Economic Impacts; some models include such impacts within their own processes, whilst others are used to supply changes in employment distributions for use in WITA or equivalent programs. It may be that the changes in home working affect commuting distances and the associated relationships and elasticities used in land use models and in appraisal of agglomeration impacts. The DfT are already conducting research in this area<sup>58</sup>. The TELMoS18A model used for the aforementioned STPR2 study included a number of such changes<sup>59</sup>, though it did not attempt to project further change in remote working and related effects beyond a "post-pandemic recovery period" up to 2025. The role that future technological change (including the development and deployment of artificial intelligence) may play in land-use/economic modelling needs to be considered in parallel with considering its role in transport modelling.

## 5.6 Other implications for transport modelling and appraisal

### Time periods and annualisation

5.6.1 In their conception transport models focused on issues of connectivity and congestion. In urban areas, which most transport models focus on, peak demand was focused around radial movements predominantly made by commuters on weekday mornings and evenings.

5.6.2 Following the Pandemic there has been a further reduction in commuting travel and traffic count data indicates that is particularly the case on Mondays and possibly Fridays. There have increasingly been questions about the need to consider Saturdays and congestion associated in part with peaks in shopping trips. Traffic levels at lunchtimes on Saturdays across the UK road network are, now, almost at the level of the weekday evening peak and exceed the morning weekday peak. It is likely that transport modellers will need to take additional care in selecting the periods the model represents and in obtaining suitable data to do so. Data about trip attractions is important, and often uses employment data for trips to work and for other purposes. The need to distinguish categories of workers was noted in section 3.4;

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<sup>58</sup> Regarding agglomeration, see Simmonds, D M Hamunen and I Stead (2023): *Agglomeration after Covid – the potential impacts of remote working on agglomeration effects and the benefits of transport improvements*. Paper presented to the European Transport Conference, Milan. Available at <https://aetransport.org/past-etc-papers/conference-papers-2023?abstractId=8040&state=b>. That study was largely theoretical, with examples quantified for a hypothetical city; the possibility of new empirical work is being considered in a scoping study (including a very extensive literature review) being carried out for the Department by Arup and Imperial College London. (The latter is a general review of the possibility of improving the present TAG agglomeration calculations, not just about the consequences of the Pandemic.)

<sup>59</sup> Cann, R, S Cragg, Va Nacar, E Revill, C Schnoebelen, C Sibilla, D Simmonds (2021): *Modelling alternative scenarios for Scotland*. Paper presented to the European Transport Conference. Available at <https://aetransport.org/past-etc-papers/conference-papers-2021?abstractId=7404&state=b>

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richer understanding of would also improve forecasting of trip attraction patterns across all hours of the week.

- 5.6.3 Draft changes made during 2022/3 to TAG modelling units (forthcoming change) do set out more clearly the purpose of modelling different time periods and consideration of annualisation in designing how best to represent variations in level of service delivered by the network. The main risk is likely to be ‘inertia’ changing practitioners from applying the ‘tried and tested’ and potentially lower cost modelling of working weekdays. Emphasis should be given to challenging whether adequate consideration has been given in reviewing Appraisal Specification Reports to ensure appropriate consideration of which time periods should be modelled and that data collection strategies appropriately considers sampling and day to day variability.

### Freight

- 5.6.4 Current practice in respect of freight is typically to deal with LGV and HGV as aggregate vehicle classes. Whilst the data do not show a large enough change to identify Covid related impacts, the data do show an increase in internet shopping and, anecdotally, there were pressures reported during the Pandemic on the capacity of delivery services.
- 5.6.5 As and when work is undertaken to refine the modelling of freight together with the use of LGVs and HGVs, there would be merits in distinguishing the purposes the vehicles are used for, thus for example differentiating customer delivery chains, better to represent any changes of shopping in person to shopping online on the transport networks.

Future freight modelling should differentiate distinct segments, better to represent the influence of different demand drivers.

### Active travel

- 5.6.6 It appears that the increase in cycling (and walking) that occurred during the first lockdown may largely be viewed as a substitute for other activities, although improved ambience (ie less traffic on the roads) may also have been a stimulus. Whilst there was no apparent persistence of the behaviour following the Covid Pandemic, this does raise two questions.
- 5.6.7 Appraisal methods apply estimates of modal change to assess health benefits. The first question is whether the modal change to increased active travel considered in current appraisal is (partly) a substitute for other physical activity whether through time budget or energy budget considerations.
- 5.6.8 Secondly, the scope of most transport models is limited to travel that serves as access, or a utility, for undertaking another activity. A substantial

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proportion of walking and cycling is undertaken as a leisure activity in its own right. Depending on the importance of health related indicators it may be worth devising methods and extending the scope of transport modelling and appraisal to represent such leisure activity.

Consider the merits of modelling and appraising walking and cycling as a leisure activity.

## 6 Summary

6.1.1 There have been a number of significant impacts on the UK socio-economic system over the past five years. After making allowance for other economic impacts, the analysis of available data set out in this report suggests that the main consequences of the Covid Pandemic (including all the measures taken in response to the Pandemic) on subsequent travel demand have been:

- a reduction in trip rates of around 5-10% overall, which are almost certainly associated with increased use of internet based telecommunication technologies; and
- an additional reduction in the use of public transport modes, likely arising from changes in modal perceptions and attitudes.

6.1.2 There has been an increase in home working, most of which is believed to be due to increases in remote working, i.e. working at home by people who could (and at least sometimes do) commute to a conventional workplace (typically an office). Trends in land use take longer to materialise, nevertheless available evidence currently indicates that this has led to:

- a modest increase in preference for larger dwellings;
- a preference for shorter term office lease giving flexibility for change, reflecting a range of strategies from 'cost minimising' through 'office interaction' to 'full attendance' adopted by different companies to providing office space; and
- a greater preference for higher quality offices, implying a greater preference for more attractive work locations.

6.1.3 'High Street' retail vacancy rates rose during the Pandemic and have not significantly recovered. Vacancy rates for leisure (in all kinds of locations) have also been increasing for a decade or more. This contrasts with the growth in trips for "entertainment or public activity" and "day trips" (whereas the decline of retailing is matched by a decline in "shopping" trips). The

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implication seems to be that people are making trips to different kinds of leisure activities.

- 6.1.4 It is recommended that metrics on the use of telecommunication technologies are developed. This would include but not be limited to whether individuals chose to work at home on the survey day(s) instead of commuting to a workplace. Questions used in surveys, including NTS, should be refined accordingly to enable future analysis of this demand driver on travel demand. In the interim, interpretation of correlation between evidence from Ofcom surveys, the time use surveys and NTS may provide a basis to develop and apply alternative scenario based forecasting assumptions.
- 6.1.5 Some specific analysis is recommended to identify the extent to which the increased use of telecommunication technologies have influenced travel behaviours. If this is slight it would indicate that little change would be required for variable demand modelling practice. If not then a range of actions have been suggested. These would include research to allow modelling of how the take-up of telecommunication alternatives is affected by the quality of the physical travel alternative (e.g. whether workers with particularly long, slow or expensive commutes are more likely to work remotely if they can).
- 6.1.6 The 2021 Population Census took place during Pandemic 'lockdown' management measures, which are believed to have resulted in significant distortions of the data relative to the situations before and after the Pandemic. As these will affect use of the data for a range of purposes, not just transport planning, it would be most cost effective if a coordinated (inter-departmental) effort were made to generate a detailed database for transport (and LUTI) modelling for 2024 from a range of sources, including selective use of the Census outputs where they are judged (or better still, can be shown) to be robust.
- 6.1.7 The analysis indicated increased volatility in office, retail and leisure land uses. TEMPro MSOA forecasts do not reflect these emerging trends and it is recommended that the accuracy of the MSOA forecasts be reviewed to determine whether TEMPro forecasts should continue to be published at this spatial granularity. If the decision is taken to publish TEMPro only at more aggregate spatial geography, advice could be provided on the interpretation of land use trends to assist preparation of spatially disaggregate scenario based forecasting assumptions.
- 6.1.8 While not directly attributed to the Covid Pandemic, the changes that occurred emphasise importance in actions already being given consideration around the segmentation of freight demand by purpose in improved freight modelling, the need to consider whether to model time periods outside or instead of the conventional working weekday and whether agglomeration parameters require revision to reflect changes in travel to work behaviour.

## Appendix: Indicators of cost and service operated

<b>Measure</b>	<b>2019</b>	<b>2022</b>	<b>2023</b>	<b>Source</b>
GDP deflator	2233921	2505981	2689974	HM Treasury March 2024
CPI index	107.8	120.5	128.6	ONS: CPIH
GDP / capita £	33443	33497	33271	ONS: CVM market prices
Fuel prices (unleaded/ Diesel)	124.88/ 131.48	164.73/ 177.66	147.75/ 158.19	DpT for Energy Security & Net Zero (ULDP, ULSD) – ex VAT
Motoring expenditure: petrol & oil	369.9	491.4	441.2	RPI: DOCU
Bus fares	498.5	599.9	595.7	RPI: DOCX
Rail fares	425.1	471	494	RPI: DOCW
Bus miles operated (London)	476	470	454	GB stats BUS02_KM
Bus miles operated (GB non-London)	1847	1625	1549	
Rail miles operated	558.4	473.7	460.9	ORR table 1243 (financial year starting)