The impact of the COVID-19 pandemic on mobility has increased the uncertainty in a sector that was already undergoing rapid technological change, seeing new business models being introduced, and facing changing consumer expectations. Almost all forms of transport have been affected by the pandemic with mass-transit services, particularly those in urban centres, recording substantial declines in demand. Increased levels of remote access, for work and consumption, allied to evolving perceptions of risk are amongst the most influential factors in determining transport usage patterns during the pandemic. However, the extent to which these changes, and the other impacts of the pandemic, endure remains highly uncertain. As such, a number of possible futures for mobility in urban environments could occur and this study posits that individual behaviours will help determine these scenarios. In this context three futures, which are based on safety, economy, and green behaviours are proposed. Each of these scenarios has different implications for the economy, city spaces, spaces, and mobility.
Introduction

On 12th March 2020, the World Health Organisation (WHO) declared the spread of the novel coronavirus, COVID-19, as a global pandemic due to largescale community transmission across multiple regions. In response to the public health crisis arising from the pandemic, many nations introduced full national lockdowns that involved the strict enforcement of ‘stay at home orders’. As part of these measures, non-essential businesses were forced to close, educational settings switched to remote learning, and social contacts between different households were restricted. These stringent measures were effective in controlling the rate of infection and during the summer months of 2020 many nations began to relax the most restrictive interventions. However, following a resurgence of infection rates during the latter period of 2020 many of the most stringent measures were redeployed.

For many aspects of society, COVID-19, and the mechanisms introduced to control the rate of infection, have had profound impacts on existing behaviours and routines. Mobility has not been immune from these impacts, with significant changes in travel patterns and modal choice. These changes have extended the uncertainty in sector, which was already evident before the pandemic. Rapid technological change, evolving business models, and shifting consumer expectations were reshaping mobility particularly within urban environments. In some cities a ‘renaissance’ of mobility was taking place prior to the pandemic through the introduction of shared and connected modes that lessened the pressures on public transport (BCG, 2020). So whilst the creation of a more sustainable and equitable mobility paradigm seemed somewhat inevitable, the rate of change across different environments varied. As such, there remained a great deal of uncertainty surrounding the pace of these changes (Corwin et al., 2020).

The rate of change in transport is also influenced by the ability of individuals to access new technologies, an issue considered by Rohr (2020). Should individuals not have access to the appropriate infrastructure, or be unable to afford advanced technologies, then the capability to adopt new routines will be impacted. Moreover, as the circumstances of the pandemic mean that the post pandemic model for transport, particularly in urban environments, could be radically different. For example, the presence of mobility-as-a-service provision, which combines multiple modes of travel, may offer consumers a more personalised solution (Strategy and PwC, 2020). However, for those unable to access these systems new inequalities, in terms of accessibility, may arise.

The purpose of this paper is to add to the debate surrounding the impact of the pandemic on mobility in city spaces by proposing potential scenarios for future transport that build upon insight from various studies such as Aldred (2020), Corwin et al (2020), European Parliament (2020) and Mott MacDonald (2020). This study will assess the baseline position for travel before outlining how the pandemic has impacted these routines. Key behavioural changes, such as remote working, will then be assessed prior to establishing the potential future scenarios for transport. These future scenarios are articulated around three key behavioural constructs of safety, economy, and green. Each of these scenarios has distinctive impacts on the economy, society, and the environment, with the routines emerging in these outcomes leading to different mobility solutions. Critically, behaviours in these scenarios are framed around attitudes towards the pandemic and the threat posed by COVID-19.
The Pre-COVID Travel Baseline

Through assessing official statistics on transport usage, a baseline for travel prior to the COVID-19 pandemic can be established for the UK. Data from the DFT (2019) indicated that personal vehicles were the primary modal choice for travel to work purposes with 68% of commutes undertaken via this method. Still, there were some substantial regional variations in vehicle usage with just 27% of commuter trips in London undertaken via this mode compared to 80% for Wales and the West Midlands. In terms of public transport, 58% of all journeys on these services took place on buses with 4.8bn trips during 2018/19. In comparison, there were 1.8bn passenger journeys via rail (21%) and 0.3bn (4%) on light rail and trams. The remaining 17% of travel was undertaken via underground systems in cities such as London and Glasgow (DFT, 2019). These data also reflected that the trips on rail were typically longer, and less frequent, than those recorded on bus services. In England, it was estimated that a typical person took 22 trips via rail and travelled 992km compared to 48 journeys via bus for a total of 441km (DFT, 2019).

2011 Census data, as displayed by Centre for Cities (2020A) helps to illustrate city and town level differences in the mode of commuting. These data suggested that many areas in the West Midlands and North of England, outside of major metropoles, have higher than average rates of commuting via passenger car. For example, in Telford, it was stated that over 77% of travel-to-work was undertaken through using a car. Moreover, locations in the North West and Yorkshire, such as Preston, Burnley, Barnsley, and Wakefield all recorded over 70% of commuter journeys via car. In contrast, major cities recorded less than 65% of commuting travel taking place through this mode. In Newcastle, just 58% of commuters used cars, whilst in Oxford and Cambridge this was 37% and 34% respectively (Centre for Cities, 2020A).

The Centre for Cities (2020A) analysis also highlighted the usage of public transport for commuting purposes with these data suggesting that major cities have higher demand levels when compared to other areas. Although there are exceptions, such as Basildon and Southend, the majority of the locales recording over 15% of commuter travel via public transport are cities including Birmingham, Coventry, Manchester, Newcastle, and Sheffield. In terms of active travel, DFT (2019) stated that just 15 local authorities reported cycling rates in excess of 20%. At a city level many of the areas with higher rates of cycling are towards the South and East of England. Many locations in the North West, Yorkshire, and West Midlands had a very small proportion of commuters who used this mode for travel-to-work purposes, in some cases less than 1%. Conversely, 29% of commuters in Cambridge used a bicycle, although this is an outlier compared to the rest of the country (Centre for Cities, 2020A).

Rates of walking have steadily increased over time with the DFT (2019) indicating that there was a 2% growth in the number of people undertaking this activity once a week between 2015/16 and 2018/19. Those locations exhibiting low levels of walking, for commuting purposes, include some of the larger UK cities, including London, Birmingham, and Newcastle who all had rates below 10%. In contrast, areas such as Norwich, Exeter, Plymouth, Bristol, and Cardiff had over 14% of commuting trips made by foot (Centre for Cities, 2020A).

Typically shared mobility, particularly the notion of car share, has been seen as unattractive due to concerns surrounding convenience. For example, insight from Marsden et al (2019) highlighted that...
71% of respondents strongly agreed that owning a vehicle was important for their current lifestyle, whilst 80% enjoyed the independence arising from having access to their vehicle. Still despite these concerns the number of users registered at car clubs has risen in recent years, particularly in major urban centres. Angeloudis and Stettler (2019) reported that the membership of car clubs in London increased by 20% between 2014/15 and 2015/16. Users of these schemes tend to be under the age of forty (CoMoUK, 2019). Alongside car share, there is also increased interest from local authorities in providing bike share schemes in urban environments (Angeloudis and Stettler, 2019).

**The Impact on Mobility**

All forms of transport, whether personal, mass-transit or freight, have been significantly impacted by the COVID-19 pandemic. Initial evidence from the International Energy Agency (2020) estimated that global road transport had fallen to less than 50% of the 2019 average by the end of March (2020), whilst demand for commercial passenger flights fell by 75% when compared to the 2019 levels. Furthermore, there was a significant collapse in demand for public transport services, which could were as high as 95% for some services (IEA, 2020). This was most evident in urban locations with metropolitan areas of the UK, USA, and Canada all recording a reduction in usage of over 70% (WSP, 2020). In nations where formal national lockdowns were avoided, such as Hong Kong, South Korea and Sweden, there was a less significant impact on demand for public transport services. This was estimated at between 30% and 50% (WSP, 2020).

In exploring the mobility trends that have occurred during the pandemic, data from Google Mobility Report (2020) and Apple Mobility (2020) is effective in identifying routing requests and travel patterns. The evidence from Google Mobility Report (2020) indicated that travel across a variety of contexts dramatically declined during the spring 2020 period. For instance, in analysing travel to retail and recreation, supermarkets and pharmacies, residences, parks, workplace and public transport it is apparent that mobility for these purposes hit their lowest point during April 2020. Although some of this activity has subsequently exceeded the baseline level, such as travel to parks and supermarkets and pharmacies, travel to work and public transport remains supressed worldwide (Google Mobility Report, 2020).

Another assessment of the impact of the pandemic was provided by INRIX (2020) who outlined the level of vehicle miles travelled. These data followed a similar pattern to the one outlined by Google Mobility Report (2020). Road transport across many nations hit its lowest point during March and April before gradually recovering through the rest of the spring. However, there were some country variances, with the reduction of road travel in Spain much greater than in many other developed nations. This reduced to less than 20% of baseline levels, and compared with the German low point, for example, of around 40%. As such, the pace of recovery was quicker in Germany when compared to Spain. Although France and Italy both exhibited much lower levels of road travel than Germany during lockdown, the rate of recovery was slightly quicker during the late spring (European Parliament, 2020). In the UK, 49% of motorists stated that their use of vehicles declined in 2020, compared to 21% in 2019. In contrast, a third of respondents stated that they were driving as much as previously and 17% were using their vehicle to a greater extent (RAC, 2020).
Shared mobility, including services such as Uber and Lyft, has not been immune from the crisis with estimates suggesting that Uber made 70% fewer tips in cities that had been seriously affected by the spread of COVID-19 (FutureBridge, 2020). Overall, in the second quarter of 2020, Uber reported a 35% contraction in the number of trips made when compared to 2019 (Global Data, 2020). As many shared mobility providers are largely loss-making operations the pandemic represents a potential threat to their future viability. In contrast, active travel was one of the beneficiaries of the pandemic with rates of cycling and walking increasing, particularly during the period of lockdown (DFT, 2020; Transport Focus, 2020). Given these circumstances, some 150 cities worldwide introduced temporary infrastructure to support cycling and walking by the end of April 2020. Such interventions enabled these activities to take place in a safe manner and in-line with social distancing rules (ITF, 2020).

**Behavioural changes during the pandemic**

Shamshiripour et al (2020), through analysing the situation in Chicago, identified four key areas of change due to the pandemic. These related to increased levels of home working, greater reliance on online retailing, reduction in airplane travel, and evolving perceptions of risk. Such issues are present across many locations. In the UK, rates of remote working peaked during April 2020 with 46.6% of the labour force undertaking some work from home during the month (ONS, 2020A). Before the pandemic, the ONS (2020B) reported that under 30% of the labour force had worked from home, and in December 2019 it was estimated that only 5.1% of individuals were operating remotely. Even as measures were relaxed in the summer, rates of home working remained well above pre-pandemic levels. In Mid-October 2020, some 25% were still working solely from home with a further 11% operating in both remote and physical locations (ONS, 2020C).

In assessing the picture across the UK, both Costa Dias et al (2020) and ONS (2020A) indicated there were regional variations in home working rates, with London reporting a higher degree of remote activity than other parts of the country. This has implications for public transport demand as Costa Dias et al (2020) state that over 60% of those using public transport in London are in professions that are amenable to home working. In contrast, this is less significant in the North West where under 40% of public transport users are in jobs that can be conducted remotely. As a result, encouraging home working in London, and indeed the South East and East of England, was likely to have a greater effect on demand for public transport in these areas when compared to those such as the North West.

For those unable to work from home due to business closures, government support, such as the Job Retention Scheme for employees, provided critical financial relief in a period where no activity was taking place. Data from HMRC (2020) indicated that 9.6m positions had been registered on the scheme by the end of October 2020, which was prior to the extension of the programme into 2021. Most of these registrations had occurred by early May, with data from the ONS (2020C) highlighting how the proportion of the workforce furloughed steadily fell from the end of May onwards. This reduced from 15% in May to 1% in October. As more businesses reopened, and individuals returned to work, there was an impact on mobility but, as the DFT (2020) data counts on transport indicated, this remained well below pre-pandemic baselines for public transport usage. In urban environments there is evidence that many workers continued to operate remotely, with the Centre for Cities...
(2020B) stating that the number of people operating from physical workplaces in cities and large towns was only marginally higher than the period of lockdown by the end of September. This has only risen, on average, by 8% from a low of 12% in April to a high of 20% in September.

Another factor influencing the footfall in city centres is the increase in online retailing, which the ONS (2020D) estimated at record levels during May 2020. In the final month before the national lockdown, February 2020, 20.1% of all retail sales were recorded online, but during May this had risen to 33.9%. As non-essential shops were reopened in June, the level of online activity fell but still represented 27.5% of all retail sales in September 2020 (ONS, 2020D). This continued high level of online retailing impacts the recovery of town and city centres. Typically, movement in major UK cities, such as Birmingham, London, and Manchester only recovered to around 60% of the baseline prior to the introduction of tougher national measures in November 2020 (City Mapper, 2020). With fewer workers and shoppers in these locations, there are significant questions over the viability of physical retail (Mott MacDonald, 2020).

In terms of changing perceptions of risk, a significant area of concern for transport users relates to the safety and hygiene of public transport services. During the initial period of lockdown, SYSTRA (2020) reported that 20% of respondents believed that they would be making fewer trips on public transport in the future. Of those who stated this view some 49% argued that their behavioural changes would occur due to concerns surrounding contagion on these services. In May 2020, public transport was ranked as the second most significant area of concern by respondents, only ahead of attending large gatherings, with 61% stating that they were not comfortable in using these services (IPSOS Mori, 2020). The RAC Motoring Report (2020) indicated that 52% of drivers will be using public transport less in the future, suggesting that motorists are becoming more ‘wedded’ to their own vehicles.

Other recent studies also suggested that a large proportion of respondents were concerned about the safety of public transport services. At the end of October 2020, findings from the Transport Focus (2020) omnibus survey suggested that 24% of respondents were still avoiding public transport with the same number stating that they did not feel safe on these services. Regionally, the evidence from the Transport for West Midlands (TfWM) COVID survey indicated that the number of people feeling concerned about public transport was broadly static between the first and second waves of their study. However, it was evident that the number of participants feeling ‘extremely concerned’ fell from 43% to 39%. Conversely, the number of respondents stating that they had no concerns remained static at 15% (TfWM, 2020B).

The high levels of concern surrounding the safety of public transport were also reinforced by 23% of the respondents to the TfWM (2020B) survey stating that they would not use these services until an effective treatment or vaccine had been introduced. In the same study, 32% of participants also argued that they would not return to public transport until it was advised, by a medical professional, that travel on these services was safe. Longer-term, evidence from the RAC (2020) study indicated that improvements to public transport, as a means of driving modal shift from personal vehicles, were likely to be less effective due to the pandemic. They found that 43% of respondents, down from 57%, reported that they would use their vehicle less if these services were improved. With changing expectations surrounding access to remote working (SYSTRA, 2020; Transport Focus, 2020),
it is evident that public transport demand faces twin pressures resulting from safety concerns and evolving working habits.

Given these insights, it is unsurprising that the emerging data on transport usage captured during the pandemic suggested that there has been a shift away from public services towards personal vehicles. Whilst the DFT (2020) data on transport counts highlights how usage of cars and public transport still remained below the pre-pandemic baseline by the autumn, there had been a much greater recovery in the use of personal vehicles. In contrast, after a much greater decline in usage, the recovery in demand for national rail and bus services was much less evident. For instance, at their lowest point in April, usage of national rail and bus services fell to 4% and 10% respectively. For cars, the lowest level of usage was recorded in March at 23% of the baseline. When assessing the rate of recovery, by early July 2020, the number of cars on the road reached 80% of February 2020 levels. In contrast, it was not until September 2020 that the number of rail passengers recovered to 43% of 2019 levels before declining again. Meanwhile, the number of bus service users peaked at 60% of the baseline in September and October (DFT, 2020).

These broad national trends were also reflected by views expressed in the Transport Focus (2020) omnibus survey. A significant proportion of respondents, which has fluctuated over time, stated that they had replaced public transport trips with personal vehicles. This peaked at over 40% in September and had steadily risen since May where it was initially under 30%. A much smaller number, steady at around 17%, argued that they had replaced public transport trips with walking, whilst those cycling instead of using public transport has stabilised at around 4% (Transport Focus, 2020). Insight from TfWM (2020A) indicated that there were modal shifts undertaken in relation to travel for both work and shopping. For work purposes, there was a shift towards cars (as a driver or passenger) and active travel, whilst for shopping it was apparent that most of the movement occurred between public transport and walking. These data are shown in Table 1 and 2:

<table>
<thead>
<tr>
<th></th>
<th>Car (driver)</th>
<th>Car (passenger)</th>
<th>Rail</th>
<th>Bus</th>
<th>Walk</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>31%</td>
<td>6%</td>
<td>21%</td>
<td>48%</td>
<td>17%</td>
<td>4%</td>
</tr>
<tr>
<td>Shopping</td>
<td>53%</td>
<td>17%</td>
<td>5%</td>
<td>23%</td>
<td>29%</td>
<td>3%</td>
</tr>
</tbody>
</table>
(Source: Transport for West Midlands COVID-19 Survey Wave 1, 2020)

<table>
<thead>
<tr>
<th></th>
<th>Car (driver)</th>
<th>Car (passenger)</th>
<th>Rail</th>
<th>Bus</th>
<th>Walk</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>40%</td>
<td>10%</td>
<td>12%</td>
<td>37%</td>
<td>20%</td>
<td>7%</td>
</tr>
<tr>
<td>Shopping</td>
<td>52%</td>
<td>18%</td>
<td>2%</td>
<td>13%</td>
<td>40%</td>
<td>4%</td>
</tr>
</tbody>
</table>
(Source: Transport for West Midlands COVID-19 Survey Wave 1, 2020)

**The Future for Transport: Possible Scenarios**

The changes identified in Section 3 of this paper have potentially significant ramifications for the future of transport in urban environments. As reflected earlier in this paper, there is a great deal of
uncertainty surrounding how the future shape of transportation. Fundamentally, the extent to which changes, such as remote working, influence future trends within the transport sector is still unclear. For example, will remote working be seen as unproductive? Will policymakers aim to return office staff to physical locations in order to protect the viability of city locations? Or will individual workers want to return to an office environment in order to alleviate any sense of isolation? In contrast, should some of these routines be adopted longer-term there is the potential for a ‘fundamental’ realignment in how transport shapes economic activity. In this sense, greater levels of home working will lead to less congestion on key roads and environmental improvements (Strategy and PwC, 2020). Lower travel times will support productivity enhancements, and environmental improvements could support new business opportunities.

According to McKinsey (2020) there are five key aspects that could shape the future of transport; a greater consumer emphasis on safety and reliability, interventions from policymakers, mobility going hyperlocal, an upscaling of mobility, and innovation. From this analysis, policy interventions form a critical component of shaping the future for transport as they could facilitate a quicker transition to electric vehicles or encourage the adoption of shared mobility services. Meanwhile, simply introducing blanket national interventions may not be sufficient due to the ‘hyperlocal’ nature of mobility, which requires city-specific solutions and strategies. This is particularly evident in an environment where the rate of infection is not under control and policymakers may need to intervene in order to influence mobility patterns.

Some of these constructs were reflected in the specific UK context outlined by Hertzke et al (2020). This analysis identified eight factors that could influence the future shape of mobility in the UK and included the notion that the current crisis could lead to innovation in product and service delivery, whilst also providing opportunities for firms to ‘reinvent’ their operations. They added that policymakers will also have the possibility of shaping the future responses in the sector through the desire to secure a green recovery and the need to retain social distancing measures. These aspects will influence the nature of transport provision, and are likely to have greater impacts in urban locales.

To assess the future of transport and mobility, studies such as Aldred (2020), Corwin et al (2020), European Parliament (2020) and Mott MacDonald (2020) have sought to identify possible scenarios that could emerge for these services. These futures range from the notion that the pandemic could be a ‘passing storm’ to a fundamental realignment of mobility with impacts on private and public transport demand. Aldred (2020) posits two ‘extreme case’ scenarios for transport with the ‘negative’ scenario seeing a switch from public transport to cars, which sees a 17% increase in the number of vehicles on the road centred on urban locales. In the ‘positive’ scenario, Aldred (2020) estimates that around half of public transport commuters could switch to active travel modes such as cycling, walking, and e-bikes. However, to achieve this shift in behaviour, there needs to be further investment in active travel infrastructure and continued home working.

In contrast to the two scenarios articulated by Aldred (2020), Corwin et al (2020) identified four potential futures for transport. Unlike Aldred (2020), these scenarios are linked to virus eradication or control as well as wider geopolitical changes. The first scenario ‘passing storm’ sees an acute but brief impact on public health and the economy, which is met by an effective policy response. Due to
the effectiveness of these responses, policymakers are encouraged to support sustainable technologies in order to secure the economic recovery. In the second scenario, ‘good company’ it is foreseen that more private providers will enter the transport sector, alleviating some of the challenges faced by public sector organisations. Particularly, these firms will emerge from the technology sector leading to further innovation and adoption of new solutions.

The third scenario ‘sunrise in the east’ outlined by Corwin et al (2020) captures some of the geopolitical consequences of the pandemic. In this future mobility providers from Asian nations become dominant due to the success of controlling the virus in these locations. Moreover, this future also sees a more interventionist approach to transport and mobility decisions using policy tools that are drawn from Asia. Consumer behaviour also changes to become similar to those adopted in Asia, with a shift to long-term leasing and subscription etc. The final scenario, termed ‘lone wolves’, sees national and local authorities directly intervene in order to determine the movement of goods and people. These mechanisms are seen as critical in controlling the infection rate as COVID-19 remains in circulation. Due to the continued spread of the virus, there is a reduction in demand for transport, with work from home advice becoming permanent government guidance. More broadly, there is also significant reshoring of supply chains.

The four futures outlined by the European Parliament (2020) are also connected to the uncertainty surrounding the spread of COVID-19. The first scenario is similar to the ‘passing storm’ narrative outlined above as behaviours broadly return to a pre-COVID normal. However, such a situation is only seen as being plausible if the virus is quickly brought under control, but what is meant by ‘quickly’ is not determined in this explanation. Secondly, in a scenario where there is greater uncertainty over the spread of COVID-19, demand for private vehicles is likely to increase with possible use of subsidies and incentives to encourage electric vehicle adoption. Thirdly, with higher rates of home working and online retailing, plus improved transport demand management, there will be less need to travel and demand for mobility will contract. In the final scenario, there is a more extensive connection of public transport to active travel, creating a multi-modal future.

Whilst the European Parliament (2020) concentrates solely on transport provision, Mott MacDonald (2020) combine accessibility preference with economic recovery in order to ascertain four potential futures. As such, the economic recovery is considered to be ‘strong’ or ‘weak’ whilst accessibility preference is termed as ‘private’ or ‘public’. The first scenario is termed as ‘private and prosperous’ and in this future there is more active travel, more usage of personal vehicles, greater levels of remote working and retailing, but less usage of public and shared transport. The second scenario is ‘public and prosperous’ and in this context there is greater usage of cars and public/shared transport but lower levels of remote access. Thirdly, a ‘private and poorer’ scenario is envisaged where levels of remote access and active travel increase, but the demand for public/shared transport declines. Finally, a ‘public and poorer’ future involves increased levels of active travel but lower usage of cars and remote access.

In order to extent the thinking surrounding the future of transport, this paper will now establish three further scenarios that are based upon individual behaviours. These scenarios are based upon indicators such as perceptions of safety, attitudes towards remote working and online retailing, as well as factoring in potential responses to changing levels of infection. As a result, this study
proposes three potential futures; safety, economy, and green. Two of these scenarios, safety and green, represent a shift away from the pre-COVID ‘baseline’ whilst the economy future is considered as being largely ‘back to normal’. These scenarios are illustrated in Figure 1 and will be discussed in turn:

**Figure 1: The three scenarios**

<table>
<thead>
<tr>
<th>Safety</th>
<th>Economy</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decisions are determined by concerns surrounding individual safety.</td>
<td>There is little concern over COVID-19 so behaviour is determined by a desire to secure the economic recovery.</td>
<td>Desire to adopt more sustainable behaviours leads to greater focus on the environment.</td>
</tr>
<tr>
<td>Greater levels of remote access for work and shopping.</td>
<td>Emphasis on securing quick economic rebound means that existing inequalities overlooked.</td>
<td>Adoption of green policies stimulates economic recovery.</td>
</tr>
<tr>
<td>City spaces impacted by lower footfall. Economic damage and unequal outcomes.</td>
<td>Demand for public transport recovers level of remote working returns to pre-pandemic levels. Government sees investment in these services as a mechanism of securing growth.</td>
<td>City centres as ‘destinations’ with more use of outdoor space.</td>
</tr>
<tr>
<td>Demand for public transport declines due to concerns surrounding safety and hygiene. Questions surrounding viability of these services.</td>
<td>Passenger cars remain the most common mode for commuting. More investment in EVs but enduring barriers remain.</td>
<td>Demand for public transport recovers as a more sustainable mode. PT services connected with micro and shared mobility to create multi-modal platforms.</td>
</tr>
<tr>
<td>PT users mainly switch to personal vehicles or remote access. EVs seen as unaffordable for many.</td>
<td>Shared mobility seen as less convenient than other modes.</td>
<td>Use of personal vehicles declines. Switch to EVs accelerates with more use of shared mobility schemes.</td>
</tr>
<tr>
<td>Shared mobility is unattractive due to concerns surrounding safety and hygiene.</td>
<td>Active travel mainly for leisure purposes.</td>
<td>Active travel increases and infrastructure improved. More car free roads increases its attractiveness.</td>
</tr>
<tr>
<td>Active travel unattractive.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scenario 1: Safety**

The first future for urban environments sees a significant shift in pre-pandemic behaviours as individual consumers, employees, and passengers become more cautious due to concerns surrounding COVID-19. In this scenario, it is foreseen that social distancing and ‘rolling’ national lockdowns remain a key component of the policy mix in order to control the virus and protect
healthcare systems. This has economic implications, resulting in what PwC (2020) termed as a ‘bumpy’ recovery as measures are imposed that lead to periodic business closures. For transport, passengers see mass-transit and shared modes as unsafe and return to the comfort of their own vehicles. Demand for many forms of mobility contracts when compared to the pre-COVID-19 baseline.

To understand the impact on transport, the economic and social implications of this scenario will be outlined. Physical retail and hospitality are amongst the businesses most affected in this future as consumers move online as this is seen as the ‘safer’ option. These sectors are also the most at risk of closure due to more stringent national measures being introduced. However, as illustrated by Irwin Mitchell (2020) these risks also apply to manufacturing businesses, a particular challenge for the West Midlands, which has a less developed professional services infrastructure than other regions of the UK. The economic uncertainty will lead to higher rates of unemployment, rising inequalities, and divergent outcomes between those who can work remotely and those who cannot.

Virtually all modes of travel are impacted by the consequences of this scenario, but it is demand for public transport that will be most affected due to concerns surrounding safety and hygiene. With these concerns more entrenched due to the continued spread of COVID-19 infections, providers will need to enforce stricter control measures, such as social distancing and hygiene protocols. Improvements to services may not be sufficient to attract some customers, particularly those who feel that their own vehicle, or remote access, is much safer than using mass-transit. Shared mobility will also be negatively impacted by these perceptions, meaning that schemes, such as e-scooter trials, that are introduced in order to alleviate pressures on public transport services are likely to prove unsuccessful.

Given that the DFT (2020) data indicated that usage of national rail had recovered to around 40% of pre-pandemic levels by September 2020, it can be anticipated that this level of demand becomes a ‘new normal’ for providers. Without state support it is unlikely that these modes will be viable, essentially forcing providers to reduce the number of services they offer. Should Government decide to intervene in the sector, in order to assist providers, it could be politically difficult due to the relatively low number of passengers. Already, in the UK, it has been estimated that the national government was effectively paying a subsidy of £100 per passenger during the lockdown period (Topham, 2020). With the tightening of public finances such support is likely to be difficult to justify in an environment where many budgets will need to be reduced.

A key challenge in this future is the potential increase in congestion that will arise from people returning to their vehicles for commuting purposes. Whilst some of the modal shift will see individuals replacing public transport trips with remote working, it is foreseen that private vehicles become more attractive to younger people, who may not previously have owned a car, and longer-distance commuters who do not engage in home working. As such, the personal vehicle is the least affected mode (RAC, 2020). For some urban centres this raises the possibility of key routes seeing a vast increase in the level of traffic, leading to environmental challenges as well as productivity impacts through longer journey times. Given the economic circumstances, it is unlikely that motorists will switch to electric vehicles, at least in the short-term, meaning that government will
need to provide generous incentives to encourage adoption. Such incentives may not be affordable given the economic climate.

Finally, in this scenario, it is anticipated that the usage of active travel modes will also be impacted as commuters view personal vehicles and remote access as being safer and more effective solutions. Increased rates of cycling, as experienced during the period of national lockdown, will contract with this mode not seen as being suitable for much travel-to-work activity. Developments to cycling infrastructure, such as pop-up lanes, are largely ineffective in attracting new cyclists, whilst businesses cannot take advantage of any land-use changes due to depressed demand. In this case, outdoor retailing and hospitality do not lead to significant increases in demand for these services.

**Scenario 2: Economy**

In contrast to the safety scenario, behaviours in the economy future facilitate a return to what is largely a pre-COVID-19 normal. With the virus not considered as a major threat to public health, the key focus is to recover the economic ground lost due to the pandemic. Non-pharmaceutical measures, such as social distancing and national lockdowns, are no longer required. This encourages what PwC (2020) termed a ‘smooth’ economic recovery. Transport demand returns to normal, with passengers believing that hygiene and safety are no longer critical determinants in influencing their behaviour and usage patterns.

Whilst the smoother economic recovery is positive for employment, growth, and public finances, it is possible, in this scenario, that entrenched inequalities could be overlooked due to the emphasis on securing a quick return to normality. This is despite studies such as Blundell et al (2020) and Platt and Warwick (2020) identifying how inequalities have led to uneven health outcomes from the pandemic. Rather than addressing these underlying issues, the focus of policy interventions will be to ensure that economic activity can be recovered quickly, perhaps involving specific sector support in the short-term, for example, scrappage schemes for vehicles.

For transport and cities, the economy scenario reinforces the importance of public transport in urban environments. For example, as a mechanism of restoring growth, investment in public transport infrastructure is seen as attractive with large scale projects, such as HS2, a key component of the recovery plans. Demand levels for these services recover to pre-COVID levels as the level of remote access declines with commuters and consumers wanting to readopt pre-pandemic behavioural routines. As a result, the rate of home working returns to around 5% of the workforce as outlined by ONS (2020B). With more people back in physical workplaces there is not only greater demand for transport, but businesses such as physical retail and hospitality will see increases in demand when compared to the lockdown position. Rates of online purchases will, therefore, decline to around 20% of the total volume of retail sales (ONS, 2020D).

Despite the increase in demand for public transport, private vehicles remain important for many commuters and households with a 'normal' scenario seeing over 60% of commuting activity taking place via this mode. In this future, the economic recovery presents an opportunity to promote electric vehicles as an alternative for these consumers. However, the focus on economic outcomes will mean that consumers will need to be convinced about the performance of these vehicles.
Should conventional vehicles be seen as the most effective solution, from an economic and technical perspective, then electric vehicle adoption will remain stubbornly low.

Questions over shared mobility could arise in this scenario as individuals elect to purchase their own vehicles for reasons of convenience. Conversely for these reasons some shared mobility platforms, such as Uber, may appear attractive when compared to alternatives such as taxi services etc. The strong economic recovery will also provide the basis for further investment in shared mobility, leading to further advances in technology that could potentially encourage adoption of new schemes. For many local authorities, the need to adopt shared mobility will be less pressing due to the recovery in public transport demand, but some micro mobility programmes, could be seen as advantageous in supporting last mile activity in order to secure productivity gains.

Finally, in this scenario, the rate of active travel also returns to pre-pandemic levels. With the removal of social distancing requirements, there is no need to retain temporary infrastructure that supports cycling and walking. However, there will also be no requirement for businesses to be allocated space for operational purposes, hence there is an opportunity to improve cycling networks in urban locales. Still this will not be seen as a priority with commuters favouring other modes of transport for their travel into these areas.

**Scenario 3: Green**

The third possible future for transport in urban environments is arguably the most positive outcome for the economy and society. This scenario does not see a return to a pre-COVID normal for transport as decisions are optimised around environmental and sustainability goals. This future will combine some of the routines adopted during the pandemic, such as higher rates of home working, with a greater adoption of electric vehicles and other ‘green’ technologies and behaviours.

The wider adoption of ‘green’ policies’ is likely to provide economic benefits as Hepburn et al (2020) argued that these measures can generate a quicker recovery than traditional stimulus measures. Such interventions enable those who have lost their job during the pandemic to be quickly retrained and redeployed. However, investment in green technologies may not entirely address underlying issues with inequality. Indeed there is the possibility that some members of the population could be further excluded in transitioning to these technologies. As such, the green scenario does not entirely address some of the pre-existing economic and social challenges that have led to uneven outcomes during the pandemic.

Transportation in this scenario is optimised around sustainability with some significant behavioural changes as a result of the adoption of new routines. Demand for private vehicles declines in this future, with motorists switching to public transport and shared mobility. Remote access is seen as being beneficial for quality of life reasons, hence this becomes a regular component of working routines. However, in order to promote the vibrancy of city environments, workers are also encouraged to return to physical workplaces in order to reduce the risk of isolation and to create an effective work-life balance.

One of the most significant advancements in this scenario is the increased rate of adoption for electric vehicles. With consumers becoming more environmentally conscious, there is a greater incentive to replace existing petrol and diesel vehicles with low carbon solutions that are viewed as
being more sustainable choices. Other consumers, particularly those who live in urban environments with extensive transport networks, elect to replace their vehicle with subscription to a car share scheme, more use of mass-transit services, and micromobility. These behavioural changes will lead to positive environmental outcomes through reducing congestion in city locations as well as lowering carbon emissions.

As with the economy scenario, demand returns to public transport services, although the key driver of behaviour in the green future relates to these services being seen as environmentally friendly as opposed to cost effective or convenient. The recovery in demand for these services encourages further investment in public transport networks, enabling the expansion of very light rail services in city centres. With the increased focus on the environment, there is the opportunity for policymakers to exploit multi-modal linkages in order to further lower emissions. For example, e-scooter, e-bike, and bike schemes are connected to public transport, providing consumers with a last mile solution that negates the need for a taxi.

In contrast to the other two scenarios, the green future also presents opportunities for active travel. The desire to adopt more sustainable behaviours will encourage more cycling and walking, but it will also support the creation of more vibrant city spaces. For instance, policymakers will have scope to introduce more pedestrianised zones leading to the possibility that these spaces could be significantly reconfigured. This includes improved infrastructure for active travel, but could also capture opportunities for business to take advantage of more outdoor space particularly in the summer months. This will help to transform city centre locations into ‘destinations’.

**Summary**

Transport has been significantly impacted by the COVID-19 pandemic with demand for virtually all modes of travel reduced due to the virus and the control measures introduced by many national governments. Demand for public transport systems, seen as integral in supporting the vibrancy of city spaces, has collapsed with providers having to reduce service provision and ask for state support to remain operational. Personal vehicle use has recovered more quickly than other modes, whilst active travel increased during the initial period of lockdown.

The trajectory of the COVID-19 pandemic remains highly uncertain with the return of stringent national measures to control infection at a time when securing an effective vaccine is moving much closer to reality. As reflected by the OECD (2020) in their analysis of the initial impact of COVID-19 on city spaces, the pandemic has led to asymmetric outcomes and an economic and social shock. However, the pandemic also provides a ‘window of opportunity’ to recalibrate transport in urban environments, which improves accessibility and helps to reduce inequalities. As such, the scenarios and evidence articulated in this paper have implications for policymakers, society, and business. These will now be considered.

**Policymakers**

It is critically important that policymakers seek to restore confidence in public transport as the outcomes in the safety scenario potentially threaten the viability of city spaces in the future. As the ITF (2020) noted cities without core public transport systems cannot function due to the inability to
move large numbers of commuters at one time. Instead, these individuals may switch to personal vehicles or remote access creating challenges for city spaces. Additional vehicle usage will lead to greater congestion, whilst higher levels of remote access will lead to lower footfall and spending in these locations. Whilst vaccines may help to address the concerns of passengers, policymakers should think imaginatively about solutions that will reinvigorate urban spaces. Multi-modal provision, connecting public transport to micromobility, will form part of this discussion. However, the city space itself may need to be reimagined, with a cleaner environment encouraging the city to be seen as ‘destination’ for visitors. In some areas this could involve the creation of an outdoor ‘café culture’ whilst in others it may rely on unique independent retailers operating in a specific area of a city.

Whilst the adoption of policies designed to encourage a sustainable recovery will have significant benefits for the environment and the population as a whole, it is imperative that any interventions are inclusive. For example, creating mobility solutions that rely on apps, or smartphone technologies, may disenfranchise a large group of transport users. Some users will also need to be convinced that such changes will be appropriate, and this may require the development of incentive schemes that encourage behavioural changes. For instance, this may involve developing incentives for using public transport and avoiding vehicle usage in city spaces.

**Society**

In entering the recovery phase from the pandemic there is an opportunity to address some of the underlying issues that have been exposed by COVID-19. For instance, this study has cited evidence such as Blundell et al (2020) and Platt and Warwick (2020), which articulates how certain groups have been more exposed to the negative outcomes of the pandemic. As such, simply ‘returning to normal’ may not address some of these long-standing challenges, and it is critical that interventions can alleviate some of these entrenched inequalities. However, whilst new technologies may form part of these solutions, there is a possibility that these advances can create new divides, leading to further inequalities. For instance, inadequate infrastructure or digital skills will automatically exclude certain groups from participating in remote working, hence the implications of these practices need to be fully assessed if they are extended.

Given the circumstances outlined in this paper it is entirely possible that city spaces will need to establish a new form of mobility, which will mean that consumers will need to adapt to this new approach. These new models may create winners and losers, which may influence employment patterns and lead to additional costs for some individuals and businesses. Adopting these new models may require further support to be provided to specific consumer groups. As such, the consequences of new mobility models will need to be considered before their implementation.

**Business**

Although many businesses have adapted quickly to the specific circumstances presented by the pandemic through establishing remote working systems and expanding online sales platforms and delivery services, the extent to which some of these changes endure is highly uncertain. Remote working, for example, has been seen as beneficial by some individuals, but there are longer-term questions surrounding isolation and productivity that may impact the shape of this practice in the
future. However, if remote access becomes a regular component of working and consumption habits there are also risks to particular businesses, such as those in hospitality or retailers with underdeveloped online platforms. In cities where these businesses form a significant proportion of activity, this raises questions over their viability and attractiveness to investors and visitors.

For those businesses operating in the mobility sector there was already a significant deal of uncertainty before the pandemic due to rapidly changing technologies, business models, and consumer expectations. The outcomes of the pandemic have added to these uncertainties and may restrict future investment, particularly in a scenario where the economy does not recover quickly. Conversely, a focus on a sustainable recovery will provide opportunities for shared and micro mobility providers to extend their operations in city spaces. For instance, these services could be promoted in-conjunction with public transport as part of a multi-modal platform. Rather than competing solutions, these services could be framed as complementary, leading to a more optimised transport network within cities.

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