GETTING CITIES MOVING

Adaptive transport solutions for an uncertain future

NATIONAL
INFRASTRUCTURE
COMMISSION

Better infrastructure for all

June 2022

Our remit

The Commission provides government with impartial, expert advice on major long term infrastructure challenges.

The Commission's objectives are to:

- support sustainable economic growth across all regions of the UK
- improve competitiveness
- improve quality of life
- support climate resilience and the transition to net zero carbon emissions by 2050.

In fulfilling our purpose and objectives, we:

- set a long term agenda – identifying the UK's major economic infrastructure needs, and the pathways to address them
- develop fresh approaches and ideas – basing our independent policy recommendations on rigorous analysis
- focus on driving change – building consensus on our policy recommendations, and monitoring government progress on their delivery.

A fuller description of the Commission's remit can be found on page 34 and our website at nic.org.uk/about/what-we-do/

The members of the Commission

Sir John Armitt (Chair)

Professor Sir Tim Besley CBE

Neale Coleman CBE

Andy Green CBE

Professor Jim Hall FREng

Professor Sadie Morgan OBE

Julia Prescot

Bridget Rosewell CBE

Kate Willard OBE

Nick Winser CBE

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Executive summary

To achieve levelling up, the government needs a strategy to support improved productivity in cities. The future role and transport needs of cities may have changed in the wake of Covid-19. It is too soon to say what the long run consequences will be – however, it is critical that this uncertainty does not lead to paralysis and inaction.

The future of demand for urban transport is uncertain, depending on how people and businesses adjust over time to trends such as increased flexible working and population shifts. An ambitious but realistic strategy would include adaptive plans, which work in a range of scenarios and can respond to future developments.

Getting cities moving

Urban transport networks allow people to make trips into and around cities. This is good for economic growth as people can access employment and businesses can locate in areas which give them access to a wide labour market, generating agglomeration benefits. It is also good for quality of life as people can access the things they need and want – shopping, healthcare and leisure.

Enabling more people to make more trips in cities is a good thing – trips support economic growth and quality of life - and this is what urban transport networks need to aim to do.

However, for the largest cities in England, congestion on urban transport networks is inhibiting these trips, even with the reduction in travel caused by the Covid-19 pandemic. This is expected to some degree as congestion is a sign of success – it demonstrates demand for trips within the city. And before the Covid-19 pandemic, a lack of capacity on some urban transport networks also inhibited trips.

The challenge for transport planners is to encourage more trips within cities – supporting the government's levelling up aims – while ensuring carbon emissions targets in 2035 and 2050 are met and mitigating the other negative effects, like congestion, as far as possible. The urgency of tackling this means that uncertainty should be met with ambitious but adaptable plans that take account of possible changes in travel patterns, rather than doing nothing or continuing with existing plans.

The government has high ambitions for cities, as set out in its Levelling Up White Paper, and the Commission has welcomed some of the action government has already taken, such as the five year city region sustainable funding settlements. But without greater ambition on urban transport, the government's plans will fall short of achieving its aims. This report sets out how the Commission intends to address this challenge and develop a strategy for government, in partnership with local authorities, to go further. The Commission's recommendations on this will form part of the second *National Infrastructure Assessment*, which will be published in the second half of 2023.

Cities are central to the challenge of levelling up

One of the main priorities for infrastructure policy in supporting levelling up is to improve urban transport networks in cities outside London. This is a challenge that the government has recognised: its Levelling Up White Paper has an aim for local public transport connectivity to be closer to the standards of London by 2030, with every area of the UK having a globally competitive city.

English cities play important roles in their regional economies and are home to a large proportion of regional populations. But the productivity of cities outside London is worse than the national average and appears to lag behind similar urban areas in comparable countries, highlighting the need and opportunity to level up.

A good urban transport network will ensure that people and businesses in cities can come together, with businesses often co-locating in city centres, enabling agglomeration effects and providing businesses with access to large labour markets. This then encourages new amenities, retail, leisure and hospitality in cities, helping to attract skilled workers to join the region's economy and improving people's quality of life. The Commission's previous work in this area has suggested that efficient transport is essential but not sufficient to support economic growth. Transport investment must form part of a wider economic strategy with complementary policies, particularly on skills.

Demands on urban transport networks may change after Covid

The Covid-19 pandemic has increased uncertainty about the role of cities, and how much demand there will be in the future to live, work and play in them. The pandemic has accelerated trends towards remote and flexible working for many office based occupations. Data from Google shows that footfall in workplaces for Tuesdays, Wednesdays and Thursdays was on average around 25 per cent below the pre-pandemic baseline in May 2022 for the seven largest English cities outside London, and footfall on public transport was around 27 per cent lower.

Nobody knows what this means for cities in the long term, and whether current trends will continue. It is also unclear the extent to which people will choose to move out of cities and make longer, less frequent, commutes. Cities, with the support of government, therefore need to approach transport planning by considering a range of possible scenarios for the future of cities, which will involve looking beyond transport and considering the effects of greater digital connectivity and housing availability too.

While city centres may not return to pre-pandemic levels of occupancy, it is not clear that this is the most likely scenario. For example, although it is likely that businesses will need less office space due to flexible working, other businesses may take advantage of available office space and lower rents to relocate into city centres. Spare capacity for commuting into city centres may be required for growth.

This uncertainty does not however mean that the government and cities should do nothing for now, and wait and see what happens. The challenges of levelling up and meeting net zero require substantial investment, which will take a decade or more to deliver, and so needs to be planned now. A balanced portfolio of investment choices is likely to include taking some risks in order to avoid paralysis.

Plans for urban transport do however need to be robust and adaptable to a range of possible scenarios that may emerge for cities. And this means that now is not the time to withdraw funding for transport services prematurely, which may embed car dependency and reduce the range of options for future recovery.

Principles for better urban transport

An effective transport network provides services that meet the strategic needs of a place. This means helping to provide access to the things people need and want – providing the travel options that will enable people to move freely around to access services and meet other people.

Increasing travel options when there is little space for more cars means improving alternative options. Speed and efficiency are important considerations for journeys in cities, increasing the range of jobs and other services that people can access. But other factors are also important, for example:

- How reliable are travel options? A fast but unreliable option will be inferior to a slower but reliable option.

- How accessible are public transport options? 21 per cent of working age adults have a physical or mental disability.

- How safe do people feel on public transport? Women are much more likely than men to report feeling unsafe when using public transport on their own after dark.

A good urban transport network will achieve a balance between speed and efficiency, and providing a service that is accessible, affordable, comfortable, convenient, reliable and safe. Speed and efficiency may be obvious ways to measure quality through analysing journey times and capacity, but this should not mean overlooking these other, perhaps more difficult to measure, factors. Designers of urban transport networks need to think how to improve all factors if they are to facilitate more trips within congested cities and support levelling up. The Commission will consider how best to determine the value for money of investments aimed primarily at other factors in the second Assessment.

Facilitating more trips within cities

The car is the predominant mode of transport in English cities outside London: in 2018-19 a private vehicle was used for 64 per cent of trips (discounting walks under a mile) in urban conurbations as a whole in England; the comparable figure for London was 30 per cent.

In congested cities – where an increase in road space to accommodate more vehicles is not viable – the best way to support more trips is by encouraging people to make trips on public transport and by active travel instead. Public transport and active travel are more space efficient than the private car, enabling more people to make more trips.

The aim of urban transport policy should not be, as sometimes is suggested, to get people to travel less – if the government is to achieve its levelling up aim it should be making it easier for people to make more of the trips they want to into cities and towns. Instead, the aim should be to shift demand from cars to forms of transport that can move people around urban areas more efficiently. By shifting, not reducing, demand, cities can keep the productivity benefits that flow from employment density without increasing congestion.

Trajectory to net zero

Trips have other negative effects besides congestion. Surface transport is the largest source of carbon emissions in the UK, as well as emitting other harmful pollutants like nitrogen oxides and particulate matter. Trips also cause noise pollution and vehicles dominate the built environment.

The main priority for reducing carbon emissions from surface transport should be the electrification of vehicles: 76 per cent of journeys in England in 2018-19 were undertaken by car or van (excluding walks of under a mile). Central government and cities need to work together to ensure a prompt and comprehensive rollout of electric vehicle charging points. This will have by far the biggest single impact on decarbonising surface transport in order to achieve net zero by 2050.

But the interim emissions target in the 6th carbon budget – to reduce emissions by 78 per cent by 2035 compared to 1990 levels – is likely to be harder to achieve for surface transport. Modal shift will help achieve that interim target, and be important for reducing emissions in the interim period before the full adoption and take up of electric vehicles. The Commission will consider how best the transport sector as a whole can ensure it meets the 2035 interim target in the second National Infrastructure Assessment.

Improving public transport and active travel options

There are two ways to encourage a shift away from private cars in congested cities: improving public transport and active travel options, and reducing the relative attractiveness of driving. It is likely that both the 'pull factor' of more attractive public transport and active travel, and the 'push factor' of less attractive car journeys, will be required to bring about the necessary change.

Local leaders within cities are best placed to identify what improvements are needed to their public transport systems to address the full needs and wants of the people who use them. The government does however need to give them the tools and resources, which will include long term stable funding, alongside contributions from local areas, to take meaningful action.

The solution to making public transport and active travel more attractive does not necessarily require new transport infrastructure. At least part of the solution for cities will involve making better use of existing infrastructure, for example, by using existing technology and better use of data to provide for fully integrated urban transport networks. Cities must maximise the use and efficiency of existing assets before building new ones.

And transport is only one method that allows people to access the things that they need or want. Transport planners need to be conscious of the other methods that allow people to access the things they need too: digital connectivity (for example, online shopping) or spatial proximity (for example, living a short walk from a shop).

However, there are limits to what can be achieved with alternatives to transport, and in at least some cities the existing infrastructure may prove insufficient to meet the needs of the future, so that achieving levelling up goals for cities is likely to require significant new investment.

Work needs to start now on adaptive long term plans for mass transit

Where central government can best support cities is in providing stable and secure funding to help provide for mass transit systems, as it is planning to do in West Yorkshire. Mass transit systems can provide much higher transport capacity than cars, whether they use their own infrastructure or share the road network. Substantial investment in new forms of mass transit may be appropriate to improve capacity and the relative attractiveness of public transport. The Commission will consider further the funding required for these investments and their affordability in the second *National Infrastructure Assessment*.

The needs of cities will differ: for some, mass transit systems based on buses or bus rapid transit will be appropriate. In other places where there is sufficient density, light rail or tram based systems will be better suited. Elements of rail and bus could also form a single mass transit system if they are properly integrated and planned and operated as one system.

And uncertainty about future impacts of flexible working means that a wider range of priorities need to be considered for cities – for instance whether the emphasis is on peak capacity, enabling wider reach to surrounding towns, or improving the attractiveness of the city centre as a social and leisure hub. The best strategies will be adaptable to different futures, either by taking a modular approach to implementation – which will help avoid stop-start outcomes with low regret investments built first, paving the way for more ambitious later ones – or by adopting approaches that will work well for a range of different user journeys.

But given the time it takes to design and build mass transit, work on those plans needs to start now. This will help insure against possible scenarios where capacity is required to support growth. This might mean some risky bets on investment, but the necessity of levelling up means those bets are worth taking. An incremental, adaptive approach to planning will help mitigate losses for any bets that do not pay off.

Measures to discourage private car journeys should be taken seriously as an option

It is unlikely that making public transport and active travel more attractive will be enough to maximise the number of people switching from driving. Demand management measures should also be considered to make the use of private cars relatively less attractive for journeys where an alternative is available. These could include fiscal measures, such as congestion charging, incentives and parking levies, and physical ones like reallocating roads for walking, cycling and social uses. Some cities outside London have already implemented measures: the centre of Durham has had a congestion charge since 2002; Nottingham has had a workplace parking levy since 2012; a clean air zone has been operating in Birmingham since 2021. Any new measures could complement new investment in public transport and active travel, or be used to make better use of existing infrastructure.

But if demand management measures are calibrated wrongly, they could reduce the number of trips into city centres, which may negatively affect levelling up if higher productivity workers are discouraged from travelling. And there could also be adverse distributional effects if low income workers are affected by fiscal measures. The right balance will need to be struck – the intention of measures should be to shift trips onto public transport, not mean that people stay at home. Post-Covid patterns of travel will also need to be taken account: for example, a flat daily congestion charge is unlikely to be suitable in a scenario where commuting is concentrated on Tuesdays to Thursdays.

Demand management measures in this context should not be confused with road pricing schemes, which are aimed at generating revenue and replacing the income from fuel duty. While fiscal measures to manage demand may generate some revenue which can be spent on improving local transport, the primary aim is to make best use of the available space in congested cities. Fiscal measures such as congestion charging schemes could be implemented in parallel with any national road pricing scheme, provided the right national framework was put in place.

1. The role for urban transport in levelling up

The reaction to Covid-19 has created uncertainty about the future role and transport needs of cities. The social, economic and physical connections built around cities mean they are likely to remain important for regional economies and to suffer from road congestion – but plans for infrastructure will need to respond to uncertainty and prepare cities for a range of possible scenarios.

Reducing regional disparities depends to a large degree on the prospects of their cities – two thirds of the population of the North lives in a city. Infrastructure remains an important tool in supporting higher productivity in cities outside London – and particularly to reduce the impacts that congestion has on connectivity – but getting the right transport strategy needs consideration of how the world may be changing.

Covid-19 has changed how we need to think about the transport needs of cities

In the immediate response to the Covid-19 pandemic, patterns of work and travel were totally transformed. The share of employees working mainly from home has been estimated to have increased from 5 per cent in 2019 to 45 per cent in the first month of lockdown.[1] Public transport usage fell by up to 90 per cent, and car traffic fell by 70 per cent.[2]

These effects had significant impacts in cities. In April 2020, the number of people visiting workplaces reduced by 60 per cent on average in the seven largest cities outside London compared to the pre-pandemic baseline. Visitors to urban transit stations fell by up to 78 per cent in the same seven cities.[3]

These extreme patterns were only ever going to be temporary, driven by legally enforced prohibitions on normal activity. Since the removal of restrictions in January 2022 there has been some reversion towards previous patterns, but with ongoing significant differences. Around 14 per cent of working adults were working from home in May 2022 with another 24 per cent working to a hybrid pattern.[4] Visits to workplaces in the seven largest cities outside London have increased but are still 30 per cent lower than prior to the pandemic, while visits to transit stations have increased but are still 20 per cent lower than previously.[5] Other data shows that overall footfall levels in city centres have surpassed pre-pandemic levels in some cities, but remain below them in others.[6]

Figure 1.1: Levels of transit usage and in-person working remain lower now than before the pandemic

Average change in transit station and workplace mobility from pre-pandemic baseline in the seven largest English cities outside London
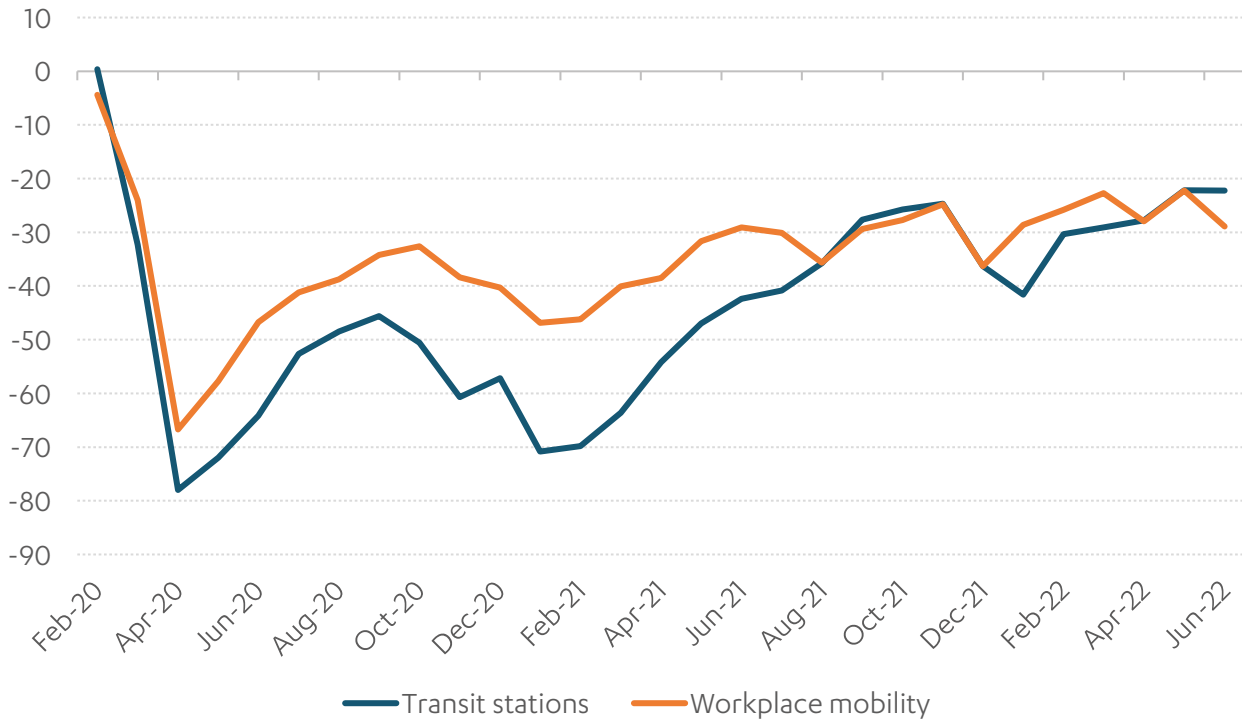
Source: Google (2022), **Google Mobility Reports**

It is too early to draw conclusions as to what the long term picture will be

Restrictions on in-person working were removed in full in January 2022 and so it is still too soon to say what the impact on work and travel patterns will be in the longer term.[7] Shocks like the 1973 oil crisis or the 11 September attacks in New York had significant effects on work and travel behaviours. However, these effects were relatively short lived, lasting a number of years before patterns more consistent with the historic trajectory re-emerged.[8] Each historical shock is unique, and so there is no simple guide to how the effects of Covid-19 will play out.

One key uncertainty is the difference that hybrid working will make to the economic demand for agglomeration in cities. Historically, growth of cities has been driven by the productivity benefits of high density, particularly for labour markets.[9] A wider pool of workers gives businesses better access to the skills they need, while personal interaction enables creativity and coaching new staff.[10]

Remote working enables some of these activities to be done at greater distances. Studies of hybrid working have suggested that working between home and the workplace may enable higher productivity than either fully remote or fully workplace based working.[11]

The potential benefits of hybrid working are particularly relevant to higher skilled jobs which are most likely to cluster in cities and could be most important for regional disparities.[12] In the UK around 60 per cent of people earning more than £40,000 work partly or wholly from home, compared to only around 15 per cent of those earning under £15,000.[13]

However, there is uncertainty on how workers and businesses will adopt hybrid working in practice. Businesses may find they can access a wider labour pool by offering hybrid work; for example, people may take a job with a longer commute if they only need to attend the workplace occasionally. The long term outcome remains to be seen and is hard to predict, particularly as people and businesses will react to what others are doing.

But even if only two or three days a week are required in the office, the most attractive locations for offices are likely still to be city centres with good public transport and high concentrations of businesses and amenities. A further uncertainty is the impact that changes in working patterns will have on the location of different activities and the impact on travel behaviours. Hybrid working could lead to a reduced volume of commuters every day, lowering peak capacity requirements.

Alternatively people may adopt a similar weekly commuting pattern so that the capacity of transport networks is stretched, but only on some days of the week. There may be good reason to expect this to happen to a degree – since the benefits of face to face interaction may be maximised with the highest number of workers attending the workplace at the same time, leading also to higher demand on those days for amenities and other services. Though co-ordination of activities to spread demand through the week may be possible in theory, this might reduce some of the benefits of different organisations being able to work together in person, and would also likely require intervention through strong price signals.

Figure 1.2: workplace attendance is currently lower than before the pandemic every day of the week, with only slightly more change on Mondays than on other days

Percentage change in workplace visitors in the seven largest English cities outside London from 9 May 2022 to 16 June 2022 compared to the pre-pandemic baseline (excluding the Platinum Jubilee bank holiday week)[14]
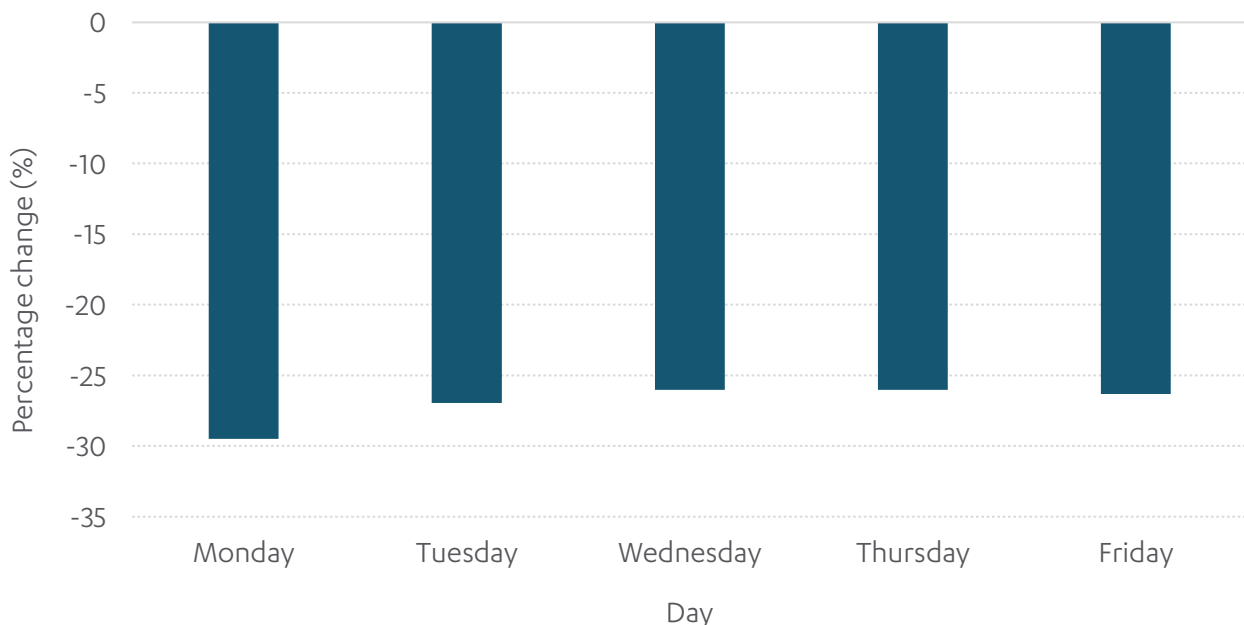
Source: Google (2022), **Google Mobility Reports**

Fewer commuting days may increase demand for some households to move further out towards more suburban and rural areas, partly as a result of increasing hybrid working. This would push up property prices in such areas, limiting how many households are able to move – although numbers could still be significant as lower income households switch to cheaper housing in more urban areas, or if housebuilding increases in outlying areas with growing demand.[15] This could lead to higher demand on longer distance commuting routes.

And increased hybrid working may not end up reducing demand to access the most attractive office areas at all. If businesses find they can reduce their required office space due to flexible working this will lead to lower rents for office space. Rather than city centre space remaining empty, it is likely that in the long run other businesses will take advantage of lower costs and space requirements to relocate into the attractive and well-connected space in city centres. If there is a reduction in the total amount of office space needed across the country, it is more likely to be felt in areas that do not have these connections.

New technology options also add to uncertainty

Hybrid working is not the only uncertainty that could affect the way people access city centres. In the long term, transformative and untested new transport technologies could also be significant.

Autonomous vehicles may increase effective road capacity to some degree by enabling co-ordination and increasing throughput at junctions.[16] They would also make driving more convenient as travel time can be used for other purposes, and more accessible to people who can not currently drive. This would generate additional demand for travel by car, which could potentially outweigh any increases in road capacity.

Electric vertical take-off air taxis could also provide another option for much faster travel, if their feasibility in a dense city can be demonstrated. Early trials suggest that it may be possible for medium-distance travellers to bypass congested roads and land in relatively small spaces. However, the volume of travel may be limited by the availability of suitable landing spaces. Noise pollution, the availability of airspace, safety and cost may also be factors affecting the viability of large scale air travel within cities.[17]

Whilst uncertain at this stage, either of these technologies could significantly change both the way cities work and the demands that would be placed on road and public transport networks.

Some things have not changed, and are unlikely to

Whatever the future of hybrid working, cities are likely to continue to exist as important centres. High density is a prerequisite for a range of attractive economic and social services that cannot be accessed other than in person. Large scale infrastructure like airports, or social amenities such as football stadiums or theatres, are only viable where they can draw on a large, concentrated pool of customers. Large centres of demand lead to more diverse restaurants and entertainment, and other specialised services, which are a draw for people to live near even if density is less important for work.[18] There is a reason that cities have remained a focal point of human activity for thousands of years, through various shocks and changes.[19]

As well as the advantages of urban life, some of the challenges facing cities are also likely to remain. One of these challenges is congestion, which also has a knock-on effect on connectivity. Figure 1.3 illustrates how larger settlements and cities have poorer road connectivity than smaller places, which is because of higher congestion. Public transport also provides poorer connectivity in cities than in smaller settlements, likely to be caused in part by the effect of congestion on buses.

Figure 1.3: Larger settlements and cities suffer from poorer connectivity as a result of higher congestion, before the effects of the pandemic

NIC connectivity metric measuring weighted average travel speed from urban centres to other destinations within the same built up area, by mode, 2016
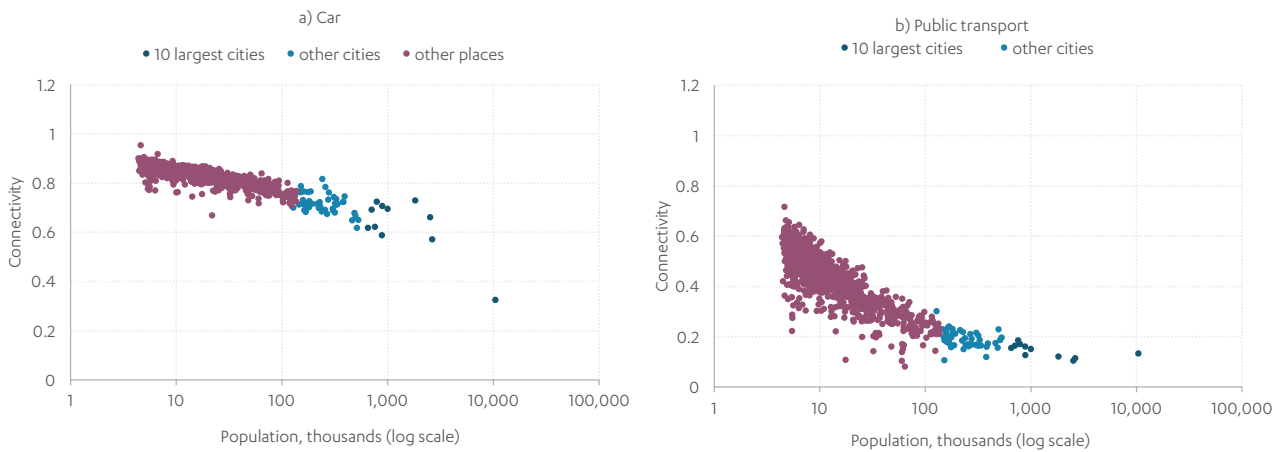

Source: National Infrastructure Commission (2019), **Connectivity Dataset**

Even during 2021, when pandemic restrictions applied to working, socialising and travelling, congestion was high in cities and especially city centres compared to England as a whole, as illustrated by figure 1.4. Indeed during 2020, when the strictest lockdowns were in place, congestion was still higher on urban local roads than the 2019 average for all local roads across England.[20]

Figure 1.4: Even during a year in which pandemic restrictions applied to in person working and socialising, road congestion was significantly worse in city centres than suburban and rural areas

Average delay on local A roads in selected English cities measured as additional seconds per vehicle per mile compared to freeflow travel speeds, 2021 (average across whole year)
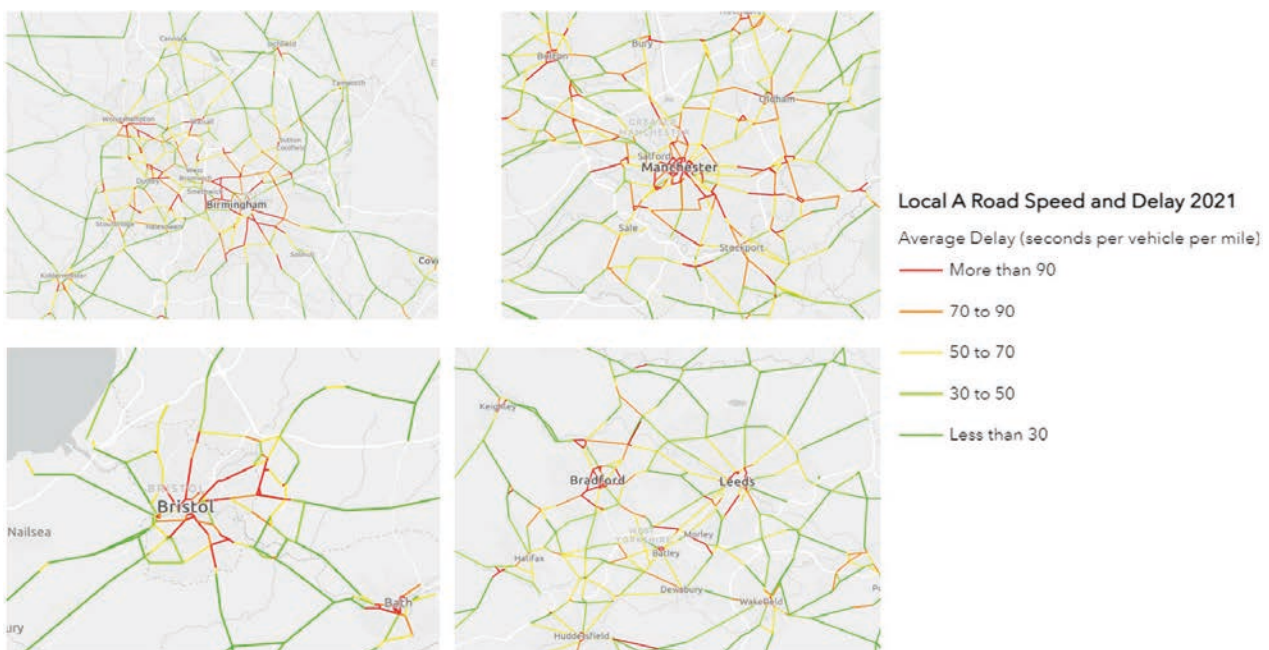
Source: Department for Transport (2022), **Local A Roads Speed and Delay 2021**

It is unlikely that travel demand will ever be lower than during periods of restricted activity, so that congestion poses an ongoing problem for cities across the range of realistic scenarios for the future. It follows that, while the role of cities and the patterns of travel within them may change, it is unlikely that the importance of addressing urban congestion will disappear altogether.

Cities remain key to reducing regional disparities

Another important reality that has not changed as a result of the pandemic is economic imbalance between regions.[21] Prior to the impacts of Covid-19, cities outside London had productivity levels that were below the average for the UK, often substantially. The most productive areas in the UK were clustered generally either in London or in the South East.[22]

Table 1.1: Productivity is generally below average in cities outside London, sometimes significantly so
GVA per hour worked in the largest English cities (primary urban area definition) compared against the UK average, 2019

City	GVA per hour, £ (index, UK average – 100)
Bristol	101
Portsmouth	98
Leeds	92
Manchester	88
Leicester	88
Birmingham	86
Liverpool	84
Nottingham	83
Newcastle	81
Sheffield	80
Bradford	76

Source: Centre for Cities (2022), **Cities Data Tool**

There is no sign that the impacts of Covid-19 have changed this. All regions declined economically during the shock caused by restrictions being imposed in 2020 – but London was the least badly hit.[23] And even despite having been hit less hard than elsewhere, the latest analysis suggests that London is currently growing faster than other regions.[24]

The continued strength of London is unsurprising given the persistence of productivity disparities over decades. The causes of these are firmly rooted, including industry mix, a higher proportion of highly educated residents,[25] the specific functions within each industry that are concentrated in different places, and factors that make individual firms more productive in London than elsewhere.[26]

Cities are particularly important in driving regional economic disparities in the UK. They are centres of production and employment, and a substantial source of demand for the goods and services produced in surrounding areas. The ten largest cities outside London have a combined population of around 11 million,[27] and 68 per cent of the population of the North is based in a city.[28]

The success of cities is important for the areas surrounding them, as there is a strong relationship between the economic success of towns and their nearest cities.[29] When towns are well connected to more productive cities, this enables residents to access employment in the city and can also attract business investment to the town itself.[30]

Cities' pivotal economic role, and their ability to drive regional growth, means that they are central to levelling up. Without action on the challenges they face, it will not be possible to reduce the disparities in economic outcomes that exist within and between England's regions. And that is likely to remain the case no matter which hybrid working and travel scenario ultimately plays out post-pandemic.

Improving transport is an important part of a strategy for local growth

The Commission's previous work has suggested that efficient transport is essential but not sufficient to support economic growth.[31] This is because the reasons for the productivity underperformance of English cities are varied: they include low levels of education and training and industrial structure.[32] Transport investment must form part of a wider economic strategy with complementary policies, particularly on skills.[33]

Without action to improve urban transport, it will not be possible to reduce the disparities in economic outcomes that exist within and between England's regions. The importance of regional cities for levelling up means that planning for urban transport investment needs to start now – large scale urban transport investments are likely to take a decade or more to deliver.

Plans for urban transport do though need to be robust to uncertainty, and adaptable to the range of possible scenarios that may emerge for cities. Maintaining availability of options is a worthwhile investment until a clear steady state emerges. A balanced portfolio of investment choices is likely to include taking some risks in order to avoid paralysis.[34]

2. A vision for better urban transport systems

The starting point for urban transport planning has to be understanding the strategic function of transport networks, and the services that can be provided to enable this. At its core, urban transport exists to enable people and businesses to access the things they need and want. To help improve economic performance and quality of life – especially in places which currently do less well – an urban transport strategy should reduce the barriers to people travelling in cities.

Urban transport should support more trips within cities

Urban transport networks allow people to make trips in cities. This is good for economic growth and levelling up as it means people can access employment and businesses can locate in areas which give them access to a wide labour market, generating agglomeration benefits.[35]

Good transport networks are also important factors in supporting quality of life. They allow people to access the things that they need and want, such as healthcare, hospitality and retail.[36] Liveable cities with good amenities and attractions attract highly skilled workers and the businesses that employ them.[37]

The goal of transport strategies should be to enable people to make these trips whilst dealing with the negative effects associated with travel such as atmospheric pollution, carbon emissions and noise. Rather than aiming to reduce the number of trips that are made, strategies should address the barriers that prevent people from making all the trips they might like to.

Slow journey times are a barrier to travel in urban areas

As set out in the previous chapter, road congestion in urban areas continues to make journeys slower than elsewhere, even as the impacts of Covid-19 continue to be felt. This affects the ability of people in cities to travel to the places they want to go. People in the UK have historically been willing to travel for around one hour a day in total.[38] Faster journeys might be expected to increase the distance people are able to travel each day and therefore the range of services they can access, and the size of a city's catchment area for jobs. Different patterns of working associated with the reaction to the pandemic may change the shape of this – for instance people travelling to work less often during the week may be prepared to spend more time travelling greater distances.

The persistence of congestion in busy cities means that it is not always possible to improve travel times, particularly for travel by road. An effective urban transport network makes the best use of available space – providing more space efficient modes of transport such as bus or train – so that even if a journey cannot be made faster, the number of people who use the network can be increased.

Other factors are significant for transport accessibility too

Speed and capacity are two of the standard ways to measure the quality of an urban transport network. But this should not mean overlooking other, perhaps more difficult to measure, factors, particularly where these encourage people to make more efficient and sustainable travel choices, and create more accessible and inclusive networks.

Reliability, and the variability of travel times, have a substantial effect on the satisfaction levels of travellers. There is evidence that people value reductions in their waiting times on buses more than reductions in journey times, as time spent travelling can be used more productively.[39] This was also shown in a separate study, where the most common issues with public transport were its general inconvenience in terms of the frequency of buses, as well as the cost of fares in comparison to driving.[40] Similarly, by providing greater certainty about driving times, satellite navigation may increase satisfaction with driving, even if journey times are longer.[41]

Research by Sustrans found that people make a choice on mode of transport depending on what they perceive to be the most attractive mode based on their needs. The most important factors that determined attractiveness were arriving on time, feeling safe from harm, journey time, flexibility, comfort and cost. Travel by car was seen to be the most attractive option based on these factors.[42]

It is also important to take into account that people have different needs. Transport networks have often been planned with some user groups more in mind than others.[43] But this overlooks the fact that not everyone is the same. The accessibility of a network is an important consideration given that 21 per cent of working age adults in the UK have a physical or mental disability.[44] And women are more likely than men to report feeling unsafe travelling on public transport on their own: 11 per cent of women feel unsafe to do so in the daytime compared to 8 per cent of men, and 48 per cent of women feel unsafe to do so after dark, compared to 19 per cent of men.[45]

Improvements to public transport should therefore involve more than just speed and capacity, important as these both are. To encourage wider patronage, a good urban transport network should also aim to be:

- **accessible**: particularly for those people with additional needs

- **affordable:** offering value for money compared with driving

- **comfortable:** well designed, with enough capacity to meet demand

- **convenient:** offering good coverage as well as integrated journeys

- **reliable:** Services that people can depend upon, with as little variability as possible

- **safe:** travel should not involve personal risk.

Although these factors will increase the attractiveness and use of public transport, it is impractical to expect that a high capacity, very frequent and comfortable public transport network is realistic everywhere. Operators, whether public or privately run, will need to ensure the services offered are commercially viable or subsidised by income from other services or elsewhere. The characteristics of a place, for example population density, will guide what level of transport can realistically be provided and what can not. In high density, high demand locations, it is realistic to expect that there will always be some overcrowding at peak times. The benefits of different modes of transit are explored in Chapter 3. It is important that local city leaders have the flexibility to determine what is right for their area.

Transport is not all of connectivity, but nor can it be fully substituted by alternatives

Transport is just one way that people can access what they want and need. Digital connectivity allows people to undertake many activities from their choice of location, for example remote working or online shopping. And spatial proximity – living nearby to employment or amenities – means that people can access what they need on foot. This is facilitated by higher population density, which is associated with lower carbon emissions per head,[46] and also makes it easier to provide sustainable public transport services.

The restrictions imposed as a result of the Covid-19 pandemic demonstrated how people were able to switch from using transport to access employment and retail, to working online and shopping online and locally. Cities must consider these three modes of access when planning local services to ensure their systems are sufficiently flexible for future needs and to balance spending in a difficult fiscal environment.[47]

However, the extent to which these alternatives will either replace or supplement transport longer term is not unlimited. The substantial reversion of people to using transport to access what they need and want since restrictions have been lifted demonstrates this – people are choosing to travel to do things, even where effective digital alternatives exist. Many activities such as social interaction, eating out or attending live performances, are never likely to be replaced adequately by digital alternatives, while online shopping transfers transport demand from passengers to deliveries. Increased spatial proximity, meanwhile, takes a very long time to achieve given that only a small fraction of urban land is redeveloped at any one time, while many people prefer to travel further to live in lower density areas.

Supporting more trips means alternatives to the car

If the government is to achieve its levelling up goal it should be aiming to increase the options for people to travel within cities, particularly into city centres and other hubs that suffer from congestion, while minimising the negative impacts of travel and especially carbon emissions.

At present, the car is the predominant mode of transport in English cities outside London. In 2018-19 a private vehicle was used for 64 per cent of trips (discounting walks under a mile) in urban conurbations as a whole; the figure for London was 30 per cent.[48] Despite the delays experienced on roads, people continue to drive in large numbers, causing congestion and limiting the total number of journeys that can be made on finite and limited road space.

The benefits of encouraging more journeys by public transport and active travel

In cities that are congested – even after the effects of Covid-19 – more travel by car is not a viable way to increase people's ability to move around. Existing road space is full, and there is no practical way of increasing road space in densely built up areas. The only way to facilitate more trips, and therefore support levelling up, is by encouraging people to make trips on public transport and to use active travel where they can, instead of travelling by car. These are more space efficient modes, that allow more people to access high demand areas at peak times.

Figure 2.1: Mass transit increases significantly the number of trips that can be made within a fixed amount of road space

Typical maximum capacity per lane (inbound passengers per hour)

720	1,800	2,100	2,880
Car	Bus	Bus rapid transit	Tram
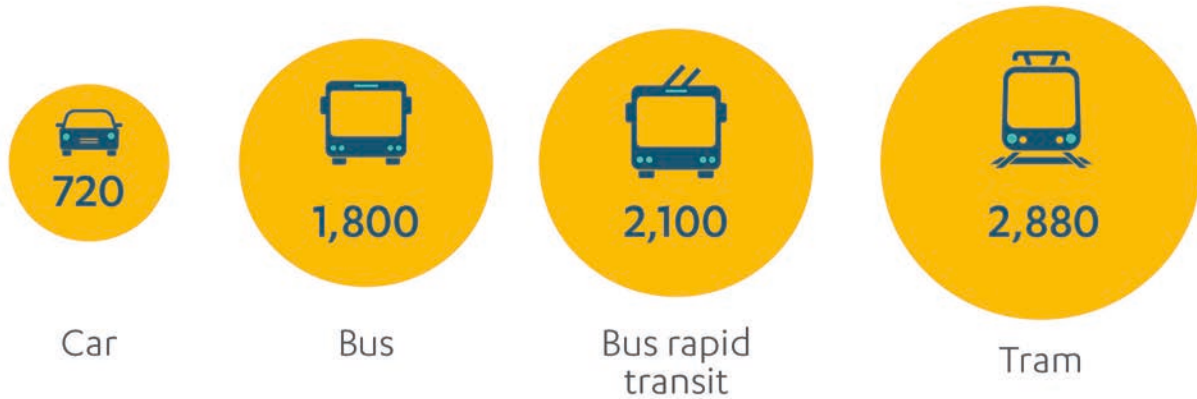
Source: Steer Davies Gleave (2018), **Urban Transport Analysis: Capacity and Cost**

This shift will also improve quality of life in cities...

A shift to public transport and active travel, and a resulting increase in the availability of travel options, could also improve quality of life for residents of cities. The Commission has recently published a framework for considering the effects of infrastructure on quality of life,[49] highlighting the role that infrastructure can play in supporting health, connectivity, affordability and local and natural surroundings. Urban transport networks are particularly important for connecting people to family and friends and allowing them to connect with their communities. Increasing the capacity available within a city enables more people to undertake these journeys. Indeed, a majority of travel within cities is for purposes other than work – although this may not be true for peak time journeys in the most congested locations.[50]

Table 2.1: Across the whole day and week most trips in cities are for leisure or social purposes rather than for work, though this may not be true for the most congested times and places

Average trips per person per year in urban conurbations by trip purpose, 2018-19

Trip purpose	Percentage of trips per person per year
Shopping and leisure	45
Other[51]	19
Commuting	18
Education	15
Business	3

Source: Department for Transport (2021), **Purpose of travel (NTS9906)**

There is some evidence suggesting that there is a positive relationship between active travel and better mental and physical health, although this may reflect that active travel is more attractive and accessible to healthy and able-bodied people.[52] Congested journeys are stressful for commuters, while an inability to access employment opportunities has a negative impact on life satisfaction.[53] Until the transition to zero emission vehicles is complete driving will continue to be a source of carbon emissions. All motor vehicles, including electric vehicles, give off particulates from their tyres,[54] create noise pollution[55] and can dominate the built environment. The impacts of vehicle congestion such as air pollution impact disproportionately on poorer households, particularly children,[56] despite these individuals being less likely to have access to a car.[57]

While modal shift has the potential to deliver broad improvements to quality of life in cities, the Commission recognises that these benefits may not be evenly distributed, particularly for people on lower incomes who depend on their cars for work, and for people with reduced mobility. The second Assessment will include analysis of the distributional impacts of urban transport recommendations.

...and support the trajectory to net zero

Encouraging more trips by public transport and active travel in cities also has an important role to play in reducing carbon emissions to meet the legally binding Carbon Budgets. Since 2016, transport has been the largest source of carbon emissions in the UK. In 2019, the sector was responsible for 27 per cent of the UK's domestic emissions, the vast majority of which was from cars, vans and HGVs. While the energy sector has been successful in reducing emissions through the switch to renewables, emissions from transport have not fallen significantly.[58]

By far the main priority for reducing carbon emissions from surface transport is the transition to zero emission road vehicles. Motor vehicles are responsible for the vast majority of surface transport mileage and emissions – even in cities, two thirds of journeys are made in cars or vans.[59] The primary action needed to achieve this is for central government and cities to work together to ensure a prompt and comprehensive rollout of electric vehicle charging points. At present, progress on this is too slow, as highlighted by the Commission in the *2022 Infrastructure Progress Review*.[60]

However, the interim emissions target in the 6th Carbon Budget, covering 2033 to 2037, will be challenging to meet for surface transport. The ban on the sale of new petrol and diesel cars will only come into force in 2030,[61] and it will take more than decade for all vehicles on the road to be replaced with zero emission models.[62] The ban on new diesel HGVs – representing a growing share of emissions as cars and vans are electrified, and not easily transferable to other modes – will not be effective until 2040.[63]

In the meantime – unless these timelines can be accelerated – the only ways to reduce emissions will be to switch car trips to less carbon intensive public and active travel, or to reduce the overall volume of travel.

Interurban road transport is responsible for more carbon emissions than urban transport, as most road mileage and therefore emissions is associated with medium and longer distance trips.[64] The Commission will consider emissions from these journeys as part of its interurban transport challenge for the Assessment. But it will also be important for cities to play a role, given that there may be more opportunity to substitute car use for public transport.

Many large cities already have objectives and targets for modal shift in their local transport plans in support of net zero, as do the Scottish and Welsh governments.[65] These are explored in box 2.1. In many cases there is an emphasis on mode shift, which aligns with the wider prioritisation of public transport and active travel for reasons beyond carbon reduction. However, all cities will need to ensure they provide adequate access to electric vehicle charging if carbon targets are to be met.

Box 2.1: Local plans for reducing emissions

Local authorities across England have set out a wide variety of plans to achieve net zero emissions in their transport sectors, either as part of net zero plans or wider transport strategies and visions. A recurring theme amongst these plans is to invest in and support more sustainable transport infrastructure. The majority of these plans aim to reduce car usage. Policies to achieve this vary by local authority but tend to focus on modal shift to public transport, walking and cycling. For example, Greater Manchester's transport strategy sets out the importance of having the 'right mix' of modes of travel, with the ambition to have 50 per cent of all journeys made by public transport or active travel by 2040.[66] Other local authorities have introduced charges to disincentivise travel by car. For example, Birmingham recently introduced a clean air zone which requires the most polluting vehicles to pay a daily charge to drive within the zone.[67] Other policies aim to reduce the need for car travel by promoting remote work where possible or improving online access to council services. Another common strategy is to reduce individual ownership of cars to try to shift people away from using cars as the default option. For example, Nottingham's Carbon Neutral Action Plan sets out plans to develop local electric car clubs and car sharing schemes.[68]

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3. Encouraging the shift to public transport and active travel

Encouraging more people to use public transport and active travel will require two complementary sets of policies: measures to improve the attractiveness of public transport and active travel, and demand management measures to reduce the attractiveness of the private car. Both sets of measures will be necessary to encourage the change in travel behaviour required.

Government and local areas can improve the attractiveness of public transport either through investment in mass transit, or through measures to make better use of existing infrastructure. And demand management measures can act as a 'push' factor by making the car a relatively less attractive option – provided there is adequate alternative public transport for journeys to switch to.

Improving options for public transport and active travel

Local leaders in cities are best placed to identify the improvements that are needed to their urban transport systems to achieve the vision the Commission set out in Chapter 2. The Commission recommended in the first Assessment that cities required devolved powers and funding to develop and implement effective transport strategies.[69] Steps have been taken towards this through the five year city region sustainable funding settlements,[70] but the government needs to do more if it is to achieve its goal of London-style transport networks in every city. While there is uncertainty about future travel demand, providing a genuine alternative to the car will in many congested areas still require significant investment in better mass transit networks.

This does not mean however that the solution for all cities is to build new infrastructure. First, cities should consider how they can get more out of their existing infrastructure, including through the use of technology, before building new assets.

Making better use of existing infrastructure

Before committing to major new investments cities and the government need to ensure that they are getting the best out of their existing infrastructure. There are many measures that could be taken now and would deliver appreciable improvements. For example, a fully integrated ticketing system for urban transport – with tickets that work across different modes of transport and allow multiple interchanges within a fixed fare – can help make a system more efficient, affordable and accessible.[71] A well planned bus network – with services timed to align with onward rail connections – can also improve the convenience and speed of public transport services.

Subsidised fares are another possible route to improve uptake of public transport services. In London bus fares were reduced in real terms from 1999 to 2003 which, in parallel with introduction of congestion charging, helped to increase the number of bus journeys at a time when they were falling elsewhere in the country.[72]

Some cities have experimented with providing entirely free public transport networks, including Tallinn, which introduced fare free public transport for all residents in 2013. This helped to shift the balance of demand from car to public transport as well as increasing the mobility of people on lower incomes.[73]

Cities should also consider the role of technology in improving existing infrastructure and managing congestion. For example, smart traffic management systems can be used to regulate the flow of traffic through cities and navigation and travel information apps can enable efficient route planning by providing passengers with real time traffic information.[74] Cities should consider how they can facilitate the integration of these technologies and emerging ones too. For example, connected and autonomous vehicles could in theory increase road capacity, however, they may also increase demand and will require digital infrastructure to operate.[75]

Active travel can also play a role in supporting modal shift within an integrated urban transport system. Most public transport journeys start and end with a walk to the station or stop, and while it may only have the potential to replace a small proportion of commuter trips, good active travel infrastructure, designed to be accessible for people with different mobility needs, can make walking, wheeling or cycling a more attractive option for short, local journeys and promote more vibrant streets and better places.

But existing infrastructure may be insufficient for some cities

However, there are limits to what technology and improvements to existing infrastructure can achieve. At least for some cities, the existing infrastructure may prove insufficient to meet the needs of the future and to support levelling up. Although there has recently been spare capacity on public transport as a result of the Covid-19 pandemic,[76] current trends are not always indicative of the long term outcome. As figure 3.1 shows below, public transport demand into central Manchester during the morning peak was rising steadily in the years before the pandemic, to the point where a fifth of peak hour rail services were crowded beyond capacity.[77] Meanwhile there was no growth in travel by car into the city centre despite rising overall demand. Under some scenarios growth of demand into cities like Manchester may return, placing strain on these networks once again. Under other scenarios, demand may not increase substantially but may move onto different parts of the network such as longer distance commuting. As cities like Manchester continue to have congested roads, substantial growth in travel is unlikely to be possible in any scenario through more use of private cars.

Figure 3.1: Prior to the pandemic, peak passenger travel into central Manchester was increasing on public transport while access by car was declining

Trips into Manchester city centre 07:30-09:30 on a weekday by mode
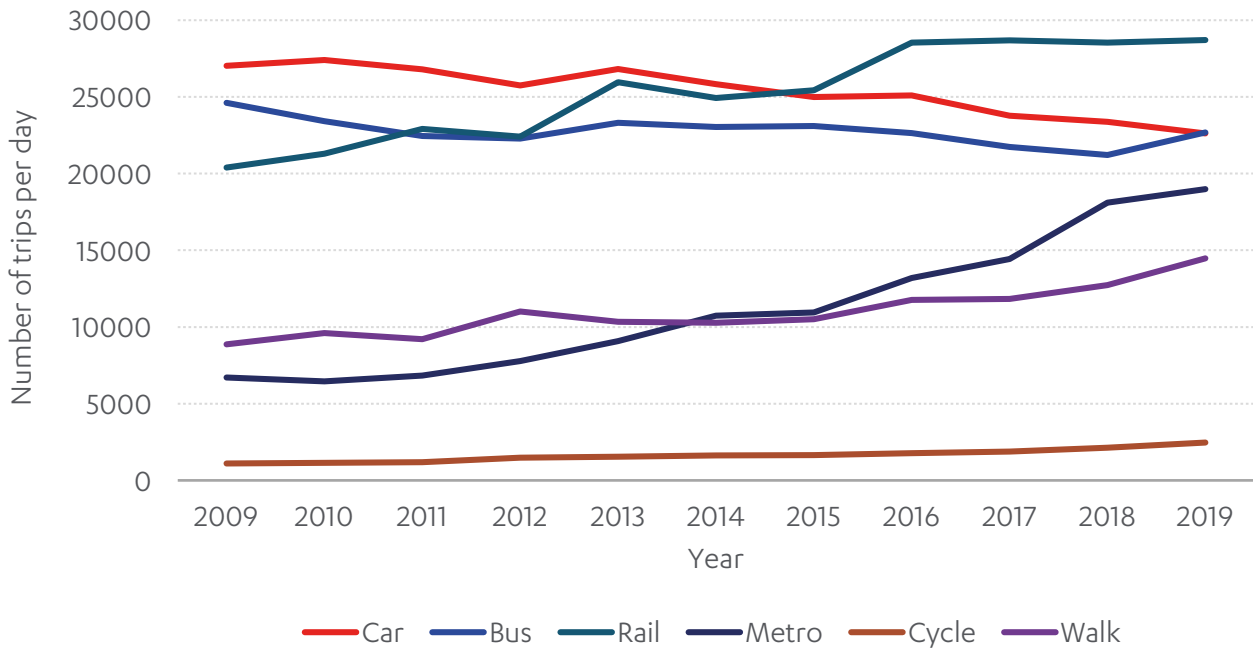
Source: Transport for Greater Manchester (2022), **Transport Statistics Greater Manchester 2019 Key Centre Section**

Mass transit offers an opportunity to make better use of limited space

Mass transit can be provided by any type of high capacity public transport operating in an urban area. This could mean a single-mode network, such as a metro or tram system. However, mass transit can take a range of forms and usually involves the integration of several modes of transport. In the most congested cities, it is likely that only high capacity mass transit will allow more people to access the employment and leisure opportunities that will help levelling up.

There are various different types of mass transit, as set out in box 3.1.

Box 3.1: Types of mass transit systems

Some examples of mass transit systems in operation or being planned in the UK are set out below.

- **Bus Rapid Transit, Belfast:** Glider is the bus rapid transit system in Belfast which connects the city to the city centre. Though the system uses bus lanes, it operates in a tram-like way.[78]

- **Tram, West Midlands:** This tram system operates between Birmingham and Wolverhampton, with further extensions expected to open later this year.[79] The network runs on a combination of reopened railway lines and on-street running in urban areas.

- **Tram train, South Yorkshire:** The tram train provides a connection between Rotherham and Sheffield. It is the first of its kind in the UK, operating on both the Supertram system in Sheffield and the railway network into Rotherham.[80]

- **Very Light Rail, Coventry:** This light rail tram system proposed for Coventry will be the first of its kind in the UK. As the system is battery powered, it's expected to be significantly cheaper than conventional systems which require expensive overhead electrification.[81]

- **Metro, Merseyside:** Merseyrail is Merseyside's urban rapid transit network, which combines two electric third rail lines with underground sections in Liverpool and Birkenhead with the wider commuter network.[82] The network has recently added new battery powered trains to extend services across the wider city region.[83]

Mass transit systems are effective at moving large numbers of people quickly across urban areas. This need to move many people in a limited space is only necessary in large, densely populated built up areas. Without sufficient population density in proximity to a transit stop, or station, it is unlikely that the service would be used by enough passengers to make it worthwhile. Conversely, in high density areas operators are typically able to run more frequent services to cater for the higher demand.

The type of network that is appropriate increases in scale as the size and population concentration of cities increases. For some cities, a bus-based system will be the most suitable option. These require a lower level of density to be effective in cities than rail-based systems and are typically cheaper to implement and operate.[84] As a result, a bus based system might be the most cost-effective way for some cities to reach the government's aim of a London style integrated system, particularly if fares can be simplified and made more affordable.[85] This option can also be quicker to implement and more adaptable to future changes in demand,[86] which is particularly important in periods of uncertainty. Buses are also an effective way to fill gaps between fixed infrastructure as part of an integrated system, particularly where services are frequent, and may be well suited to a future with less commuter demand and more short local journeys.

In more congested cities, bus rapid transit systems might be needed to increase accessibility. Bus rapid transit networks can incorporate some or all of dedicated or priority roadways, priority at junctions, platform level boarding and off-board fare collection and are typically more reliable, convenient and fast than regular bus services.[87] In addition, they are cheaper to develop than fixed rail infrastructure as they do not require dedicated track infrastructure,[88] and may provide greater adaptivity to demand patterns.

And in the highest density cities, tram or rail based routes may be required. Rail can generally carry more passengers per vehicle and requires less land per peak passenger trip. As a result, this form of mass transit can be more cost effective than bus on high-density corridors.[89] But due to the high cost and the long delivery time for these types of mass transit systems,[90] they will only be appropriate in the most congested places. Table 3.1 below sets out some of the characteristics associated with different forms of mass transit.

Table 3.1: Mass transit can be suitable in a range of different contexts

Transit type	Implementation	Effect on space	Relative cost	Flexibility	Relative capacity
Bus / bus rapid transit	Relatively modest new infrastructure required	Reduce other road space	Lower cost	Can be redirected as needed	Medium
Light rail / tram	Would need new infrastructure	Reduce other road space	Medium cost	Infrastructure fixed when implemented	Medium
Heavy rail	Would need new infrastructure	Segregated from other road space	High cost	Infrastructure fixed when implemented	Higher
Metro / underground	Would need new infrastructure	Segregated from other road space	Very high cost, esp. if underground or extensive tunnelling required	Infrastructure fixed when implemented	Higher

Note: Characteristics of different transit types will vary significantly, dependent on factors such as service frequency and design specifics

Density is not the only characteristic of a place that influences travel patterns – land use diversity and the design of the built environment also contribute.[91] As the characteristics and needs of different cities vary, a one size fits all approach is not suitable to deliver effective urban transport networks across the UK.

Mass transit systems do not have to be solely tram or rail based – a mass transit network can be multi-modal if the different forms of transport are integrated properly, as is the case with London's public transport network.[92] The lack of integration of public transport modes persists as a complaint in passenger satisfaction surveys.[93] Integrated public transport systems can deliver a lot of benefit to passengers by making it simpler and more convenient to use and as a result, more attractive than competing private modes such as cars and taxis.[94]

Work needs to begin now on adaptive long term plans

As discussed in chapter 1, it is unclear whether the changes in behaviour brought about by the Covid-19 pandemic will be permanent, making the long-term future of travel patterns and the return to pre-pandemic travel levels uncertain.

The Commission has set out how it will manage uncertainty in the second Assessment in its recently published *Managing Uncertainty in the Second National Infrastructure Assessment*.[95] Uncertainty about the future requires a pragmatic, evidence based approach to long term policy proposals. This means cities pursuing a programme with the potential to work well across a broad range of possible future scenarios, and implementing them using an adaptive framework that has the flexibility to adapt as more becomes known. Such a programme would include a portfolio of projects, with a balance between different levels of risk.

A programme should include a stable core of robust, low regrets investments that would add value across a wide range of possible scenarios. This might for instance include improved ticketing technologies and modal integration which will improve travel experiences for a range of different user and journey types, or investment in active travel and public realm which will enhance quality of life and the attractiveness of city space irrespective of future demand.

Cities may also want to consider projects which can be modularised, with low regret first stages clearing the way for more ambitious later ones. One example of this approach would be installing bus priority lanes or bus rapid transit infrastructure on key routes. This could then be replaced with a tram or other light rail at a later stage, since the route is already established and some infrastructure, such as shelters or boarding platforms, may be adaptable.

An ambitious programme may also include some reasoned strategic bets on transformative opportunities, which may not end up being fully used under all scenarios. This might include investment in major mass transit infrastructure, particularly where this is targeted at an opportunity area with high transformative potential, or as part of a wider package of policies aimed to stimulate growth in a particular place.

Finally, policy hedges can be used to seize unexpected opportunities and insure against unpredictable events. This might include investment in new bus routes, which could be redeployed if demand patterns or policy priorities change. In particular government should avoid the temptation to save money in the short term by prematurely withdrawing transport services that are currently experiencing low demand. This could lead to a further fall in use as services become less frequent, reliable and popular, locking in car dependency and potentially increasing the long run costs of providing the transport services that will support the most growth in regional cities.[96] Even if realignment of provision is needed eventually, maintaining the availability of options during the period of uncertainty will be a worthwhile investment.

The case for demand management measures

Mass transit investment is unlikely to be sufficient on its own to encourage people to take more trips by public transport. In most cities with existing mass transit systems, the car is still the main mode of travel. For example, despite their mass transit networks, the main mode of travel for commuters in the wider city regions of Liverpool,[97] Sheffield,[98] and Manchester[99] is the car. As discussed in the previous chapter, the car is more attractive to people than public transport due to its convenience, flexibility, comfort and reliability.[100]

While the presence of a good mass transit system can act as a 'pull' factor by encouraging people to use public transport more, demand management measures can act as a 'push' factor by discouraging people from driving.[101]

There are a few different categories of demand management measures:

- **Fiscal:** Using financial (dis)incentives such as congestion charges. Clean air zones also discourage certain vehicles, and may reduce demand although this is not a primary objective.

- **Physical:** Using physical barriers, such as road closures and pedestrianisation, to encourage modal shift. This includes low traffic neighbourhoods.

- **Prioritisation:** Giving priority to certain modes or uses to make them more attractive, for example high occupancy vehicle lanes, and bus lanes.

- **Promotion:** Public campaigns attempting to change people's preferences and awareness of other options.

Demand management measures aim to reduce travel demand, or to redistribute this demand in space, mode or time to maximize the efficiency of the urban transport system.[102] They reduce car use which creates more space for higher density modes such as buses, and the revenue they provide can go some way towards subsidising public transport.[103]

London introduced a congestion charge in 2003. It now costs £15 to drive into central London between 7am and 6pm on weekdays and between 12pm and 6pm on weekends and bank holidays, with buses, taxis, low and zero emission vehicles and disabled drivers exempt from the charge.[104] The scheme was launched with an extensive public information campaign and had an immediate impact – the number of bus passengers entering the zone increased by 37 per cent in the first year, and congestion fell by 26 per cent in the first four years of operation.[105] By 2019, vehicle traffic in the zone was nearly a quarter lower than ten years before though new forms of congestion were emerging, particularly relating to ride sharing services such as Uber.[106]

Some English cities outside London also have demand management measures in operation. Clean air zones in cities such as Birmingham, Bath, Bradford and Portsmouth[107] have the objective of reducing demand for the most polluting vehicle types, though may not be expected to reduce overall demand as travellers have the option of switching vehicle type instead. Early results from Birmingham's clean air zone show a 13 per cent fall in nitrous oxide emissions.[108] Nottingham has adopted a workplace parking levy, discouraging people from commuting by car but also raising revenue for public transport from those who still do. Since the scheme was introduced in 2012 it has raised more than £90 million, which has helped fund public transport and active travel improvements in the city, including the extension to the city's tram network.[109] Many cities also have low traffic neighbourhoods in which access for cars is restricted in some way – including Birmingham, which is proposing to limit car access across the whole city centre.[110]

Box 3.2 presents some examples of where demand management measures, in particular congestion charging, have been implemented in international cities.

Box 3.2: International case studies of demand management measures

Congestion charging and pedestrianisation have been used across the world to manage travel demand and congestion in city centres. Three examples of successful cases are detailed below.

Gothenburg: Gothenburg introduced a congestion charging zone in 2013[111] to reduce traffic congestion, improve the environmental situation in the centre of the city and to collect revenue to finance large road and rail projects in the city.[112] To support the expected rise in public transport use, the city added bus lanes and increased the frequency of buses and trams when the charge was introduced.[113] Studies on the effectiveness of this demand management measure show that overall traffic in the city fell during charging hours by approximately 12 per cent.[114] However, evidence also shows that there was a rise in traffic along roads outside the boundaries of the charging area.[115] Public attitudes toward congestion charging have improved as people have realised the benefits. Public support rose from 30 per cent when the charging zone was introduced to 55 per cent a year after implementation.[116]

Milan: As a densely populated city with large-scale industrial activity, Milan has suffered from severe pollution and congestion.[117] In 2012 the city adopted a congestion charge of €5 imposed on cars entering the charging zone on weekdays between 7.30am and 7.30pm.[118] The city also introduced other complementary measures to support its vision to transition towards a more sustainable urban mobility system.

This included a rise in parking restrictions and investment in new bike lines, digital systems to provide real-time traffic information and bike share systems.[119] Traffic congestion during charging hours fell by approximately 30 per cent and the average speed of buses rose by between four and 11 per cent.[120]

Singapore: As a small country, Singapore has a very high population density and limits vehicle ownership to manage levels of pollution and congestion.[121] Singapore was the first country to introduce congestion charging, implementing its paper-based Area Licensing Scheme in 1975.[122] The system became fully electronic in 2008 with the introduction of Electronic Road Pricing, which has been a significant source of revenue.[123] The introduction of pricing was followed by a 15 per cent fall in traffic on expressways[124] and speeds on major routes have increased and become more consistent.[125] The government also introduced additional bus services and expanded roads to manage the resultant increase in traffic in ring roads.[126]

Some of these demand management measures reduced traffic in city centres by a significant amount. The congestion charges also raised income[127] and have been used as long term sources of revenue for cities and governments. Despite this, congestion charges are often dismissed for being costly to implement. High implementation costs can be eased by multiple cities sharing a common base system for congestion charging.

As evidenced above, another potential issue with the implementation of congestion charging is negative public attitudes. However, steps can be taken to facilitate the implementation and acceptance of these demand management measures, including:

- publishing data to demonstrate the effectiveness of the measure

- explaining how revenues will be utilised

- highlighting the harmful effects of pollution and the benefits the measure will bring

- avoiding referenda, which can lead to polarised single issue debates, and miss out on the potential for public acceptability to grow following successful implementation.

The findings from the case studies above demonstrate that reduction in traffic and modal shift cannot necessarily be achieved by demand management measures alone. Complementary measures help to maximise the effectiveness of demand management.

Maximising the effectiveness of demand management measures

The effectiveness of these measures will depend on the availability and adequacy of alternative modes of transport. Demand management alone is unlikely to be effective at moving trips onto more efficient modes if those modes are not viable options for passengers, or cannot manage the additional demand. Cities must therefore strike the right balance with demand management measures and ensure that they do not reduce the total number of trips into city centres, which could make regional disparities worse. The West Midlands Strategic Transport Plan identifies the importance of having adequate infrastructure to support the shift to active travel. It proposes a number of ways to achieve this including plans to increase secure cycle parking at interchanges and improve the integration between cycling and public transport networks.[128]

The importance of considering distributional impacts

The distributional impacts of demand management measures must also be carefully considered. Fiscal measures such as congestion charging and other pricing schemes can disproportionately affect lower income households and individuals.[129] Demand management measures may help increase access to the city through encouraging more space efficient modes of transport, but the benefits are unlikely to be felt equally across the whole population.[130]

Low income groups may be more negatively impacted.[131] Lower income households in the UK tend to have relatively low ability to reduce car trips in response to increases in the cost of motoring, which may be because they have less access to alternative modes or because they are already making only the most essential trips.[132] Additionally, low income groups typically have less flexibility to work from home.[133] These factors mean that an impact of congestion charging may be to reduce the ability of low income households to pay for other goods and services.

Cities should forecast the expected distributional impacts of different interventions to identify vulnerable groups. The potential benefits of economic growth must be considered against the risk of penalising already marginalised groups. The distributional impacts will vary between cities and therefore there is unlikely to be a universal solution to mitigate adverse effects. Instead, cities should consider a tailored suite of policies most suitable for their passengers. These include targeted support measures for vulnerable groups.

Congestion charging is compatible with road pricing

Fiscal measures such as congestion charging schemes could be implemented in parallel with any national road pricing scheme, provided the right national framework was put in place.

A road pricing scheme aimed primarily at generating revenue, for example to replace fuel duty lost through electrification, would be very different from one set up to manage demand and promote modal shift in a particular location. Most of the national road network is not congested most of the time,[134] so a road pricing scheme aiming to generate revenue would not necessarily charge people differently for higher demand locations. Even if there is some level of demand weighting on national road pricing, any congestion charging schemes for cities should be administered locally so that the design of the scheme aligns with local strategies, and revenues can be retained for local improvements.

But this does not mean they should be thought of as alternative options. A clear policy framework would enable national revenue collection to be supplemented by additional charges levied by local leaders in areas affected by congestion. A shared platform for monitoring use and collecting revenues could provide a seamless experience for drivers.

Careful thought needs to be given at an early stage to how infrastructure can be shared, and systems designed to work together to meet both local and national needs while providing good user accessibility so as not to deter travel. This will require co-ordination and compromise, with particular consideration of how any enforcement infrastructure, and the data it generates, will be governed.

While fiscal measures to manage demand in congested cities may generate some revenue, the central aim is to maximise the use of the available space.[135] The more successful congestion charging schemes are at achieving mode shift, the less revenue they will generate. The potential revenue generated from congestion charging is unlikely to be comparable to what will be required to fund major transport investments to level up places – London's congestion charge raises around two per cent of Transport for London's annual operational expenditure.[136]

Major investment projects in cities should be conditional on contributions coming from local revenue to ensure that beneficiaries pay. But ultimately, levelling up is a national mission which will require national funding to be directed into target areas.

4. Considering urban transport in the second National Infrastructure Assessment

The second Assessment will consider the case for public transport and active travel investment in cities in the post-pandemic context, and what role demand management techniques including congestion charging could play in ensuring cities in the UK have an accessible, affordable, comfortable, efficient, reliable and safe transport system.

The Commission's approach to uncertainty

The Commission's first Assessment recommended that investment should be made in expanding public transport capacity in cities.[137] Congestion and a lack of public transport capacity was a limiting factor in enabling people to move around efficiently. Increasing capacity would enable more people to access employment within the city, in turn generating productivity benefits through agglomeration and helping places to level up.[138]

However, since then Covid-19 has had a significant impact on travel patterns. No one knows precisely how this could play out and what travel behaviours may look like in the long run, but a question arises about whether capacity will remain a limiting factor under all scenarios. The second Assessment will test the recommendations from the first Assessment against the current fiscal and social context to develop a plan that is robust and adaptable to a range of outcomes.

The Commission's recent publication, *Managing uncertainty in the second National Infrastructure Assessment*, sets out the approach the Commission will take. Good infrastructure policy must be robust to a wide range of uncertain events and must incorporate a degree of flexibility in response.[139]

What the second Assessment will cover

The second Assessment will consider what transport infrastructure would be required for cities to thrive in the decades to come. First, the Commission will update its work on behaviour change following Covid-19, revising and further developing the possible scenarios for the future of urban travel. It's crucial that the recommendations in the second Assessment stack up in a range of different possible futures – developing well considered and robust plausible scenarios will facilitate this.

The analysis will then consider what the transport infrastructure requirements could be, using the scenarios as a guide, specifically exploring the case for investment in mass transit and other urban transport interventions as well as options for improved use of or upgrades to existing systems. The analysis will also consider how demand management techniques, such as congestion charging, could be effectively deployed to support the efficient functioning of the transport system and the implications they may have for different user groups.

The effects that any investment packages could have on a range of outcomes such as productivity, quality of life and carbon emissions will be assessed.

The work will be crucial to forming recommendations for urban transport in the second Assessment, as well as considering what the right balance of urban and interurban transport investment could be alongside the needs of the other infrastructure sectors in the Commission's remit. The second Assessment will also set out the Commission's recommendations on interurban transport.

The second Assessment is expected to be published in the second half of 2023.

Remit and structure of the Commission

The National Infrastructure Commission was established as an executive agency of the Treasury to provide impartial, expert advice and make independent recommendations to the government on economic infrastructure. The Commission operates independently, at arm's length from government.

The Commission's purpose, and its principal outputs, accountabilities and duties are set out in its Charter and accompanying Framework Document.

The inaugural Framework Document published in 2016 committed government to reviewing the Commission's performance of its core objectives and responsibilities within five years. This review was conducted during 2021 and is reflected in a revised and enhanced set of objectives and fiscal remit for the Commission, set out below. The date of the next such review will be no later than 2026.

The Commission's remit covers all sectors of economic infrastructure: energy, transport, water and wastewater (drainage and sewerage), waste, flood risk management and digital communications. The Commission also considers potential interactions between its infrastructure recommendations and housing supply; and between its recommendations and the government's legal target to halt biodiversity loss by 2030. This explicit biodiversity consideration was added in 2021. Housing supply itself, other social infrastructure such as schools, hospitals or prisons, and agriculture and land use are all outside the remit of the Commission.

The Commission's objectives are to: 1) support sustainable economic growth across all regions of the UK, 2) improve competitiveness, 3) improve quality of life, and 4) support climate resilience and the transition to net zero carbon emissions by 2050. The latter objective was added in 2021.

In fulfilling its purpose and objectives, the Commission seeks to:

- **set a long term agenda** – identifying the UK's major economic infrastructure needs, and the pathways to address them

- **develop fresh approaches and ideas** – basing our independent policy recommendations on rigorous analysis, and

- **focus on driving change** – building consensus on our policy recommendations, and monitoring government progress on their delivery.

The Commission delivers the following products and services:

- a *National Infrastructure Assessment* once in every Parliament, setting out the Commission's assessment of long term infrastructure needs with recommendations to the Government

- specific studies on pressing infrastructure challenges as set by the government, taking into account the views of the Commission and stakeholders; these studies will include recommendations to government

- an Annual Monitoring Report (styled as an *Infrastructure Progress Review*), taking stock of the government's progress in areas where it has committed to taking forward recommendations of the Commission.

The Commission's binding fiscal remit requires it to demonstrate that all its recommendations for economic infrastructure are consistent with, and set out how they can be accommodated within, gross public investment in economic infrastructure of between 1.1 per cent and 1.3 per cent of GDP each year between 2025 and 2055. The fiscal remit was previously between 1.0 per cent and 1.2 per cent of GDP. The Commission's reports must also include a transparent assessment of the impact on costs to businesses, consumers, government, public bodies and other end users of infrastructure that would arise from implementing its recommendations.

When making its recommendations, the Commission is required to take account of both the role of the economic regulators in regulating infrastructure providers and the government's legal obligations, such as carbon reduction targets. The Commission's remit letter also requires the Commission to ensure that its recommendations do not reopen decision making processes where programmes and work have been decided by the government or will be decided in the immediate future.

The Infrastructure and Projects Authority (IPA), a separate body, is responsible for ensuring the long term planning carried out by the Commission is translated into successful project delivery, once the plans have been endorsed by government.

The Commission's remit extends to economic infrastructure within the UK government's competence. Across much of the Commission's remit there is currently substantial devolution to Northern Ireland, Scotland and Wales. The Commission's role is to advise the UK government, but the Commission works with both the UK government and the devolved administrations where responsibilities interact.

Table: Devolved administration responsibilities, by infrastructure sector

Sector	Devolved administration responsibility		
	Northern Ireland	Scotland	Wales
Digital	Reserved	Reserved	Reserved
Energy	Devolved, except nuclear	Reserved, except energy efficiency	Reserved, except energy efficiency
Flood risk	Devolved	Devolved	Devolved
Transport	Devolved	Largely devolved	Devolved, except rail
Waste	Devolved	Devolved	Devolved
Water and sewerage	Devolved	Devolved	Devolved

The Commission's members

The National Infrastructure Commission comprises a Chair and between four and 12 additional non-executive Commissioners.

The current members of the Commission are:

Sir John Armitt CBE (Chair) published an independent review on long term infrastructure planning in the UK in September 2013, which resulted in the National Infrastructure Commission. Previously Chief Executive of Railtrack (later Network Rail), Sir John sits on the boards of the Berkeley Group and Expo 2020.

Professor Sir Tim Besley CBE is School Professor of Economics and Political Science and W. Arthur Lewis Professor of Development Economics at the LSE. From September 2006 to August 2009, he served as an external member of the Bank of England Monetary Policy Committee.

Neale Coleman CBE is a co-founder of Blackstock Partnership. He worked at the Greater London Authority from 2000-2015 leading the Mayor's work on London's Olympic bid, the delivery of the games, and their regeneration legacy. Neale has also served as Policy Director for the Labour Party.

Andy Green CBE holds several Chairman, Non-Executive Director and advisory roles, linked by his passion for how technology transforms business and our daily lives. He chairs Lowell, a major European credit management company and has served as Chair for the Digital Catapult, an initiative to help grow the UK digital economy.

Professor Jim Hall FrEng is Professor of Climate and Environmental Risks in the University of Oxford and Director of the University's Environmental Change Institute. He is internationally recognised for his research on risk analysis and decision making under uncertainty for water resource systems, flood and coastal risk management, infrastructure systems and adaptation to climate change.

Professor Sadie Morgan OBE is a founding director of the Stirling Prize winning architectural practice dRMM. She is also Chair of the Independent Panel for High Speed Two and is a Mayor's design advocate for the Greater London Authority. She sits on the boards of the Major Projects Association and Homes England.

Julia Prescot holds several board and advisory roles. She is a co-founder and Chief Strategy Officer of Meridiam and sits on the Executive Committee of Meridiam SAS. She has been involved in long term infrastructure development and investment in the UK, Europe, North America and Africa. She is an Honorary Professor at the Bartlett School of Construction and Project Management, University College London. Since 2019 she has sat on the board of the Port of Tyne.

Bridget Rosewell CBE is a director, policy maker and economist. She served as Chief Economic Adviser to the Greater London Authority from 2002 to 2012 and worked extensively on infrastructure business cases. She has served as a Non-executive Director of Network Rail and Non-executive Chair of the Driver and Vehicle Standards Agency. She is currently Chair of the Atom Bank and the M6 Toll Road.

Kate Willard OBE is the is the Thames Estuary Envoy and chairs the Thames Estuary Growth Board. Since 2017 she has served as Chair for the Arts Council England's Area Council North. In addition, she is an independent consultant working on a diverse portfolio of infrastructure and growth projects. In March 2022 she was appointed Chair of Teesside International Airport.

Nick Winser CBE has had a 30-year career in the energy sector, including serving as UK and European CEO of the Board of National Grid and President of the European Network of Transmission System Operators for Electricity. He currently serves as Chair of the Energy Systems Catapult.

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