The required revolution: transforming the UK's transport connectivity

Prepared for the UK2070 Commission

Greengauge 21

June 2020

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Executive Summary

1. There are two overarching Government policy imperatives that serve to underline the timeliness and importance of this report. These are:

   (i)   The aim of 'levelling up' the UK economy.

   (ii)   The need to achieve net zero carbon by 2050

2. The Government's aim of 'levelling up' reflects the UK2070 Commission's ambition for a more balanced and a fairer society. Government wants to lift economic productivity in places where it is lagging to levels closer to or even above the national average. Transport connectivity has a role to play in meeting these aims. Recovery in the wake of the Coronavirus epidemic adds to the urgency.

3. ***This report sets out a pan-UK transport network, designed to respond to the two overarching Government objectives and the very different post-Coronavirus world.***

4. The pan-UK transport network developed here is ambitious – indeed revolutionary. It will take time to implement fully but much can be done straight away as the economic recovery builds. It is comprehensive, and so operates, inter-connectedly, at three levels:

   (i) Intercity (long distance travel)

   (ii) Urban-metropolitan

   (iii) Across the wider urban-rural continuum.

   It is at the third level that the most disadvantaged places as measured, for example, by social mobility scores, are to be found. But a truly national network has to be fully joined up across all three levels and avoid the waste entailed in different modes of transport failing to offer joined-up travel opportunities. An express interurban bus service in a peripheral area will be more viable if it connects its customers seamlessly into the national rail network, for example.

5. Through the Covid-19 lockdown, travel, as of necessity, has been sharply curtailed. Re-setting how connectivity should be provided in future, starts from an unexpected situation. Current (June 2020) reliance on private car transport cannot continue as restrictions are progressively eased without major road congestion and severe and negative environmental consequences. The current price paid for carbon will need to be increased.

6. How the Coronavirus will impact on overall travel demand patterns ahead depends on what happens to cities and city centres. There are many unknowns. Cities have overcome set-backs repeatedly through history. One key factor is the location of Government. This alone will continue to sustain and reinforce the dominance of the London economy nationally. The higher growth rates of Edinburgh and Cardiff in recent years are evidence of the benefits devolution can bring in terms of stimulating city region growth.

7. The overall transport strategy developed here to meet the Government objectives post Covid-19 has four elements:

(i) ***re-allocation of road space*** nationwide to support a planned expansion of walk/cycle (active travel modes) to support local neighbourhoods

(ii) creation of a much more ***user-friendly, nationwide scheduled public transport network***, accessible by active and demand-responsive travel modes and essentially operated with electrically-powered vehicles

(iii) ensuring that the national public transport system, through tying together various public transport services, provides necessary ***connectivity to well-off/high accessibility places and less well-off/peripheral places alike***

(iv) creating ***a national logistics network*** that reduces dependency on HGVs, with electrified multi-modal trains (and potentially, hydrogen fuel cell-powered, HGVs) linking a much-expanded set of distribution centres from which customer fulfilment can be made by fleets of rechargeable electric vans and cargo bikes.

8. In this report, we take the inevitable loss of highway capacity for vehicular traffic as a given. Re-allocating road-space in favour of active travel modes led us to rule out an approach that would increase dependency on the national highway network for a car-based travel: it will have insufficient capacity.

9. A radically improved, user-friendly, public transport network needs to serve the whole nation, not just its more prosperous parts. Investment in it is needed because:

(i) the **nation's scheduled public transport system is not joined-up**. Buses and trains are managed entirely separately. They have separate fares systems; they present very different challenges for mobility impaired travellers; interchanges between bus and rail exist, but not always where they would be most expected and helpful. Timetables are rarely matched for through travellers, and information sources are scattered across the internet

(ii) some parts of the public transport network are **seriously unreliable due to road and rail congestion**. For rail, this may well be best tackled at least in the short to medium term through longer trains and removing a few services so that those that remain can be operated reliably to schedule

(iii) public transport is still provided to a significant extent through **diesel powered vehicles which need to be eliminated** to avoid poor outcomes both in terms of carbon emissions and air quality

(iv) the public transport **network is suffering from some serious gaps**.

10. It would be wrong to return to the *status quo ante* (the previous state of affairs) and earlier investment priorities. The challenge of 'levelling up' – and the distributional component in transport policy – needs a higher priority and new thinking. Peripheral areas may not need high-capacity investment in motorways or fast rail links, but they do need to support and allow people day-by-day access in a timely and affordable way to jobs, higher education and higher education opportunities. Very often, this means travel to the regional centre. If this option isn't viable, those seeking advancement will make the choice to leave home, and in doing so, deprive communities left behind of their personal skills, drive and ambition. It is with this realisation that the ability to commute comes to be seen as a way to maintain age balance, support local economies and strengthen the overall health of local communities.

11. EU-funding which has been channelled as a matter of policy into areas of relative deprivation will soon end. **A new funding programme is needed and retaining and improving transport connectivity in the more peripheral and 'left behind' areas needs to be prioritised.** Current congestion-driven project appraisal approaches need to be changed. Levelling up will strengthen overall UK economic performance, with a shift from investing just where the economy happens to already be doing well.

Service integration across the urban-rural continuum

12. Places with the worst Social Mobility Index scores display a clear (and perhaps surprising pattern) across the country:

    (i) Few are in cities/conurbations

    (ii) Most are in broadly rural settings, and most of these are former single-industry areas (for example, coal and steel-making)

    (iii) Many are in coastal areas

    (iv) Many are on the eastern side of the country (in both England and Scotland).

13. There is an eclectic mix of public transport service provision across the rural-urban continuum. Many rail and bus services have disappeared over the multiple decade period of growth in car ownership and declining coverage of public transport. The pattern of public transport that remains is patchy and totally lacking in coherence, with bus and rail subject to completely different funding and regulatory regimes.

14. Some quite small places, almost as if by chance, retain local rail stations; others have the fortune to be served by high-quality interurban bus routes. Providing ongoing financial support into the rich variety of localised demand responsive transport services is going to be needed in the post-Covid-19 recovery period if increasing numbers of communities are to avoid being cut-off.

15. People living in remote, peripheral and 'left behind' areas pay an economic price through lack of access to job opportunities and a social and health & well-being price through isolation and inaccessibility to key services. This pattern is perhaps most severe for post-industrial towns. Whereas some (ex-steel town Corby, for example) have successfully transitioned, others have struggled, even with financial support packages. In many places, the regeneration task is incomplete, and they remain 'left behind'.

16. Cities with a good range of job and higher education opportunities may be tantalising close to hand, yet still too hard to access for those on low incomes. In other cases – and this seems to be true of many (if not all) coastal towns that once relied typically on fishing industries and domestic tourism – transport network weaknesses stem from a failure to provide the good inter-connectivity that is needed to attract new businesses. This report identifies the infrastructure and operational measures needed to make a difference:

    (i)   Some rail line re-openings

    (ii)   Connected interurban express bus lines

    (iii)   A set of mobility hubs (where transport modes come together for passenger convenience and to help foster services in the local economy) and support for community based and demand responsive travel services

    (iv)   Some new rail estuarial crossings, to expand the catchments and economic strength of disadvantaged coastal communities

    (v)   An integrated (national) fares and public transport information system for ease of use, and to support concessionary fares systems for those that most need them.

17. We recommend that Government gives consideration to updating the Indices of Deprivation to establish a new measurable domain: accessibility to services, employment opportunities provided by sustainable/affordable transport.

City Regions: a new investment priority

18. There is a pressing need to enhance metropolitan rail networks. Funding programmes that were once available to city authorities to support the creation of, for example, the Tyne & Wear Metro and Liverpool's 'loop and link' networks no longer exist. Yet without better metropolitan rail networks, not only will economic development be held back, but the benefits of investment in better intercity connectivity, now in hand, will not be fully realised.

19. **Four new metropolitan area S-bahn style rail services and networks need to be created for Birmingham, Bradford, Manchester and Leeds.** Bristol, Cardiff, Nottingham and Southampton each need to develop metro systems (Nottingham having a head start with its expanding Light Rapid Transit (LRT) system).

20. **A set of LRT (or equivalent) systems are also needed for the 'next size down' cities and towns, accompanied by major improvements to the public realm in urban centres, with pedestrianisation measures.** This programme should be used to prioritise active travel alongside an appropriate zero carbon transit system for all cities over 175,000 population.

21. In all of these cases, access to the services and opportunities that only larger urban centres can provide from outlying areas need to be examined unconstrained by historical administrative boundaries.

Intercity rail to become the mode of choice for longer distance journeys

22. HS2 should be configured as an 'X' rather than a 'Y' shaped network. This will **allow HS2 to perform a cross country (inter-regional) function as well as link major cities with the capital.**

23. This proposition requires the implementation of the Midlands Rail Hub proposal, integrating Moor Street and Curzon Street stations (which adjoin each other) for easy passenger interchange. It will place Birmingham at the heart of the national high-speed network, rather than on a short branch line from it.

24. While some London HS2 services could serve the eastern side of the country, it is not possible to make the comprehensive switch achievable with the west coast. **Upgrading the East Coast Main Line (ECML) should become a high priority alongside implementation of HS2.**

25. Government has expressed enthusiasm for a fixed connection (bridge or, as presumed here, tunnel) across the Irish Sea – specifically between **SW Scotland and Northern Ireland. This could make a major contribution (once built) to reducing UK carbon emissions**, reducing the need for short-haul flights and lengthy HGV movements, as well as improving connectivity with Northern Ireland.

26. Overall, across the national geography, the measures we identify as necessary to achieve the required transport connectivity revolution will:

    (i)   **Improve connectivity from high inequality areas to major opportunity areas**

    (ii)   **Help create stronger agglomerations though broadened catchments for access to jobs and education**

    (iii)   **Improve connectivity with international gateways and with London**

    (iv)   **Improve connectivity along coastal corridors.**

1. Overview

In February 2020, the UK2070 Commission published its final report that sets out how, in the decades ahead, the nation can create a less imbalanced economy and a fairer society.[1] Greengauge 21 supported the UK2070 analysis through a report on the transport component of this ambition.[2] This work, in turn, drew on an earlier report '*Beyond HS2*', released by Greengauge 21 in May 2018.[3]

Following up on its February 2020 report, the Commission is keen to set out what a pan-UK transport network should look like – one that transforms connectivity in a way that can help meet Government policy objectives. This new report has necessarily taken into account, even at this early stage of understanding, the possible medium/longer term consequences of the Coronavirus epidemic. We also needed to reflect – insofar as it makes a difference – the ending of the UK's membership of the European Union.

There are two over-arching Government policy imperatives that serve to underline the timeliness and importance of this work. These are:

(i)   The need to achieve net zero carbon by 2050
(ii)   The aim of 'levelling up' the UK economy.

While the net zero carbon objective is massively challenging, especially in the transport sector, its pursuit should not be allowed to obscure complementary environmental objectives – such as restoring air quality to compliance levels and enhancing bio-diversity. These wider objectives also have a bearing on transport policy.

The Government's aim of 'levelling up' reflects the UK2070 Commission's ambition for a more balanced and fairer society. Government's concerns reflect an ambition to lift economic productivity in places where it is lagging to levels closer to or even above the national average. The UK 2070 Commission is also concerned with a separate and distinct need to address the very wide consequences of inequality on, for example, human health and life expectancy. These aims may translate into productivity improvements but carry a virtue of their own.

In section 2 below, we set out how these high-level objectives and pressing policy concerns affect the approach to defining a sustainable, integrated, pan-UK transport network. 'Sustainable' is an overused word, but it certainly requires that the two Government policy imperatives noted above need to be achieved and adhered to over the decades ahead.

The typology with which the Pan-UK transport network is constructed has three elements:

-   Intercity
-   Urban-metropolitan (city-region)
-   Urban-rural continuum.

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[1] http://uk2070.org.uk/2020/02/26/uk2070-final-report-published/
[2] See http://www.greengauge21.net/the-uks-2070-transport-infrastructure-requirement/ published in November 2019
[3] http://www.greengauge21.net/beyond-hs2-a-plan-for-a-national-rail-strategy/ published in May 2018

Using this hierarchy allows us to cover questions of national, regional and much more localised inequalities, and the contribution that better transport services and connectivity can provide in a structured way. Sections 3, 4 and 5 then set out the three linked areas in turn, drawing on case-studies.

In Section 6, we draw the three elements together and set out an overall pan-UK sustainable transport network.

2. A sustainable national transport network

There are two key aspects to achieving sustainability as we have defined it: zero carbon and equity/fairness.

Net Zero Carbon

Whereas the Treasury's Green Book guidance was modified to take account of climate change as long ago as 2009,[4] in practice carbon effects have had to date only a minor impact on subsequent transport sector project appraisals.

In relation to zero carbon, influential economist Dieter Helm outlines three key principles for a sustainable economy[5]. These are:

- the polluter-pays principle, meaning that the costs of pollution should be integrated into every decision made by businesses and consumers

- public goods that the market will not deliver unaided should be provided by the State, including crucial low-carbon infrastructures and R&D

- finally, residual carbon emissions should be offset by more than the expected damage, and most of this should be natural rather than industrial carbon capture and storage.

Achieving a net environmental gain is the objective (*i.e.* passing on a set of assets at least as good as those we inherited). Helm also points out that the net zero carbon target needs to be viewed on the basis of consumption, not production. A lot of the historic fall in the UK's carbon emissions since 1990 stems from the replacement of domestic production with the off-shoring of production – to countries such as China which have hugely increased their exports over the last 30 years. This development has the effect of transferring carbon scores to supplier countries, but this characteristic is avoided if carbon is scored on the basis of consumption. Rapid reductions of emissions are required annually and this in turn will require air and road demand management policies through the 2020s and beyond.

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[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191501/Accounting_for_the_effects_of_climate_change.pdf (published June 2009)
[5] Net Zero: How We Stop Causing Climate Change, Dieter Helm (forthcoming 3/9/2020)

This is not the only implication for transport policy from the three principles that Helm suggests. The *polluter pays* principle means that a much higher price needs to be set on carbon. At current pricing, the impact of carbon and indeed other emissions such as Nitrous Oxides and particulates hardly affects benefit: cost appraisals at all. If carbon was scored highly enough to reflect the polluter pays principle, this would lead to much more emphasis on measures that reduce the demand for travel (by people, for freight) – and in turn would lead to wider policy effects, such as supporting a localist agenda, with needs met within say a 30-mile radius from home. It would also, of course lend further support to 'active travel' (walk/cycle). But one of the risks to address around a localist focus is that it will encourage private car use, if the range is set too far for walk/cycle and too short to make public transport networks commercially attractive. Mayor Anne Hidalgo (Paris) addresses this with her 15-minute neighbourhood concept, with "grocery shops, parks, cafes, sports facilities, health centres, schools and even workplaces just a walk or bike ride away".[6] Public transport, in this model, has the function of linking neighbourhoods.

Paying a corrected price for carbon emissions will help to eliminate, or at least minimise, the use of fossil-fuel based vehicles. Paying fully for poor air quality impacts would mean that vehicles that are rubber-tyre based or depend on friction braking systems would also be penalised. The latter can be avoided with regenerative braking systems, a further benefit of using electric motors. So, this essential measure would have three effects that need to form a background presumption in identifying the right direction for the pan-UK transport network:

● *reduced use of petrol/diesel*, replaced with electric

● *a higher price per-mile for travel*, encouraging shorter trips and potentially strengthening local economies (although the counter-effects of reduced catchment areas would weaken GDP levels); this means less travel overall

● an *added stimulus to move away from rubber-tyre based transport*.

The way to mitigate the economic loss from application of the second, localist, effect (with less travel an inevitable or even sought-after outcome) is to ensure that connectivity is retained at affordable price levels across the wider (city, regional, and national) geography – provided by transport systems that are zero-carbon with ultra-low emissions. Fortunately (although not uniformly across the country) we have a ready course of action: the use of electrified rail-based systems.

The South East of England is well placed in this regard, but the rest of Britain is lagging[7], as the (slightly out of date) map below shows.

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[6] Source:
https://www.theguardian.com/world/2020/feb/07/paris-mayor-unveils-15-minute-city-plan-in-re-election-campaign, according to which the driving force behind the 15-minute city idea is the Sorbonne professor Carlos Moreno, who believes the "core of human activity" in cities must move away from oil-era priorities of roads and car ownership as we move into a post-vehicle era.
[7] Wales, South West England, East Midlands score particularly poorly

Extent of electrified rail network

Note: This map has not been updated and relates to the situation c2012

The second of Helm's principles recognises that Government will need to lead and fund required infrastructure changes. But, of course, Government funds will be stretched post-Coronavirus. The question of whether private sector funding has a role to play will inevitably be asked.

Only transport infrastructure with allocated user charges, and a dependable charging regime that translates into an income stream, can plausibly be funded by the private sector. Investor assurance can be achieved in the UK through independent regulation of pricing. This applies in the UK at present to just one capital investment category – significant new railway lines. In Government asset sales (privatisations) over the last 10 years, only HS1 (let through a 30-year concession shortly after its completion) has yielded a significant return to Treasury. In the recent Full Business Case for HS2 Phase 1 go-ahead, reference was made to an equivalent opportunity that lies ahead for HM Treasury receipts from deployment of a similar concessioning or other arrangement with HS2 in due course.[8]

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[8] See https://www.gov.uk/government/publications/hs2-phase-one-full-business-case published 15th April 2020

Offsetting carbon damage caused by transport is something practiced by the aviation sector (at passengers' discretion) and is a major component of HS2, which is committed to planting seven million trees along the route of HS2 to create a green corridor for wildlife and nature.[9] Finding a way to secure an equivalent outcome from continuing highway use remains a major challenge ahead.

A Fairer and More Equitable Society

In transport terms, sustainability needs to be for everyone, not just an elite that can afford to travel more, with access to a private car taken as a given.

The work of the UK 2070 Commission that reported earlier this year explains how the fairness/equitable objective should be met.[10] In our work on the transport implications of fairness and equality, we have been guided in particular by the findings of the Social Mobility Commission which identified transport as one of four key enablers to help overcome what is a continuing crisis for much of the UK.

Transport improvements may not impact beneficially on labour market effects as directly as some might suppose. This point was explained recently in the following terms, thinking about rail enhancements for the north of England:

> "No one expects unskilled workers in Blackpool to commute to jobs in Manchester. But more skilled workers can make the journey whether they are attracted to places with weaker economies by lower house prices or more likely because they have existing personal or family connections with these places. And once there their wages will inject spending power into the local economy creating jobs for those on lower wages. This is exactly the pattern which has emerged in the more successful US cities, where successful economies create well paid jobs and these in turn help to create a buoyant local service economy."[11]

Notably this ties together the question of stimulating local economies with the advantage of sustainable medium distance transport (Blackpool-Manchester is a rail line that has recently been electrified). Transport is only one factor in tacking inequality, in levelling up; but it is an important one.

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[9] See High Speed Rail Group submission to the National Infrastructure Commission High Speed North consultation, May 2020, which notes that in respect of bio-diversity: " A double track railway can carry as many passengers as a ten-lane motorway typically does: it is therefore more cost effective to provide green bridges, which will be shorter and in turn appealing for a wider range of species to use. Phase 1 of HS2 alone includes 16 green bridges, more than exist in all of the UK today. Rail noise is less disturbing than road or air noise at the same decibel level (and above 30mph, an EV is as noisy as a petrol car), while it is simpler to mitigate because noise barriers can be placed closer to the source than on a wide motorway. With Defra estimating the annual health costs of road noise to be £10bn in urban areas of England alone, these are important benefits".

[10] http://uk2070.org.uk/2020/02/26/uk2070-final-report-published/

[11] See paper by Wray, Thrower and Steer, http://www.greengauge21.net/wp-content/uploads/REVISITING-HIGH-SPEED-NORTH-.pdf

Coronavirus Impacts

The impacts of *Coronavirus*, with the UK following practice elsewhere and instigating a lock-down, have of course been dramatic for the travel and transport sector. It is too early to say what the longer term effects on travel demand will be. It is clear that regardless of employee preferences, some businesses will not re-open their offices when travel restrictions are lifted. Many have discovered that they can operate with a lower cost base satisfactorily 'from home'. Broadband availability is required of course, and no doubt its national coverage will be one of the priorities for investment ahead.[12]

The effect on commuter travel is likely to have lasting impacts. Of course, only some, office-based, jobs can be made home-based. And in this sub-category, many employees and some employers will wish to have sight of their colleagues and engage in team briefings and so on. A switch to commuting (say) 1, 2 or 3 days per week for those that don't need to be physically present, rather than every day, could be a likely consequence. But commuting accounts for less than a fifth of all travel. And office-based work, only a minority of all jobs.

How this translates into overall travel demand patterns ahead depends on what happens to cities and in particular city centres. Will office blocks be re-purposed? Will retail-based high streets revive? These are simply unknown at present.

For some aspects of city life, the post-Coronavirus outlook is more assured. Markets (across various sectors including leisure/tourism) need scale to operate efficiently – often now described under the heading of 'agglomeration benefits'. Cities have overcome set-backs repeatedly through history and can do so again.

One of the biggest drivers of city economies, even in a country with such an established recent history of down-sizing the public sector, is Government itself. The rationale for business co-location is very strong in supporting the very functions of Government: "UK cities need devolution of powers and links to London to succeed".[13]

This point serves to underline an often overlooked point around devolution. With so much of all Government activity in the UK centred on London (which contributes almost a quarter of the country's output and broadly 30 per cent of its economy-related tax take, according to Professor Tony Travers)[14] this adds to the problem of regional imbalance.

The degree of centralisation in London deprives other centres of a share of this part of the economy. Cities with devolved Governments have bucked wider economic trends, as their economies build smaller versions of the wider business infrastructure that supports London. Between 2000 and 2008, while the economies of many cities in the north improved, they didn't close the productivity gap with the national average. Those with devolved Governments, such as Cardiff and Belfast, however, did particularly well, and between 2008 and 2010, London and Edinburgh were the only UK cities in the world's top 20 per cent worldwide by gross value added per head.[15]

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[12] The UK2070 Commission included this as a priority in Action 3 (page 50) of its Final Report earlier this year: Covid has made it more urgent.
[13] https://www.ft.com/content/35c7a600-d51f-11e3-9187-00144feabdc0 The latter regional development point is often overlooked by critics of HS2
[14] https://www.london.gov.uk/sites/default/files/devolution_-_a_capital_idea_lfc_2017.pdf

Making transport investment decisions in the face of uncertainty will not be easy. Projects that have been progressed for capacity reasons alone, based on medium/long term planning forecasts, may well be postponed, some cancelled. But the country, to function as a productive, democratic and open society, needs to be able to support inter-personal contact in a variety of ways, and not just be left reliant on digital hook-ups. This entails travel. The economy will also not function – for consumers or for producers – unless goods can get to market.

What is clear is that the short-term palliative of discouraging public transport use in the early stages of easing the lockdown will become unsustainable. It will put many people, those living or working in large cities in particular, but also all of those wherever they live that rely on public transport, at an unacceptable disadvantage and in an untenable predicament that will require resolution.

As the economy gets back to full operation, travel restrictions are being eased. With no real demand management tools (and with fuel prices at a very low level) private car-based traffic levels are rising and will likely continue to rise sharply. Not only will this prejudice the widely noted air quality, bio-diversity and tranquillity gains apparent during the lock down period, it will also result in intolerable (and highly inefficient) levels of road congestion. Accommodating the reduced levels of travel that will be part of achieving the net zero and wider environmental objectives will require demand restraint measures. If these are not to be economically damaging, and to garner sufficient public support, then suitable alternatives to car use have to be provided.

Locally, active travel is the best answer in sustainability terms, but not everyone is able to participate, and it only makes sense for most people for trips of up to (say) 5 miles cycling distance (which circumscribes an area of around 80 square miles) – or much shorter if walking – before trip times get too lengthy. Beyond that, to avoid reversion to private cars (or taxis, Uber, or minicabs), the country will need to turn to its public transport system. It will find it to be – for the main part – in rude health, having benefitted from governmental financial support through the lockdown period.

But it's far from perfect. In the immediate term, investment and demand management are needed to help maintain social distancing. Longer term there are several areas where investment (and in some cases, pricing action and regulatory advances) are especially needed:

- the nation's scheduled public transport system **is not joined-up**. Buses and trains are managed entirely separately. They have separate fares systems; they present very different challenges for mobility impaired travellers; interchanges between bus and rail exist, but not always where they would be most expected and helpful. Timetables are rarely matched for through travellers, and information sources are scattered across the internet

- some parts of the public transport network are **seriously unreliable due to road and rail congestion.** For rail, this may well be best tackled through removing a few services so that those that remain can be operated reliably to timetables. For the bus sector, journey times and service unreliability will quickly remerge post-Covid because of traffic growth and measures that have re-allocated road capacity to pedestrians and cyclists (in support of active travel): unless there is a complementary attempt to reduce car traffic when this happens, bus service quality takes a hit

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[15]

https://www.liverpool.ac.uk/media/livacuk/publicpolicyamppractice/UK,City-Regions,in,Growth,and,Recession,-,Final,Version,March,2014.pdf

- public transport is still provided to a significant extent through diesel powered vehicles with resulting *poor outcomes both in terms of carbon emissions and air quality*

- the public transport network is suffering from *some serious gaps*.

The last deficiency needs some explanation. The public transport network, to function efficiently and provide a substantive alternative to car use, has to offer an interconnecting set of routes that come together in a series of hubs, intersections, or junctions – the network 'nodes'. On the rail network, these key nodes are generally found in cities. This is why, regardless of the likely long term impact of Coronavirus on cities themselves, if public transport is to form the core medium and longer distance national network, then services to these key hubs (cities and major towns, usually) must be retained and improved where they are deficient. And places that lack good inter-connections – even if they are geographically peripheral – must be provided with them, for public transport to be a truly national facility.

Within the public transport network, it has to be recognised that interurban bus speeds are very low compared with rail speeds. For example, in a Greengauge 21 survey of interurban bus routes between places with over 5,000 population (so ignoring deep rural routes) carried out in 2018, of 98 services identified, only eight achieved end-to-end operating speeds of over 20 miles/hour. The other 90 were all in the range 10-20 miles/hour. Rail speeds are typically much faster of course.

So, when it comes to a joined-up national network that can obviate car-dependency, a rail network, suitably backed up by inter-urban (as well as local) bus services, is what's needed to join local communities with each other, regional centres, the national capital, and international gateways.

Of course, to meet the zero carbon target the overall system needs to use electrically-powered vehicles (much easier to achieve with rail, where already over half of journeys are made on electrically-powered trains). For freight, there is a real problem, since battery-electric power is cost ineffective and range-limiting for the HGV fleet that dominates the country's logistics arrangements. Much hope is being placed in the use of hydrogen technology which looks more promising than other approaches[16], although this is equally dependent on electrical power decarbonisation and potentially on the use of carbon capture technologies too.

Just on the issue of international connectivity, it is worth reflecting on the combined impact of Brexit and achieving net zero carbon. Brexit will lead to some revision in patterns of trade – and hence freight/logistics patterns – but have a lesser impact on person travel patterns. Indeed, here the impact of carbon reduction through a more climate conscious society with a predilection for less flying will keep leisure travel more tied to surface transport than would otherwise have been the case – and hence international travel to more of a Europe-based focus. With significant travel distances by surface modes, however, the importance of expanding the set of services using the high-speed rail network will probably increase, as UK holiday makers consider travelling further afield avoiding flights, encouraged by the imposition of carbon tariffs.

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[16] See https://www.commercialmotor.com/news/buying-advice/closer-look-hydrogen-fuelled-trucks October 2019

In summary, does Coronavirus mean that capacity concerns on rail (and bus) can safely be disregarded, because demand will decline, especially into cities? The answer must surely be no, and for this reason. True, it may well be that for a period of months, maybe longer, the effective capacity of individual public transport vehicles will be reduced to help achieve social distancing guidelines. But having fewer passengers per train operated, for example, doesn't mean it would make sense to cut service frequencies or train lengths – indeed, rather the opposite, as carrying people safely means that more space has to be provide on trains (and buses) not less. And once the need to keep socially distant is passed, the only sustainable option we have is public transport as demand picks up, and that is structured around a set of service hubs that are, in general, in major cities.

There is a second strand to the Coronavirus event that impacts on the subject of this report. It is becoming clear that the impact of coronavirus is not uniform: it has impacted poorer communities and neighbourhoods, the elderly and the BAME community hardest. As ONS data attests, the death rate of people living in the poorest 10% of England during the outbreak is at 1.28/1000, whereas it is at half that level (0.59/1000) in the wealthiest 10%.[17]

Coronavirus also appears to be causing differential impacts across the education sector, with children in poorer households less able to study from home using laptops to connect with teachers, according to an IFS survey of 4,000 households.[18] Inevitably, this means a set-back for the life-chances of children growing up in lower income households: the social mobility challenge will be made all the greater for the young generation by the virus.

And the economic impacts are also likely to have an equivalent, adverse, effect on the working age generation. It may prove possible to retain a large part of 'white collar' employment post-pandemic, with remote screen-based work practices offering a spin-off advantage of reduced commuting times and lowered (or even avoided) place-of-work (office) costs. But the same is not true for blue-collar workers, who engage in 'hands-on' activities, where the economic recession is more likely to result in job losses. To which it should be added, both white and blue collar jobs are likely to be subject to losses (as well as opportunities) through the application of digital technology.[19]

Implications for transport policy

We have noted here a set of far-reaching shifts that will affect the demand and pattern of person-travel and of freight flows in the years ahead. It will not be enough to return to the *status quo ante* and earlier investment priorities. The challenges of carbon and of 'levelling up' – and the distributional component in transport policy – need a higher priority.

We see a need to:

- ***re-allocate road space*** nationwide to support a planned expansion of walk/cycle (active travel modes) to support local neighbourhoods

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[17] Quarterly data from ONS:
https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31may2020. Death rates are in normal times higher in poorer areas, but the ONS data for March-May show this effect being intensified.
[18] See https://www.bbc.co.uk/news/education-52701850 May 18th, 2020
[19] Employers expect nearly two in five (37per cent) job roles to alter significantly or become redundant as a result of new digital technology and automation in the next five years – affecting 12 million workers across the UK. Source: https://www.hrreview.co.uk/hr-news/digital-revolution-to-impact-12-million-jobs/117135 June 2019

- create **a national logistics network** that reduces dependency on HGVs, with electrified multi-modal trains (and potentially, hydrogen fuel cell-powered HGVs) linking a much-expanded set of distribution centres from which customer fulfilment can be made by fleets of rechargeable electric vans and cycles

- create a much **more user-friendly, nationwide, scheduled public transport network**, supported by access facilities for active and demand-responsive travel modes and capable of operation throughout without recourse to the use of fossil fuel energy sources

- ensure that the national public transport system, through tying together these various public transport services, provides necessary **connectivity to well-off/high accessibility places and less well-off/peripheral places alike.**

This report sets out what such a network would look like, the investments needed to create it, and necessary complementary policy measures.

This is not revolutionary in technology terms, although there is huge scope for the application of digital technologies, for instance in simplified fares systems and train control systems. But some revolutionary policy shifts are needed.

The network we envisage requires an emphasis on investment in electrification that has been lacking.

The network must serve the whole nation, not just its more prosperous parts, and be sufficiently appealing to make acceptable imposing increased prices (and taxes) and other measures that will be necessary to restrict short-haul flying and 'long-haul' car journeys – each of which has unacceptable carbon outcomes.

The network must be a fully joined-up system that avoids the idiosyncrasies of locally-set fares systems and timetables, defined separately for 'competing' modes of transport.

And the customer imperative is to provide a railway system that works as a coherent whole, integrated with bus services. New technology will help with ticketing, and in due course, with easier to negotiate ticket and security checks; it will also provide travellers with personalised guidance through complex hub stations. A simplified fares system – we have elsewhere suggested a national zonal design that can be extended to work on feeder transport modes[20] – will be needed too. Friendly and helpful expert staff will still be required. It must become easier for those with mobility difficulties to use the rail system, which lags in this respect with what's on offer from the bus network. A renewed focus on network benefits, with live travel information and support, is long overdue.

These customer needs apply in the heart of a busy network, but also at its – sometimes neglected – periphery, where dependence on connections and low service frequencies can be especially challenging.

The overall strategy has to address the complex geography of places others refer to as 'left behind', and it achieves this through:

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[20] The case for zonal fares can be seen at
http://www.greengauge21.net/general/rail-in-the-north-stepping-stones-to-a-rebalanced-britain/#more-2723

- a comprehensive approach to intercity connectivity (Chapter 3)

- a set of metropolitan regional rail plans to link surrounding towns and ex-industrial areas with growing commercial centres (discussed in Chapter 4)

- selected rail line re-openings to re-connect places with the national rail network (we compare the cases of Corby and Consett in Chapter 5)

- attention to the coasts where rail connectivity is still limited by a failure to provide estuarial crossings that have been provided for the highway network many years ago. New rail estuarial crossings could be highly beneficial for locations such as Grimsby, Hull and Middlesbrough (also covered in Chapter 5)

- integration into the national 'rail' offer of a set of connecting high quality interurban bus services[21] and also demand responsive transport and mobility services (also in Chapter 5)

This need for service integration across the national network is vital and we examine what's needed in turn for intercity travel, for city regions and across the urban-rural continuum, before presenting an overall picture in Chapter 6. This order is adopted not because intercity connectivity, for example, is deemed in need of most attention, but because addressing them in this sequence allows identification of where investment at a higher (regional/inter-regional) level can meet connectivity needs (or at least set the context for) measures taken at a more localised level.

Missing from this approach, it will be noted, is an equivalent plan described in spatial terms for the national highway network, which will continue to be, of course, of huge significance. An unspoken presumption of current policy is that problems experienced by motorists in terms of congestion and unreliable journeys can be ameliorated through a major road investment programme. But the evidence has existed for several decades now that the level of supressed demand for car travel is such that no plausible effort to increase the network's capacity to accommodate it can succeed – other than to permit yet more journeys to be made in congested travel conditions. So, adding to the capacity of the national highway system is not the right way forward. But there is much else to be done, and the implications are that, in overall terms, the road capacity available for powered vehicles is likely to reduce. This is the obvious implication of needing to accommodate active travel at a neighbourhood level and to reduce both the harmful emissions from road vehicles and the continuingly high numbers of deaths and serious injuries from road traffic 'accidents'.

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[21] See http://www.greengauge21.net/the-interurban-bus-network/ March 2018

3. Intercity travel

Whatever is decided more locally (which we cover in Chapters 4 and 5), a strategy is needed to provide for essential (and leisure) travel across the whole country, making sure that no part of the country is excluded.

Based on the assessment set out in Chapter 2, we address the requirement through two key elements:

a. create a much more user-friendly, nationwide, scheduled public transport network, supported by access facilities for active and demand-responsive travel modes and capable of operation throughout without recourse to the use of fossil fuel energy sources; and

b. create a national logistics network that reduces the need for HGVs, with electrified multi-modal trains linking a much-expanded set of distribution centres from which customer fulfilment can be made by fleets of rechargeable electric vans.

Both requirements envisage moving on from today's level of de-carbonisation, so we start there. Much if this depends on switching more fully to electrically-powered transport systems, and this in turn is dependent on a continuation of the good progress the nation has made in switching from coal/oil-based electrical power generation to renewable energy sources. But it also requires a continuing and much-intensified programme to reduce the carbon impacts of transport sector assets, including vehicle fleets, and attention to ways to reduce the carbon impacts of new infrastructure where that is inescapably needed, and of maintenance/renewal activities.

Electrification at a national level

To meet de-carbonisation aims, there is no alternative to electrification of intensively used main line railways. The three busiest long-distance lines – the West Coast Main Line (WCML), East Coast Main Line (ECML) and the Great Western Main Line (GWML) as well as the southern section of the Midland Main Line (MML)) are each now electrified – although there are still key gaps on the GWML (for instance into Bristol and Oxford) and the northern parts of the MML that remain to be provided. Destinations off-route are now generally, but not entirely, served on these lines by hybrid trains with both electric and diesel capability. Such trains will need to be phased out.[22] An ongoing programme of main line electrification has been called for by the Railway Industry Association.[23]

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[22] The Hitachi 800 series trains are mainly capable of deploying both electric and diesel power to reach 'unelectrified' destinations and also capable of switching to electric-only operation in future.

[23] See https://bettertransport.org.uk/government-needs-kick-start-rolling-programme-rail-electrification-say-business-passenger-freight   RIA suggest that the UK commits to a 30-year programme of rail electrification doubling the proportion of the network that is electrified to 80%. This equates to a total of 10,000 single track kilometres or just over 400km (250 miles) per annum.

Even when the 'main lines' which radiate from London are electrified, there are many lengthy onward routes, unsuitable for battery powered or hydrogen fuel cell powered trains, that should be electrified to complete the transformation (see Table 3.1). There also remain a number of strategic cross country and regional connections that are sufficiently intensely served over significant distances and where there is no suitable alternative to electrification (shown in Table 3.2). In addition, the national logistics network also requires a set of further rail lines to be switched to electric power, including key routes to/from ports and the channel tunnel (see Table 3.3).

Table 3.1 Programme for Electrification of Main Line Railways

Corridor/Route	Section	Corridor/Route	Section
Great Western Main Line completion	Wootton Bassett-Bath-Bristol Bristol Parkway-Bristol-Taunton Newbury-Taunton-Exeter-Plymouth-Penzance Swindon-Gloucester Cardiff-Swansea-Carmarthen-Milford Haven Didcot-Oxford-Worcester-Hereford	**West Coast branches**	Wolverhampton-Shrewsbury Crewe/Warrington-Chester-Bangor-Holyhead Carnforth-Barrow in Furness Carlisle-Dumfries-Kilmarnock-Glasgow
East Coast branches	Northallerton-Middlesbrough/Sunderland Doncaster-Hull Doncaster-Cleethorpes Newark-Lincoln	**Midland Main Line completion**	Market Harborough-Leicester-Nottingham-Newark Leicester-Derby-Chesterfield-Sheffield-Doncaster Trent-Toton-Mansfield

Table 3.2 Electrification programme for Cross Country routes and other major schemes

Cross Country	Bromsgrove-Bristol Parkway/Newport Birmingham-Derby Newport-Shrewsbury-Crewe Birmingham-Nuneaton Norwich-Ely Redhill-Guildford-Reading Southampton-Salisbury-Bath	Scotland	Motherwell-Stirling-Perth-Inverness Edinburgh-Kirkcaldy-Dundee-Aberdeen-Inverness
Pan-Northern	Sheffield-Stockport York/Hull-Leeds-Huddersfield-Manchester Leeds-Bradford-Halifax-Rochdale-Manchester-Wigan-Kirkby-Liverpool Newcastle-Carlisle	Wales	Shrewsbury-Aberystwyth
English Heartlands	Milton Keynes-Bedford-Cambridge (EWR)	South East	Basingstoke-Salisbury-Exeter Ashford-Hastings

Table 3.3 Strategic Freight Routes Electrification

Strategic Freight routes	Stowmarket-Ely-Peterborough-Leicester-Nuneaton Peterborough-Lincoln-Doncaster-Knottingley-York Eaglescliffe-Stockton-Ferryhill-Newcastle	Basingstoke-Reading Oxford-Leamington-Nuneaton Oxford-Milton Keynes Liverpool Docks-Preston/Blackburn-Burnley-Todmorden-Wakefield-Church Fenton

This will still leave a lot of the rail network unelectrified. Lengthy routes in Scotland (which is blessed with good renewable local energy sources) will justify being added to the list, and so too could the limited rail network in Northern Ireland (in its entirety)[24]. Some further local lines would be electrified as part of the city-region requirements – see below. But many branch lines operated today by diesel trains would remain unelectrified and they would in future need to be served by a combination of battery powered and fuel cell/hydrogen technologies.

Sustainable Connectivity

A recent analysis of current rail connectivity between the 37 English Local Enterprise Partnership (LEP) areas - and their equivalents in Scotland and Wales - revealed some surprising gaps in city-city rail connectivity. We found that Cardiff was Britain's worst inter-connected of the UK's major cities.[25]

City pairs lacking direct rail connections are illustrated in Figure 3.1. The pattern is one of cross-country (*i.e.* not London), largely longer-distance, north-south connections. Pre-Coronavirus some of these connections would have been provided by regional airlines.

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[24] With a new route added to serve the parts of Northern Ireland that lack a rail services – see
http://www.greengauge21.net/the-uks-2070-transport-infrastructure-requirement/ November 2019
[25] Beyond HS2, Greengauge 21, May 2018

Figure 3.1 City Pairs with weak rail connectivity

Source: Greengauge 21, Beyond HS2, May 2018 (excludes Northern Ireland)

The Contribution of HS2

HS2, as planned, will provide very significant extra capacity including on the existing rail network and improved connectivity between our largest cities. A number of new connections are being considered for HS2 Phase 2. We outline elsewhere how the HS2 connections may be simplified in the Manchester area, while we suggest additional connections for Nottingham.[26]

The HS2 network shape – as a 'Y' – means that there is also scope to add further services to the two network arms that link the Midlands and the North. There is in particular more spare capacity (on current HS2 service plan assumptions) on its eastern limb. This could help accommodate additional cross-country flows.

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[26] See http://www.greengauge21.net/the-rail-needs-of-the-north-and-the-midlands/ May 2020

HS2 should be configured as an 'X' rather than a 'Y' shaped network. This is illustrated in Figure 3.2 below. The new 'limb' of HS2, to the south west from Birmingham, is achieved by means of an additional HS2 junction in the West Midlands; adoption of an expanded Moor Street station (alongside Curzon Street) for cross-country NE-SW trains; and ***an upgrade of the line from Birmingham – Bristol Parkway***[27] (including its electrification and provision for operation at speeds of 125 mile/h) south of Birmingham.

This proposition requires the implementation of the Midlands Rail Hub[28] so that integration of Moor Street and Curzon Street stations which adjoin each other can be integrated for easy passenger interchange. This happens to have the potential to enable the benefits from HS2 to be extended from the North and the Midlands to South West England and South Wales and will improve the business case of both the Eastern limb of HS2 and the Midlands Rail Hub. This really will place Birmingham at the heart of the national high-speed network, rather than on a branch line from it.

Achieving this has implications for the development of local rail services in the West Midlands. The new chords into Moor Street should *not* be used for local urban services[29]; instead the capacity created needs to be used for long distance trains. Trains from the eastern limb of HS2 would use the northern chord to access Moor Street and the southern chord would be used for onward journeys south west towards Bristol. In effect, Moor Street/Curzon Street would replace New Street as the long distance hub station in the West Midlands. New Street, in turn, would become the hub of the city region network of services.

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[27] This additional limb of the 'X'-shaped network is therefore assumed to be an improved existing line, rather a new-build high-speed line
[28] Midlands Hub is the flagship project of Midlands Connect
https://www.midlandsconnect.uk/midlands-engine-rail/midlands-rail-hub/
[29] Services at planned new stations on the 'Camp Hill' line would instead be routed into New Street

Figure 3.2 Changing HS2 from a 'Y' to an 'X'
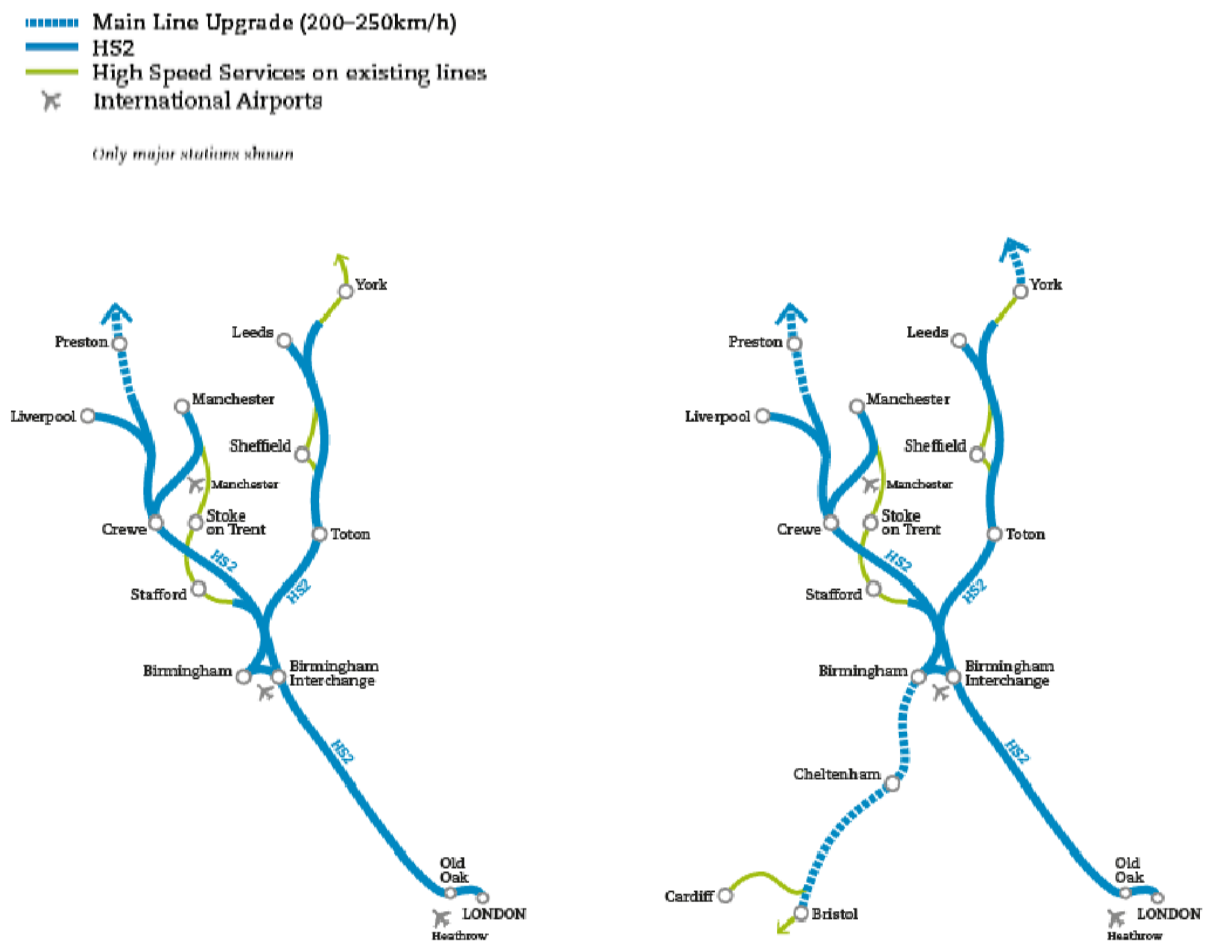
Source: Greengauge 21 Beyond HS2

Further Network Developments

While HS2's spare capacity could help make good some of the connectivity weaknesses identified in Figure 3.1, elsewhere upgrading existing lines is more likely to be needed rather than new high-speed infrastructure – the latter likely only to be justified where capacity constraints (as well as connectivity limitations) cannot be overcome by lower cost (upgrade) measures.

A key area of connectivity weakness is between English provincial cities in the North/Midlands/South Wales with Scotland (see Figure 3.1 above). Some new services – such as Trans Pennine Express's Liverpool-Scotland service – have been introduced since 2018. Others are needed. This points to a need to relieve critical sections of line that will become bottlenecks and uplift line-speeds where feasible and viable, including beyond the northern limits of the new HS2 infrastructure.

We have identified a target of a 3h10 London-Glasgow/Edinburgh rail journey time (with equivalent speed-ups for links between Scotland and provincial cities in England), and believe this could be achieved by 2033-5, allowing a substantial switch from short-haul air travel to rail.[30] This development alone would make a very significant impact on de-carbonising the UK's national transport network.[31]

The staged implementation of HS2 will result in two thirds (or more) of the paths available into London being taken by services from the western side of the country. While some London HS2 services could serve the eastern side of the country, it is not possible to make the comprehensive switch achievable with the west coast. This leads to the view that *upgrading the East Coast Main Line (ECML) should become a high priority alongside implementation of HS2*.

Government has expressed enthusiasm for a *fixed connection (bridge or, as presumed here, tunnel) across the Irish Sea* – specifically between SW Scotland and Northern Ireland. This could make a major contribution once built to reducing UK carbon emissions by reducing the need for short-haul flights and lengthy HGV movements. In an early response, Greengauge 21 set out how such a facility could be implemented and pointed out the need for major improvements to access infrastructure in SW Scotland and argued that, in order to meet sustainability and de-carbonisation ambitions, the link should be in the style of Eurotunnel, with through rail capabilities for fast, long-distance passenger services as well as rail freight supported by a vehicle shuttle.[32] We have added this connection to form part of the UK plan.

We have also looked across the country as a whole to identify where else large-scale network capacity short-falls (of the type that triggered HS2) are foreseeable and so where new lines would be the best approach.

One such corridor is across the Pennines, between Leeds and Manchester, as being studied by Transport for the North and Department for Transport together. Arrangements for transiting across Leeds and Manchester are likely to be critical – and *we conclude a new east-west tunnel is likely to be needed for Manchester*. The topography of the Pennines may be challenging, but the distances are quite short, so the solution is unlikely to be a new *high-speed* route (over 250 km/h).

The Great Western Main Line, together with the relevant parts of the East and West Coast Main Lines, and the connection from Newport to Crewe (the 'North and West' route), need to be enhanced to improve connectivity.

A common theme is likely to be the deployment of new digital ETCS train control technology to optimise train throughput and performance reliability – and potentially to accommodate higher speeds. Where new sections of line are justified to provide sufficient route capacity, the opportunity for operation at speeds in the 125-150 mile/h range will need to be considered. *The East Coast Main line between Doncaster, York and Darlington should be upgraded to 140 mile/h when ETCS is introduced*.

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[30] See Connecting Scotland, Greengauge 21 for High Speed Rail Group, May 2020, for details
[31] As well as providing a better alternative to short-haul flights, Anglo-Scottish high-speed services would reduce the flows of highly carbon hungry long-distance car trips.
[32] See http://www.greengauge21.net/connecting-great-britain-and-northern-ireland/, January 2020

Limitations of network geography combine in some places with an expected resumption of demand growth in the medium/longer term and a complex mix of existing rail services that limits network utilisation. In some cases – in particular the northern section of the West Coast Main Line – this is territory where short-haul flights are an option and where there is huge scope to achieve a switch from air to rail by enhancing the network capability to support more and quicker rail services.

In other instances – the Great Western Main Line along the south Devon Coast being the most crucial example – the risk of ongoing damage from a combination of expected sea level rises and extreme weather events creates an ongoing risk of a whole region being periodically cut off from the rest of the national network, despite remedial measures that have been progressed since the last major 'break' in the rail service in 2014 (at Dawlish). Here, there is at present no alternative railway line **connecting south Devon, Plymouth and Cornwall** to the rest of the country, so the pan-UK plan provides **for re-instatement of a missing inland link**, to ensure network resilience and service continuity in this part of the country.[33]

Developments needed by 2030

Some local capacity pressures and connectivity short-comings that could have a bearing on overall network development are more pressing and arise well before 2040. We would highlight:

● **the need to connect the Black Country to the new HS2 station in Birmingham** at Curzon Street (new rail connections are needed along with an intensification in the use of the Moor Street-Snow Hill cross city connection)

● **the need to resolve the pressures on the Castlefield corridor in Manchester**, where a north-south connection has recently been provided that was originally intended to accommodate long distance inter-regional trains but has largely instead been used for an expanding network of city region services, leading to a localised collapse in train performance.[34] These problems will be exacerbated, rather than eased, by the start of HS2 services into Manchester in 2030, or soon thereafter

● **the role that a western link to Manchester Airport can play** in freeing up the key network constraint at the existing airport terminus railway station and in reducing conflicting train movements at Piccadilly station in the medium term (by 2029). This would be followed by a tunnelled link to free up the Castlefield Corridor westwards to Ordsall from the new HS2/Northern Powerhouse Rail platforms at a 'superhub' style development at Manchester Piccadilly.[35]

While these are all projects in metropolitan areas (which we discuss in the next chapter), they are projects that, while bringing local benefits on a substantial scale, are needed to create a better balanced and better utilised intercity network.

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[33] http://www.greengauge21.net/re-opening-tavistock-okehampton-why-when-and-how/
[34] See RAIL issue 906. P42-48 for an overview of this problem Who can clean up Manchester's mess? Philp Haigh
[35] This scheme would bring multiple benefits: it would allow the 20-minute Liverpool-Manchester (Northern Powerhouse Rail) target journey time to be achieved; it would free up Manchester's Castlefield Corridor to support an expanded city-region rail network (see Chapter 4); it improves the integration of HS2 and NPR in Manchester and would allow some HS2 services from the south to be extended beyond Manchester Piccadilly and continue northwards.

4. City regions

Here we cover the major city regions across the UK, seen by the Chair of the National Infrastructure Commission as being a core part of the national re-balancing project:

> "Urban public transport investment – and particularly in starting to plan now for transformative new projects – remains key to supporting future economic growth and levelling up the country." [36]

In England, Combined Authorities (some with elected mayors) have superseded and encompassed those areas originally accorded Passenger Transport Authority Executive (PTA and PTE) status under the 1968 Transport Act (here referred to as 'metropolitan areas'). Elsewhere in England, some cities and their sub-regions have established combined authorities, while others have not yet made that shift and maintained more informal sub-regional partnership arrangements.

In Scotland, Regional Transport Partnerships have been in place since 2005. Some RTPs are also responsible for the delivery of transport services. In particular Strathclyde Partnership for Transport owns and operates the Glasgow subway and major bus stations across the west of Scotland.

In Wales, the national development framework identifies three regions, including South-East Wales centred on Cardiff. Transport for Wales, working with the local authorities, is however the primary transport planning body.

In Northern Ireland, as in Wales, the focus for public transport planning resides with the Devolved Administration. The Belfast Region City Deal, however, includes responsibility for delivery of Belfast Rapid Transit – a bus-based network for the city region

Metropolitan Areas in England

There is a pressing need to enhance several metropolitan rail networks. Funding programmes that were available to city authorities in earlier years to support the creation of, for example, the Tyne & Wear Metro and Liverpool's 'loop and link' networks[37] no longer exist. Yet without better metropolitan rail networks, not only will economic development be held back, but the benefits of investment in better intercity connectivity will not be fully realised.

As the existing UK examples show, there is no single template for using the conventional ('heavy') rail network to support city region level rail services. The Tyne & Wear Metro network is sometimes regarded as Light Rail, even though it shares tracks with main line services (to reach Sunderland) and does not have any street running sections.

But in general, the opportunities can be classified as following one of three types:

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[36] Letter from NIC Chair Sir John Armitt to the Chancellor of Exchequer Rush Sunak. May 22nd, 2020
[37] Both implemented in the 1970s

1. Creation of a metropolitan area network of services that use existing (or extended) parts of the national rail network. These might follow the characteristics of the *S-bahn systems* in Germany/Switzerland. Typically, services are electrified, and operate on a cross-city basis linking suburbs and outlying areas with each other and the city centre (where connections are made into national rail network services).[38] In Germany these services often started up operations sharing tracks with longer distance trains but, over time, have switched to operating on dedicated tracks

2. *Light Rail Transit* systems. These are also electrically powered, and generally operate over either reserved rights-of-way, or on-street. Some variants ('tram-train') operate also over existing railway lines (as in the national pilot scheme which has extended Sheffield Supertram to Rotherham)

3. *Metros.* These are free-standing fully segregated operations, often with undergound stations. In the UK, examples are few: London Underground, Docklands Light Railway (DLR, although often regarded as LRT) and Glasgow's Subway.

We have identified four city regions where investment to create better cross city rail links (*S-bahn* style) would bring huge benefits, and the specific measures needed. Together, these amount to investments of national significance.

> **Creating four new metropolitan area city region S-bahn style rail services and networks**
>
> The cities of **Birmingham, Bradford, Leeds and Manchester** have established, but inefficient, city region rail networks. In each case, there is scope to extend the reach of the local service network and expand labour markets accordingly. In each city, there are plans or prospects for new fast/high-speed rail links for intercity travel. Effective hub stations in the centre of each city will need to feed local, city-region rail passengers into the intercity/high-speed rail stations – in much the way that London Underground does for London's intercity stations.
>
> **Birmingham** Here there is an under-utilised and unelectrified cross-city route between Snow Hill and Moor Street/Curzon stations – the latter being the city's new HS2 station at the centre of the national high-speed network, yet remote from key poorly performing parts of the West Midlands conurbation. Its capacity should be increased to 22-24 trains/hour and new connections west of Birmingham city centre need to be provided so that services can operate from Wolverhampton, Walsall and Dudley directly and quickly to Curzon Street
>
> **Bradford** has a problematic legacy of two unconnected central stations, making cross-city travel impossible. While the case for creating this link has been repeatedly studied (the first World War put a stop to the original plans), the prospect of a new connection southwards to Huddersfield and onwards to Manchester over NPR, makes the investment case much stronger since there is a prospect of regional connectivity as well as city-region level improvements

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[38] Creating cross-city links can transform the usage of local stations, especially those in inner city locations for which 'short hop' rail travel to the city centre can be of limited attraction compared with using existing bus routes

Leeds is reckoned to be the largest city in Europe without any form of urban transit system, despite gaining Parliamentary Powers to start the construction of a Light Rail Transit system in 1992. While Leeds has a well-sited single city centre station – into which, on current plans, HS2 platforms will be combined – it has few local services operating on a cross-city basis. As a result, platforms are occupied by terminating trains, and the scope to expand services is constrained by platform non-availability.

Enhanced access from the east (potentially with a third track added) and route electrification would allow more services to be operated across the city, (inter-connected from – on the eastern side – York, Selby, and Pontefract (with a re-instated branch line *via* Kippax or via a new link at South Milford)) and – on the western side – Halifax/Bradford, Skipton, Ilkley and Harrogate. This would obviate the need for wasteful extended occupation of platform by terminating services.

In **Manchester**, the Northern Hub has overcome the isolation of Victoria and Piccadilly stations. The newly built connection (the Ordsall chord) was intended for use by longer distance trains across the north of England line but has been over-subscribed, with an unmanageable combination of longer distance inter-regional demand as well as city region flows. As described in Chapter 3, there is an excellent solution to this problem that will free up the 'Picc-Vic' link for the exclusive use of city region services.[39]

In all four cities there is the need, prompted by HS2 (and in the North, Northern Powerhouse Rail) to create new or improved city region rail networks. These would have the shared S-bahn style characteristics: cross-city electrified routes, able to support a number of city region radial lines with high metro-like service frequencies providing access to the new high-speed and intercity networks and reaching places that are in need of a connectivity boost.

Newcastle and *Liverpool* have long-established 'metro-style' operations that operate over some parts of the national rail network. In both cases, consideration is being given to service extensions and these could be of huge value, bringing regular interval services to a number of key destinations. Some of these lie beyond the old PTE boundaries. Merseyrail Electric services could be readily extended to Preston, Skelmersdale, Warrington and Wigan, for example, and Tyne and Wear Metro services to Consett (see next chapter) and Washington.

There are equivalent developments needed in London too, but those we have identified would not carry the high price tag associated with Crossrail 2 (see below).

Major Conurbations

Here we consider examples of some of the other major conurbations in the UK - ***Bristol, Cardiff, Nottingham and Southampton***. In each case, there are local rail services that have been re-instated, with further ambitions for development. But the questions of whether there is sufficient rail network capacity, and good enough access to the city centre are being tackled in different ways.

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[39] See http://www.greengauge21.net/the-rail-needs-of-the-north-and-the-midlands/ May 2020, for details

In **Bristol**, adding extra tracks between Temple Meads and Filton will allow some local service expansion. Re-opening the line to Portishead has been pursued for many years. But there is no rail link to Bristol Airport and large residential areas of the city remain unserved. A programme of busways will tackle some of this problem. But with limited road-space, and the need to allocate more road-space to active travel modes, it may be that it is time to consider more radical options, including use of underground construction to create the missing core of the city's public transport system.

In **Cardiff**, the re-development of the area around the city's main railway station is progressing as are the ambitious plans for the Cardiff Valley lines, some of which will be electrified. These plans also incorporate a limited application of tram-train technology to serve the Government buildings in Cardiff Bay. As with other major cities, further local service expansion on existing lines will quickly run into capacity constraints.

Interestingly, Bristol-Cardiff has a higher level of inter-commuting than Manchester and Leeds, and with the ending of toll charges on the Severn road crossings, this is likely to increase. This illustrates well the importance of close planning collaboration between nearby city planning authorities which might be best facilitated by wider regional and in this instance cross-border planning arrangements.

Nottingham has pioneered in transport policy, securing funding for its LRT system in part through the application of work-place parking-space charging. It is a model that other cities might do well to adopt. The Nottingham LRT system is capable of further expansion including to serve Toton, where a station on HS2 is planned.[40]

Southampton is a key 'node' in the national transport network with lines converging from Bournemouth, Salisbury, Basingstoke and Portsmouth. Local services might be extended if the 'Waterside Line' that links Fawley (where major housing development is expected) is re-opened with the city using a former freight railway line.[41] The main line network uses 'third rail' electrification which is largely incompatible with tram-train type system developments that could improve access to the city centre. As is the case elsewhere (see section on other cities below), it would make sense to examine here LRT systems (or equivalent technologies) that connect with the main line railway but don't seek to run over it. In this case, reconsideration of links with Gosport and Portsmouth might allow the creation of much more direct links by public transport than by road, helping to support a major reduction in car use across the Solent area.

Other Cities

Many other cities across the UK have considered building transit systems over the last few decades, including **Glasgow, Leicester, Hull, Tees Valley/Middlesbrough and the Medway towns**. **Edinburgh** has its tram line in place from the New Town to the airport and its extension to Leith and Newhaven is underway. **Belfast** is extending its 'Glider' network of high-quality bus services[42]. **Cambridge** is progressing a free-standing, potentially 'autonomous' metro system, built underground across the city centre.[43]

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[40] Interestingly, the Toton hub and associated development need not wait for HS2's arrival, but could be fed by new 'classic line' services in the interim, see
http://www.railtechnologymagazine.com/Rail-News/revolutionary-27bn-plan-for-derbyshires-links-to-hs2-hub-station-at-toton-
[41] Initial grant funding for this scheme has been obtained (May 2020)
[42] https://www.translink.co.uk/usingtranslink/introducingglider
[43] https://cam.consultationonline.co.uk/

France is a country that, like the UK, by the mid-1970s had virtually eliminated its first generation tramway networks. But to be eligible for central Government funding, cities needed to prepare plans and unlike in the UK there has been a consistent policy of encouraging new transit systems.[44] First implemented in Nantes and Grenoble in the 1980s, LRT systems are now being introduced into cities with populations down to 150,000. French LRT applications are associated with major improvements to the public realm in urban centres, often with pedestrianisation measures.[45] A similar programme is needed in the UK and it can be used to *prioritise active travel alongside an appropriate bus or rail based zero carbon transit system for all cities over say 175,000 population.*

London

The capital has led the world in its public transport system development. In the next two years, Thameslink service introduction will be completed and Crossrail will open. The two lines, one north-south, the other east-west, meet at Farringdon. They follow on from the DLR (opened in stages from the mid-1980s), Jubilee Line Extension (1999), and the creation of the orbital 'London Overground' (2012). Together Thameslink and Crossrail will be transformational.

The 'next scheme' had been assumed to be Crossrail 2, but it has a relatively poor business case, and decisions on its development are quite likely to be put on hold, pending a better understanding of the likely pattern of post-Covid-19 recovery, since its case centres on housing growth (for which demand might diminish in London or shift to accommodate longer, but less frequent commuting patterns) and congestion relief (which might not materialise as previously anticipated).

Nevertheless, London's transport system has some remaining deficiencies. The new HS2 station at Euston has no connection to nearby St Pancras (HS1) inhibiting through travel[46]; Euston also has no direct connection with Docklands; more generally, connectivity other than with central London is poor across outer London. Few projects have been developed to tackle this (unlike in Paris, for example) and those that exist (such as the Croxley link) have not been implemented. Prioritising these areas would make sense.

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[44] https://halshs.archives-ouvertes.fr/halshs-00069621/document
[45] See https://www.citylab.com/life/2018/05/france-action-coeur-de-ville-urbanization-small-cities/559349/ which reveals plan for the next level of French 'average cities' in the population range 15,000-100,000 population.
[46] An interesting example of a national network deficiency of little consequence to 'Londoners' – and therefore not a priority for Mayoralty-inspired prioritisation, illustrating the value of national level strategies, as well as regional and city-regional plans.

5. The urban-rural continuum

Transport Accessibility and Social Mobility

The national transport system fails to meet the needs of the less well-off and is a factor in sustaining existing patterns of inequality across the country. Better transport connectivity could make a contribution to addressing inequality and rebalancing the UK.

Weekly transport costs can exceed wages for some on very low incomes, and unaffordability restricts the ability of some households to access good jobs and to exercise choice in health and education services.

Evidence that indicates a clear relationship between transport disadvantage and health and well-being (and by implication, poverty) is provided in a recent evidence review carried out for DfT. It concluded that:

> *"There is a more direct relationship between transport, health, and wellbeing than there is with inequality as wider factors are more at play with the latter which can render the potential of transport to alleviate disadvantage an important yet secondary policy lever. With health and wellbeing, the relationship is more directly measurable"* [47]

Older people, job seekers, the young, low income groups and those with disabilities are particularly likely to suffer transport isolation. This is exacerbated by rising train and bus fares in recent years, as well as significant cuts in bus services. For older people, public transport is often a lifeline helping maintain their independence by enabling them to connect with friends, family and their community, whilst also allowing them access to health and social care and other key services. But for other frailer elderly people conventional public transport is not an option and, where they exist, community services can become the fundamental means of avoiding isolation. Those living in rural areas without access to a car can face particular difficulties in finding work due to poor and non-existent transport provision and a lack of affordable social housing located nearer to employment opportunities. This is also the case for young people unable to access training and the elderly and others accessing health care facilities.

Conclusions on parallel research into the link between transport and inequality reveal that it is seen as important, if indirect:

> *"Transport is an integral yet intermediary component of the wider picture of socioeconomic inequality"* [48]

In practice there are three main inter-connected factors which determine whether and how transport links to inequality, each of which has a spatial component:

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[47] See Transport, health, and wellbeing: An evidence review for the Department for Transport
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/847884/Transport__health_and_wellbeing.pdf July 2019
[48] See Transport and inequality: An evidence review for the Department for Transport
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/847884/Transport__health_and_wellbeing.pdf, July 2019

1. Residential location, which is linked to economic status, as higher earners will have more options in both where to live and how to travel (and noting that transport links are a key component of land value and housing costs)

2. How *opportunities* are distributed in relation to housing locations – for healthcare; for education (especially higher education) and training; and for employment

3. How *accessible* the transport system is, in terms of its affordability, its coverage, accessibility and ease of use, including questions of connectivity between different transport modes and options.

The drivers of transport inequality, and its spatial basis, can be examined through the lens of the Social Mobility Index. This index is based on a composite of factors such as access to higher education and the likelihood of successor generations achieving a shift in economic status. It has been calculated for all (391) local authority areas across England, Wales and Scotland. Places with the worst Social Mobility Index scores display a clear (and perhaps surprising pattern) across the country:

● Few are in cities/conurbations

● Most are in the rural-urban continuum, and most of these are former single-industry areas (for example, coal and steel-making)

● Many are in coastal areas

● There is a bias towards the eastern side of the country (in both England and Scotland).

Other measures are used in *Northern Ireland* and it is clear that remoteness from the opportunities and facilities available in the major cities is a key factor driving poor educational achievement, low income levels (and productivity per head) and lack of social mobility. This characteristic is visible across parts of all four nations but is perhaps most marked in Northern Ireland where *a whole swathe, the western part of the province, scores poorly.* This is an area bereft of any rail service (other than the link along the north coast between Ballymena and Derry/Londonderry), so accessibility to city-based services (in Belfast in this case) is poor. With higher-paid jobs most prevalent in cities, provision of a rail service - as we show through case studies – is a key factor. It is a problem in Ulster that cries out for a radical solution.

Of the 40 worst ranking *English* local authority areas in terms of Social Mobility Index scores, three are in NW England, two are rural areas in the West Midlands, and four are in coastal locations in southern/south-west England. *As many as 28 of the lowest ranking areas (70% of the total) are on the eastern side of the country, with a large proportion in the East Midlands and northwards into South Yorkshire.* In England (and Wales), former industrial areas – especially based on coal mining – decades on from the sector's collapse still represent places with poor social mobility: they haven't moved on, despite regeneration efforts.

In *Scotland*, while poor levels of life expectancy are widely spread, so too are (comparatively) good outcomes on education attainment levels which suggests a potentially recovering trajectory. *The six worst scoring places (out of a total of 32 local authority areas) lie on the east coast.*

In *Wales*, the worst scoring places are *either coastal (Conwy and Pembrokeshire) or former mining/industrial areas (Neath-Port Talbot, Blaenau Gwent, Wrexham)*.[49]

There are discrepancies in funding levels visible when comparing the places that score poorly on social mobility with those that are doing better. Government initiatives have tended to be concentrated in a central 'policy corridor' where the approach of building on existing success is figured to be a safe (if unbalancing) bet,[50] leaving areas on the periphery where annual income levels/head are £2,600 below the national average, under-supported.[51] These less supported areas – many of which have experienced until now significant levels of EU-funding, are not usually a focus of Government transport investment, but as we show below, much can be done and should be done to improve connectivity and ensure that nowhere is left beyond the reach of the sustainable national network.

Transport services providing mobility and accessibility

Here, we outline some of *the key transport components that define the accessibility* of such places to the key opportunities and facilities that determine outcomes in terms of income, health and well-being. We then turn to look at different types of areas, post-industrial towns, rural areas and peripheral/coastal areas in turn, using case studies to illustrate key findings.

In terms of the key transport components, there is an eclectic mix of public transport service provision across the rural-urban continuum. Many rail and bus services have disappeared over the decades-long period of growth in car ownership and limited public funding for public transport. ***The pattern of public transport that remains is patchy and totally lacking in coherence***, with bus and rail subject to completely different funding and regulatory regimes. Some quite small places**,** almost as if by chance, retain local rail stations; others – as we shall see – have the fortune to be served by high-quality interurban bus routes. To help mitigate this geographical happenstance, there has been a degree of innovation, with increasing attempts to use digital technology to make demand responsive services a viable option. But there is little preparedness for the carbon reduction challenge ahead, and continuing financial support is going to be needed in the post-Covid-19 recovery period if services are to survive.

(i)   Inter-urban, longer distance and express bus services

More people travel by bus than other transport mode, but journeys are generally short, 5 miles on average outside London[52], and the reality is that most of them are made in urban areas. Rural bus services have been cut back as available resources to fund them have been reduced. Where they exist in deeper rural areas, bus services are often far from daily and rarely convenient, although often designed for half or quarter day shopping trips. Ridership has declined as a consequence (and is in many cases a cause of service of withdrawals)[53].

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[49] See Greengauge 21 report Annex A in Beyond HS2, May 2018 for a full tabulation of English/Welsh/Scottish social mobility scores at local authority level

[50] https://www.cornwall.gov.uk/media/39213175/britains-leading-edge-booklet-july19.pdf

[51] Places that have come together under the Leading Edge banner are: Cornwall, Cumbria, Dorset, Durham, East Riding (Yorkshire), Herefordshire, Isle of Wight, Isles of Scilly, Lincolnshire, North Yorkshire, Rutland and Shropshire.

[52] See p17 in
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/823068/national-travel-survey-2018.pdf

[53] *Ibid*: down 29% 2002-2018

In contrast, many interurban bus routes – linking towns together, some of them with services labelled as being 'express' – are today prospering and are generally run on a commercial basis. In general, these services have good frequencies through the day, are fully accessibility for wheelchair users, and offer free wi-fi. They are a much under-rated part of the national public transport system – a hidden asset that, as well as connecting key towns and cities, also benefits the smaller rural towns and villages through which they pass.[54]

Case study - the TrawsCymru network

In Wales, nearly one in four households do not own a car or van. Buses are therefore especially important in addressing inequality of access to key facilities. The median income of people working full time who use bus to travel to work is £330 per week compared with the £460 per week for car users and £500 per week for train users.[55] Women are a third more likely to use the bus than men, and young people, older people and disabled people also much more reliant on the bus than others.

The TrawsCymru network in Wales is a good example of the provision of a planned (and tendered) interurban bus network. Serving a largely rural area, the network cannot be operated without grant support, which is provided by Welsh Government.

The network is operated by several bus companies under a unified TrawsCymru framework. The current incarnation is relatively new (the first route was introduced in 2011), and it now offers a regular weekday and Saturday service across six corridors, with regular Sunday links on two of the routes. The routes that comprise the network all terminate at places which remain on the rail network and serve some key towns en route which are also rail-served. Service frequencies and individual bus features vary, though all buses feature the same branding. TrawsCymru offers through tickets for local bus and National Express services, with an aim to offer greater fare integration with rail services in the near future. With an average subsidy per passenger journey of £0.42 as of 2016/17, the T4 (Newtown/Hereford to Cardiff) service requires the least amount of revenue support, since it as able to operate commercially between Merthyr Tydfil and Cardiff. Recently introduced route T6 (Swansea-Brecon) is the most heavily subsidised route, with an average subsidy per passenger journey of £1.23.

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[54] See http://www.greengauge21.net/the-interurban-bus-network/ March 2018, for a full nationwide review of interurban series and the scope for their development
[55] See https://gov.wales/sites/default/files/publications/2017-10/review-trawscymru.pdf August 2013

(ii) Mobility Hubs - joined up thinking

A pre-requisite to helping overcome poor social mobility performance is a truly integrated public transport system that works for passengers across modal boundaries (between bus and rail in particular), and has targeted concessionary fares and financial support for service provision, including through morning and evening peak travel periods to provide ready access to education and employment opportunities.

This implies a need for coordination of services across transport modes. This was a feature of urban planning following the 1968 Transport Act but was made harder to achieve following the deregulation of all bus services (except in London) in the mid-1980s. Nevertheless, better interchanges between bus, light rail and rail services *have* been provided in the years since, including across Greater Manchester and elsewhere. Now, a wider concept has emerged: mobility hubs.

Political decisions around policy areas like health, education and regeneration all have significant implications for transport equality. In terms of improving connectivity for social and economic benefit – perhaps one of the most instinctive solutions is to tie things together in policy and planning terms around the concept of mobility hubs. Towns prosper when well-connected into the rail network, bringing together labour markets and access to health and educational facilities, with stations acting **as mobility hubs including connecting buses, bike hire, walkways, cycle ways, and provision for electric car charging**.[56] This is where local authority transport, climate and air quality strategies, and policies on sustainability and social inclusion (and on addressing the needs of young people who are not in employment or training – so-called NEETS) can cohere at a local level.

A key advantage of mobility hubs identified in earlier work, is that they provide, on a small and local scale, the advantages seen in major hub developments such as St Pancras station in London: a chance to help generate foot-fall for local businesses.[57]

(iii)   Demand Responsive Transport (DRT)

There is a relationship between income and type of transport used. Those on lower incomes use buses more than those on higher incomes, and those on higher incomes use cars and trains more than those on lower incomes. Demand Responsive Transport (DRT), and other services have come on stream in the last few years to help address transport inequality.

Some of these have grown out of previous community transport dial-a-ride services for older people; others have been developed as part of integrated public transport networks. Lincolnshire's Interconnect services have combined fixed route commercial bus services with subsidised DRT services linked to them from settlements away from the main routes. The Welsh Government's "*Bwcabus*" services have combined flexible and fixed route networks.

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[56] See https://como.org.uk/wp-content/uploads/2019/10/Mobility-Hub-Guide-241019-final.pdf
[57] See Interurban Buses *op cit*

New technology has led to new versions of DRT appearing. Some of these have been set up by established operators, including the ArrivaClick services; Stagecoach and Go-Ahead have also trialled such services. There have been other kinds of DRT, including shared taxis for taking people to work, and community-run minibuses. There have also been targeted services for commuters, run under contract to major employers in areas with limited conventional bus services. With Covid, there have been experiments with new kinds of demand-responsive "microtransit" services, using data from local authorities, hospitals and other employers.

Much of this is still experimental. It is however clear that, even in normal circumstances, most such services are unlikely to be (conventionally) commercial. They may, however, by bringing together different flows and funding sources, provide a network or services that can meet a variety of local needs. Previous trials of "total transport" services, including pilots in English rural areas 2015-17, suggest that the DRT world is very varied, and we include some examples here to illustrate the range of services currently available. They offer a potentially valuable complement to existing scheduled public transport services, but history suggests that they need a significant level of management oversight if they are to survive and prosper.

Transport technology is potentially helping drive a significant 'leap forward' – with pilots of 'on demand' buses and taxis already growing in popularity, particularly among younger populations. The use of car- and ride-sharing has increased similarly over the last 5-10 years. However, almost all the trials of these new technologies are focused on cities – with the aim of reducing congestion and pollution and building on the 'smart city' agenda.

DRT case study (1) - Tandem in Northamptonshire

Tandem is one of the few start-ups focused on developing solutions exclusively for towns, smaller cities and more rural areas: places where traditional public transport has struggled for decades. [58]

Local taxis and minibuses solve many transport needs, but their price renders them unaffordable for regular trips for most people. So Tandem uses technology to identify passengers who want to make roughly the same journey at roughly the same time and matches them together to share a taxi or minibus. Each passenger pays for just their seat in the vehicle, so the price is close to that of local public transport, but on routes where buses don't run, or at times where they don't. This approach is borrowed from services seen in big cities with the business and operating model fundamentally re-imagined to thrive in smaller geographies.

Tandem's core services focus on taking people to work - especially to sites where public transport isn't an option at all. In October 2019, Tandem launched a service for residents of the town of Wellingborough to get them to the industrial estates at nearby Thrapston and Raunds (small towns that lost their railway link in the 1960s). Despite being home to a range of multinational employers and just 20 minutes away by car, there is no viable public transport option for either town. With a quarter of households in Wellingborough not owning a car and more still having only one car for multiple adults, this has an adverse impact on people's ability to take on and maintain jobs.

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[58] https://www.ridetandem.co/

In partnership with two local taxi companies - with vehicles of between 4 and 8 seats - Tandem's service now offers shared journeys from Wellingborough to Raunds and Thrapston. Passengers pay the same price even if there are only one or two people on a particular journey. However, because the service only operates for the start and finish of key shifts, Tandem reports seeing an average of over three-quarters of seats filled in each vehicle in under six months from launch.

The service is open to anyone, but employment agencies play a key role in promoting the service to potential passengers, which has enabled passengers to take on jobs they otherwise would have had to turn down. These include people like Dan, 26, who works for a logistics company: "*I literally couldn't get to where I work without Tandem. I don't have a car, so I just would have had to turn the role down*". Tandem is now working with local authorities, housing developers and other employers to identify other locations where its solution can be applied.

DRT case study (ii) - Tees Flex

Tees Flex is a new Demand Responsive Transport service from Tees Valley Combined Authority area and comprises three separate geographic zones: one based on Redcar, Saltburn and Cleveland; another on Hartlepool; and the third on Darlington and Stockton.[59] It's a three-year pilot funded by the Authority and operated by Stagecoach with nine Mercedes Benz Sprinter EVM Citylines minibuses in a blue 'Tees flex' livery – the brand name chosen for the scheme. Primary Destinations comprise 20 small hamlets in Redcar and Cleveland, four in Hartlepool and 23 in Darlington and Stockton. These small communities are almost all completely without existing bus routes, so Tees flex opens up welcome connectivity to difficult-to-serve rural areas. Destinations are places like Guisborough Market Place, Redcar Station, Saltburn Station and main retail centres as well as Hartlepool town centre and key retail and transport destinations in Darlington and Stockton.

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[59] https://www.letsgoteesvalley.co.uk/ways-totravel/bus/#:~:text=Tees%20Flex,service%20doesn't%20already%20exist.

Photo: Northern Echo

(iv)   Further recent innovations

Examples are emerging through the Covid-19 outbreak of innovative travel solutions that may not be scale-able or profitable but are meeting a key community need. Whilst the current collapse of demand for public transport is a short term phenomenon, with an expectation that demand will return probably to less than previous levels but then continue to grow again, it is interesting to reflect on some "citizen focused" models. These may have longer term influences on travel patterns and contribute to a wider community-centred agenda. We have two case studies.

Todmorden Bike deliveries

Todmorden is a market town in the Upper Calder Valley in Calderdale, West Yorkshire, about 17 miles from Manchester, with a population of just over 15,000 people. During the COVID-19 outbreak, when the 'stay at home' instructions were issued, this semi-rural area with people living on the hillsides around the main roads, and in the hamlets and farmsteads on the surrounding Pennine moorland, became dependent on delivery services – pretty much overnight – with many of these delivery services unable to meet the demand. A local team of volunteers, using hired E-cargo bikes, very quickly established a delivery service which in the first 11 days completed 99 deliveries in 150 miles. As the service progresses the team is keeping tabs on the data, and so eventually will be able to compare their service with more urban services as well as to evaluate the carbon and air quality savings for the area.

South Yorkshire Wheels2Work

South Yorkshire Wheels2Work was in place pre-Covid but potentially has added relevance in the post-Covid world. The scheme loans motor scooters to people who live in South Yorkshire and have difficulties getting to work or training or college due to a lack of suitable public transport. Lease fees are £80 a month and include all the training and equipment needed to get on the road, including comprehensive insurance and a full maintenance package. Basic scheme criteria include living in South Yorkshire: being at least 16 years of age, a firm offer of work, or training or a college place; or already in work, training or at college and struggling to get there, and no suitable public transport for the journey. The scheme has helped 750 people get to work, training or college in the last three years. *"There were just no buses that could have got me to work on time and having been out of work for over a year, I was desperate to accept the job."*

(v)   Re-opening/building new railway lines in remoter/rural areas.

This is likely to be the most expensive solution of those discussed in this section. But for some places, while local measures such as DRT can help, the level of remoteness is so severe that a more fundamental solution is needed. Creating new rail links is needed where distances to cities with higher education and a mix of employment prospects are too substantial – and therefore too slow to make same-day commuting possible – by road-based travel arrangements. It is a subject with a new grant support regime from DfT.[60]

We highlight two examples here:

- Re-establishing a rail link between Portadown to Armagh, Enniskillen, Omagh and Derry/Londonderry to open up a substantial part of rural Northern Ireland (and perhaps cross border links for instance to Sligo as well) to create access to Belfast (and Derry/Londonderry)

- Re-establishing a north-south rail link Peterborough-Boston-Louth-Grimsby to re-connect east Lincolnshire with the national rail network.[61]

Places needing enhanced connectivity

Here we move on from the range of transport services that exist across the urban-rural continuum and turn to consider the types of place that score most poorly on social mobility and their need for enhanced connectivity.

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[60]

https://www.gov.uk/government/publications/re-opening-beeching-era-lines-and-stations/re-opening-beeching-era-lines-and-stations update of May 23rd, 2020
[61] See Beyond HS2 Greengauge 21, May 2018

We consider this place-base assessment under three headings:

- post-industrial areas

- rural areas

- peripheral/coastal areas.

(a) Post-industrial Areas

Consett and Corby are both ex-steel-making towns which today have markedly different job markets and connectivity. In many respects they have performed very differently since the loss of their key industry in the 1980s.

Case study (i) Consett

Consett is a town in County Durham about 15 miles south-west of Newcastle upon Tyne, with an estimated population (2018) of 25,700.

Steel dominated Consett's economy for 140 years, but in 1980 the steel works were closed with the loss of 3,700 jobs and many more from the knock-on effects in ancillary industries. The unemployment rate became double the national average, peaking at 36% by 1981, around three times the national average. The steelworks site was transferred to the Local Authority, and the council took the decision in partnership with development company Dysart Developments Ltd, to create the Project Genesis Trust, a registered charity responsible for the regeneration of the site and bringing housing, employment, education, environmental, leisure and recreational benefits for the people of the area. This went some way towards repairing the damage to the local economy, and unemployment came down to the national average, although this was also partly due to outward migration and economic inactivity due to long-term illness.

Alongside the public sector, small and medium-sized businesses now provide jobs in the area, through companies like *Phileas Fogg* and *The Explorer Group*, the UK's second-largest manufacturer of caravans.

There have also been several new housing developments on the former steelworks site and surrounding areas, along with retail and fast food outlets. More recently the *Project Genesis Trust* has secured investment of nearly £360k from the Rural Growth Network (RGN) to develop bespoke business premises and offices, including the development of a new bus depot for Go North East. When it opens, it will be the centre of Go Ahead's operation in NW Durham.

This extended recovery is increasing Consett's attraction as a commuter town within 15 to 20 miles of Durham and Newcastle.

Case study (ii) Corby

Corby is situated in the heart of England where the A43 (Oxford to Stamford) and A427 (Peterborough to Market Harborough) roads meet. The town grew rapidly around steel manufacturing, drawing workers from Scotland and Ireland from the 1930s until 1980 when the end of production was formally announced. Large scale unemployment followed. However, Corby has gradually recovered helped by significant investment – initially Enterprise Zone status and European Funding and most recently enhancement of the retail offer, with public realm improvements, the 'Corby Cube' and a new railway station – see below. Today Corby has a population of around 70,000 up 30% since 2000 and, while once known for decline, is reputedly now the fastest growing town in England[62]. Planned growth across Northamptonshire will increase demand for travel putting particular pressure on town centres and inter-urban routes connecting the main towns in Northamptonshire.

A contrast in rail service provision

Corby lost its passenger rail service in 1967 well before the closure of the steelworks in 1980. A local shuttle service to nearby Kettering operated for a brief period – 1987-1990 . There was then a long wait to 2009 for a brand new station, with new and much better rail services and facilities for taxis buses and park and ride. Since then, the route has been the focus for further investment, with double track re-instated and electrified, ready for the start of a new service to London St Pancras (scheduled for December 2020).

Corby railway station on 23 February 2009, the first day of train services at the new station.
Photo: By AmosWolfe

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[62] https://inews.co.uk/news/the-economist-why-corby-is-the-fastest-growing-town-in-england-502960

Consett, on the other hand, having lost its passenger rail service in 1955, has never regained it, despite there being a significant travel market to the Metro Centre and Newcastle. A campaign was launched recently by the North West Durham MP to carry out a feasibility study examining the local transport needs and demand, with a view to a new rail link between Consett and Tyneside.

Conclusion: a tale of two towns – the same industrial loss, but different connectivity levels thereafter

The progress of the two towns reflects the differing economic geography of North East England and the south Midlands. Corby has the advantage of being relatively central, within the logistics sector 'golden triangle', making it a good strategic location for business, with improving road and rail links. While the economy is developing well (the urban centre has seen £500M of investment in the last ten years), growth in employment has not kept pace with housing growth: unemployment remains around the national average.

Corby's economy is, nevertheless, very dependent on low wage jobs in the food manufacturing and logistics sectors, which contrasts with its hinterland across Northamptonshire where jobs in information and communications, finance and insurance, and professional and scientific services have demonstrated the greatest growth in recent years.

Consett has also experienced significant change, in terms of employment and population size, but economic growth has remained weak. Its road link to Newcastle is reasonably direct, but to the south it is a long stretch to join the A1(M). Transport connectivity as an economic driver is something that is of growing interest in the region.

The two former steel towns, both with a strong local identity and sense of community, have shown differing patterns and rates of recovery which in part can be put down to differences in economic geography. There are also differences in transport connectivity and the demand that can support a restored rail service (Corby-London) is much harder to bring about for Consett (a re-instated link to Newcastle). But transport connectivity is a critical variable for both places, and Corby has a head-start.

Case Study (iii) Community Transport in South Yorkshire

Community Transport services in South Yorkshire are available for those who find it difficult to access standard public transport due to disability, age and frailty, or geographic isolation: people who would otherwise be unable to travel or would struggle to get to a bus stop in communities that grew up around the mining and iron and steel making heritage. The services pick people up at their door and for a small charge take them to a pre-booked destination using accessible minibuses. The services operate across the urban-rural continuum.

South Yorkshire Passenger Transport Executive budgets £1.7m to support the services and also provides some vehicles to the operators for use under a *Door2Door* brand, in addition to the operators' own fleets.

All the operators have non-profit status, including Barnsley Dial-a-Ride, Doncaster Community Transport, Rotherham Community Transport, and Sheffield Community Transport. These operators offer three journey types:

- ShopperBus – picks people up from home on a predetermined day and takes them to and from a shopping location for a flat rate of £2.50 return

- Dial-a-Ride – picks people up from a location and transports them to a destination of their choice. Fares start from £2.50 for up to a mile

- Group Travel – journeys booked by groups, using their own or a CT driver; can consist of a whole eligible group going on a trip, or individuals picked up separately to go to one destination, e.g. a lunch club. Costs vary according to whether organisations provide their own driver, and the length of time and mileage of the hire.

There are also two local operators in Sheffield – Manor Community Transport and Transport 17 which offer group travel in the Manor and S17 post code areas. The operators also provide other *Door2Door* services outside of the agreement with SYPTE. These include volunteer car schemes in some districts and a 'Dial-a-Ride+' type offer which for a higher fare has guaranteed bookings, guaranteed timeslots, and daily or weekly repeat bookings (*e.g.* for regular health appointments or day centre visits).

To use the services, people pre-register (for free) as members and pre-book their journey between a week and at least a day in advance of travel on a 'first come' basis. On average registered users travel twice a week. Journeys are not eligible for concessionary travel. Fares are reviewed periodically, but as the services are subsidised, are kept below the cost of equivalent taxi journeys. The vehicles are fully wheelchair accessible and as such fill an unmet need in some districts. All the vehicles have powered rear lifts: drivers help users to board and alight, and unload walking aids and wheelchairs etc. Where passengers have shopping, drivers will help them to their door with this. The vehicles carry assistance dogs at no cost (but not other dogs at all). Carers/friends can travel with the person booking but are also charged a fare.

(b) Rural Areas

The impacts of transport poverty are perhaps most obvious in rural areas, with incomes often lower, and transport costs higher, reflecting low rural population density and longer journeys which makes it harder to run public transport. But rural areas are also known for being self-reliant and could become "innovation hotspots". Here we consider two case studies.

Case Study (i) Cornwall

 Cornwall's dispersed settlement pattern reflects the original pattern of its traditional industries - mining, fishing and agriculture, each of which have faced long-term decline. Approximately half the population live in towns and villages with fewer than 3000 people. More centralised employment and services have inevitably led to a greater need to travel to get to work, shop and for leisure as well as to access health care and education and training.

Deprivation is a persistent problem – with some neighbourhoods within the worse fifth in England.[63] This is particularly evident in the west of the county, with low car ownership, low wages, high unemployment and high crime rates, and a higher call on health and social care services. Cornwall's reliance on the car is of significant concern to policy makers in the face of the need to address climate change.

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[63] See Cornwall Council, Community Intelligence 'Cornwall's economy at a glance' (2011)).

While the rail network provides a crucial link to the rest of the country, the network west of Exeter has seen very little investment, and rail links to London and Bristol are vulnerable to surface and tidal flooding and sea level rises. Cornwall's internal connectivity and with the rest of the country is increasingly vulnerable to the predicted impacts associated with climate change.[64]

Transport for Cornwall is a partnership between Cornwall Council, Go Cornwall Bus and other local public transport providers. In 2015 Cornwall Council signed a Devolution Deal with Government to gain greater powers of governance over public transport, and successfully secured £9.5m Local Growth Funding from the Cornwall and Isles of Scilly Local Enterprise Partnership to match its own £2.9m. This was earmarked to provide improvements for passengers such as upgraded waiting facilities, new vehicles and real time information displays in bus stops across the county. From 2017, successful partnership working has encouraged significant investment of over £34m from bus operators First Kernow and Go Cornwall Bus in the provision of brand new, low emission buses to operate the network, many with WiFi and USB charging.

Working with Plymouth City Council, Cornwall Council has also received funding from Plymouth's Transforming Cities Fund to upgrade roadside waiting facilities and improve real time passenger information at bus stops and rail stations on routes into Plymouth in south and east Cornwall. It has been able to further enhance information and integration between bus and rail through a successful bid to GWR's Customer and Communities Improvement Fund (CCIF) which has facilitated the installation of real time passenger information screens at mainline stations throughout mid and west Cornwall, informing passengers of opportunities to connect easily between bus and rail. Cornwall has as a result experienced a 19% increase in bus patronage.[65]

With regard to ticketing, Cornwall also appears to be leading the way in making progress across a wide rural area. It has secured contactless payment systems on all buses providing services in the county and plans to introduce an all-operator (rail and bus) ticketing system, with separate products tailored for residents and visitors, and a regular interval timetable designed to allow good connections between rail and bus.

Case study (ii) Jersey

Another interesting example is provided by the island of Jersey. The island's *LibertyBus* is a service delivered by *CT Plus Jersey* under contract to, and in partnership with, the Department for Infrastructure at the Government of Jersey. *LibertyBus* is not a typical bus operator: it is operated as a social enterprise, meaning that it exists for public benefit.

LibertyBus aligns its support to the community in Jersey to the following wider community benefit objectives:

- Access to local facilities - Helping people to get to the shops, doctors' surgeries, community centres or other facilities that are important to them.

- Physical and mental health - Helping people get out and about, stay active and remain independent.

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[64] See https://www.cornwall.gov.uk/media/22080715/evidence-base-connecting-cornwall-final-v10-24-06-11.pdf

[65] See https://www.cornwall.gov.uk/transport-and-streets/transport-policy/local-transport-plan-connecting-cornwall-2030/

- Family, friends and relationships - Helping people stay connected with those that they care about, avoid loneliness or isolation and have a good quality of life.

- Citizenship and community - Helping people to have an active role in their community, getting involved in things or volunteering

- Employment, training and education - Making sure that people can access jobs or take part in training and education.

- Income and financial inclusion - Helping people to save money or to make the money they have go further.

- Conservation of the natural environment - Helping people to play their part in protecting the environment, getting people out of their cars, reducing emissions and tackling climate change.

In 2018 there were nearly 5 million passenger journeys on *Liberty Bus* – an increase of 38% since the service became a social enterprise in 2013. Surveying Jersey communities, it was found that one third of concession pass holders said that their access to facilities like shops, doctors' surgeries, hospital, church and so on – essential ingredients for living an independent life – had improved as a consequence of using the bus service over the last year.

A quarter of concession pass holders said using the bus had made them feel healthier, with almost one fifth of the over 75s (18%) saying their personal mobility had improved. On access to employment – the survey asked whether the service enabled people to access work (bearing in mind 13% of 16–24 year olds in Jersey are NEET (Not in Employment, Education or Training)). The survey showed that almost three out of ten (28%) young adults say they rely on the bus service to be able to do so. In fact, in the younger age groups, over one fifth (21%) of 25–34 year olds couldn't access work without the bus, dropping to 7% of 55–64 year olds. 42% of disabled people new to the bus said their access to employment had improved.[66]

(c) Peripheral and Coastal Areas

There is a distinct concentration of economic under-performance in coastal areas, attributable to loss of traditional (if sometimes seasonal) employment, remoteness and in some cases 'social dumping' of problem families re-housed from metropolitan centres.

We start with an example where downward spiral has been reversed in recent years. Margate is on the north-east tip of the county of Kent, and like so many British seaside resorts, has experienced significant economic decline since the 1970s.

The impact that the new HS1 line between London and the Kent Coast has had cannot be underestimated. Whilst the cost of London living has a bearing on this story of recovery, the connectivity that this new line has brought to Margate and the surrounding coastal towns has significantly helped improve the local economies of the entire county.

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[66]See https://www.libertybus.je/social-enterprise.

Before the high-speed connection opened, it took 2h20 to get to London, which made it non-viable as a commuting option. In 2017 alone, 1,830 people moved from London to Thanet, the area encompassing Margate, Broadstairs and Ramsgate, with just 760 people moving the other way. Contrast this with a town like Blackpool, which has been described as a "hotspot" for inequality and mortality, but the issue of connectivity isn't discussed as a contributory factor.[67] The negative impact of Blackpool's peripheral location is presumed, it would seem, to be taken as a given, along with the connectivity disadvantages it entails.

Blackpool has since benefited from the electrification of the North Fylde Line in 2018, but access to London, Scotland, the West Midlands and other large conurbations is still poor and is recognised by the local council as a key consideration for those who might want to live, work or invest in Blackpool.

Blackpool might be considered just another poorly performing northern town. But Warrington, the largest town in Cheshire and with a pivotal location away from the coast prospers. In terms of GVA change, between 1997 and 2013, Warrington was ranked as the eighth fastest growing place in the UK[68]. It continues to be one of the UK's most successful places economically and considers itself "one of the key engines of growth" in the Northern Powerhouse, citing "reinforcing and enhancing Warrington's connectivity" as a key driver of success.[69]

Other peripheral counties have been pro-active in addressing connectivity needs with limited budgets. Lincolnshire has a menu of community car schemes, dial a ride and wheels to work scooter hire[70], and Norfolk runs a community transport scheme using cars and volunteer drivers to get to essential health, social and well-being services.[71] Norfolk also has a ring and ride flexibus service with no fixed routes serving three locations – Harling, Wayling and Wymondham areas.[72]

Conclusion

The varied geography across the urban-rural continuum has prompted the creation of a rich variety of transport services. In turn, these services seem to be dependent on a wide range of funding sources. Many are highly localised and precarious, operating outwith the financial support packages that have been provided to the main bus and rail companies.

Efforts to get the very best use out of these services and to ensure that they can function together to provide more than the most basic connectivity rests on local authorities, whose resources deployed in this important area of coordination have not been seen as a priority for central government support. The levelling-up agenda brings a new perspective. People living in remote, peripheral and 'left behind' areas pay an economic price through lack of access to job opportunities as well as a social and health well-being price through isolation and inaccessibility to key services. This impacts perhaps most severely on post-industrial and peripheral coastal towns and deep rural areas. Whereas some (ex-steel town Corby and coastal town Margate, for example) have turned the corner and grown, others have struggled, even with early financial support packages. In many places, the regeneration task is far from complete and improved connectivity should form part of the national and local policy response.

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[67] See https://www.ifs.org.uk/inequality/ - Institute for Fiscal Studies, Inequality Review, 2019
[68] See http://www.greengauge21.net/wp-content/uploads/REVISITING-HIGH-SPEED-NORTH-.pdf
[69] See http://warringtonandco.com/wp-content/uploads/2020/02/WARRINGTON-MEANS-BUSINESS-2020-21.01.20-1.pdf
[70] See https://www.lincolnshire.gov.uk/public-transport/community-transport
[71] See https://www.norfolk.gov.uk/roads-and-transport/public-transport/community-transport
[72] See https://www.norfolk.gov.uk/roads-and-transport/public-transport/buses/flexibus plus other initiatives

In some instances, cities with a good range of job and higher education opportunities are tantalising close, yet still too hard to access for those on low incomes. In others – and this seems to be true of many (but certainly not all) coastal towns that relied typically on fishing industries and domestic tourism – transport network weaknesses stem from a failure to provide the good inter-connectivity that is needed to attract new businesses.

6. Conclusions

Government Policy Objectives

Most investment into public transport goes into the rail sector. The HS2 and Northern Powerhouse Rail programmes – if implemented in full – will go a long way to redressing the decades long effects of disinvestment in the rail sector while it was a nationalised industry under tight HM Treasury year-on-year financial controls. This had the effect – thanks to astute management by the British Railways Board – of stabilising annual rail passenger volumes using a steadily retrenched asset base.

The current Government policy drivers behind the case for major rail investment were set out succinctly recently:

> "…its potential to redistribute opportunity and prosperity across the country, provide much needed future rail capacity, and support the 2050 net zero carbon objective…"[73]

While it is true that regional inequality is now little different to where it was in 1900 it is much more marked than it was in the 1960/70/80s, having deteriorated sharply since 1990 – a different but equally valid headline from the one selected as a heading by the Financial Times (see graphic below).
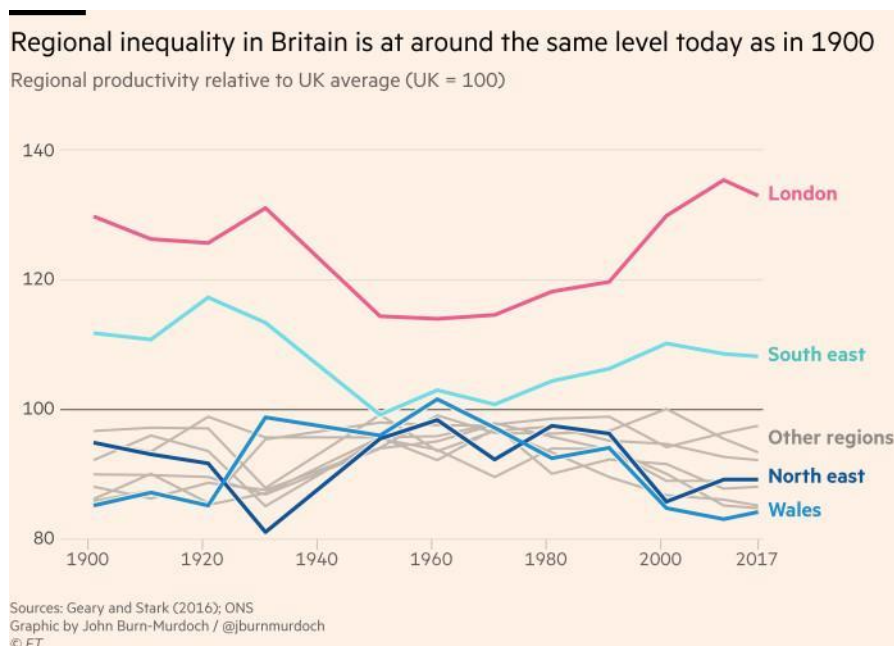
Source: Financial Times May 2020

There are many policies that will influence the way in which opportunity and prosperity can be redistributed across the country. The transport attributes of relevance are the capacity and connectivity of the network.[74]

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[73] Ministerial Foreword to the HS2 Phase 1 Full Business Case, April 2020

Essentially, providing improved connectivity is the critical response needed here, along with providing the capacity at key pinch points to achieve it. Suitable transport service is one of three key policy levers identified by the Social Mobility Commission outgoing Chairman Sir Alan Milburn as being needed to address weaknesses in social mobility.[75] How this mechanism might work in practice was explained in a recent report[76]:

> "There is more to this than simply laying on extra train services or reopening old branch lines. There must also be adequate capacity to accommodate these services across the rest of the regional rail system and especially in congested locations like city centre stations. And the labour market effects are subtle of course. No one expects unskilled workers in Blackpool to commute to jobs in Manchester. But more skilled workers can make the journey whether they are attracted to places with weaker economies by lower house prices or more likely because they have existing personal or family connections with these places. And once there, their wages will inject spending power into the local economy creating jobs for those on lower wages. This is exactly the pattern which has emerged in the more successful US cities, where successful economies create well paid jobs and these in turn help to create a buoyant local service economy."[77]

The *carbon reduction imperative* is going to be the most dominant driver of transport sector policy through the 2020s and beyond and consideration of transport connectivity and capacity. It is of central relevance to each of the proposed definition of the national sustainable transport network and the required revolution in how the nation supports travel and freight transport in the years ahead.

Most modes are expected to decarbonise; the question is how fast they can do so. The DfT currently aims to stop the sale of petrol- and diesel-only cars and remove diesel-only trains by 2040. Although UK car efficiency has improved in some years, the increased popularity of SUVs (larger and heavier) has meant that, overall, new car emissions have actually *increased* every year since 2016, more than offsetting the rise of Electric Vehicles (EVs). It is also the case that Autonomous Vehicles (AVs) currently have a much higher energy consumption than those driven by humans. Although this uplift may decline over time, AVs would still put significantly greater pressure on the grid than has been modelled to date.[78] It is clear that decarbonisation will not be straightforward and there are perverse effects arising from technological advances and human behaviour to be faced along the way.

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[74] It could be said that operational reliability and resilience (for example to adverse weather events, climate change) are of even more fundamental concern. Here, we make the assumption that when discussing 'capacity', it comes with the qualification that capacity provision over the relevant parts of the transport networks must offer high levels of reliability and resilience.

[75] "Finally, Milburn stated that the worst places to grow up in, in terms of a lack of social mobility and access to jobs, suffer from a peripherality problem. Commuting times are one problem, the SMC report found people in coastal, rural and former industrial areas are burdened with commuting times nearly four times than those in cities. Millburn was adamant that these problems could be combatted by Governments using investment in a nuanced, proactive way" - quoted in https://www.policyconnect.org.uk/news/delivering-social-mobility-what-kirkup-and-milburn-had-say

[76] http://www.greengauge21.net/revisiting-high-speed-north/

[77] See Moretti, E, The New Geography of Jobs, 2013, Boston Massachusetts: Mariner Books

[78] Source: https://www.rail-leaders.com/wp-content/uploads/HSRIL-HS2-Towards-a-Zero-Carbon-Future-Report-Nov-19.pdf

The 2050 net zero commitment has not yet fed through to wider policies. In 2020, the Committee on Climate Change is due to publish a report on the most cost-effective pathway as part of its advice on the sixth carbon budget covering 2033–37. It has repeatedly called for a shift in demand from roads to public transport and active modes but does not appear to have carried out analysis of the rail capacity potentially required for this.[79]

Sustainable transport modes

Taking a broad view of sustainability, we refer to the UN Sustainable Development Agenda, adopted in September 2015.[80] It confirms the role of economic growth and inclusion strategies in fighting poverty, tackling climate change, and encouraging environmental protection. It brings together a range of social policy areas including education, health, social protection, and job creation and employment. A pan-UK sustainable transport network needs to be envisioned against this agenda, noting that the UK Government's policy priorities, as just discussed, reflect this breadth of ambition.

Depending on where people live in the country, their incomes and outcomes in terms of health and well-being vary widely. Transport has a big impact especially in the opportunities it does or doesn't create to access employment, education, training.

By a considerable margin, for both person travel (private cars) and freight (lorries and vans) the highways sector dominates transport use in the UK. But this position would only be sustainable in future if:

- A way is found rapidly to de-carbonise a system with approximately 35m+ vehicles under private ownership currently almost entirely powered by fossil fuel engines

- The social inclusion aspect of the sustainability agenda is ignored, since for many, especially those on low incomes, there is no car available for them to use

- The wider impact of intensive use of our national highway network is overlooked – in terms of the impact of traffic-generated poor air quality levels (with associate poor health outcomes); the impact of high levels of death and injury (compared with other transport modes) on third parties and on health services; and the high levels of stress associated with congested roads and traffic noise (for drivers and for other road users and those living, schooling and working near main roads).

Continuation of the reliance on car-based travel on an ever more congested road network is not, we conclude, a viable way forward for the national transport system.

Instead, the view taken here is ***that development of the highway network needs to be focused on improved safety standards and greater environmental protection*** but *not* (in general) on providing higher levels of connectivity or capacity. Indeed, current highway capacity will be looked at ahead as a possible source of rights-of-way for prioritised bus services and active travel modes, in pursuit of committed Government policy objectives.

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[79] Committee on Climate Change (2019). Net Zero technical report
[80] See, for example, https://www.etf.europa.eu/en/practice-areas/sustainability-and-social-inclusion

We therefore need to *look primarily to the national rail network and urban transit systems for the framework of a national system*. *They will be supplemented by other modes – bus and active travel modes in particular.*

In the case of buses, they are only going to be able to achieve the standards needed if they are de-carbonised and freed from the uncertainties and other adverse impacts of a congested road network. Rail too, of course, needs to be fully de-carbonised. Already over half of rail journeys are estimated to take place using electrically powered trains, but this signals a need for a major removal of diesel traction in the next 15 years, and for consideration of how the carbon content of the rail sector's hardware can be reduced.

Funding of *rail enhancement programmes should be returned to a medium-term programme basis* and set in the context of a long term plan. Whatever emerges as the long term 'guiding mind' for the rail sector post-Williams, a rail industry body charged with long term planning needs to assume responsibility for the national rail strategy and for keeping plans coherent and up-to-date.

In some countries, standards have been set for public transport service provision – see panel. We have considered whether to adopt an equivalent approach for the UK.

> **Lyn Sloman illustrating a standards-based approach with a Swiss example**
>
> Public Transport Service standards have been set for the Zurich city region. If you live in a settlement with at least 300 people, you will have a public transport service every hour. If you live in - on a corridor where multiple settlements combined to give strong demand, you will have a service every 30 minutes. If you live in a large, dense settlement, you will have a public transport service at least every 15 minutes, and services run from six in the morning till midnight, seven days a week. Buses and trains connect, and the services repeat hourly at regular intervals.[81]

Rather than see such an approach as a framework to define a suitable national public transport system, we propose here to set out a pragmatic approach that best meets, we judge, the aims of levelling up and de-carbonising. This result is an approach that is largely conditioned by today's bus and rail network and adaptations to it. Nevertheless, the programme outlined in the next few chapters is ambitious. Its adoption might *create the opportunity for local authorities, at a future stage as public transport is improved, to set service standards based on local population levels or other explicit criteria*.

Consideration of regional plans, together with our own analysis, allows the identification of a number of opportunities for new or improved rail services that would significantly enhance connectivity for local and regional trips and permit much better access to the national rail network, including from places 'left behind' such as Mansfield.[82]

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[81] https://www.climateassembly.uk/meetings/weekend-2/lynn-sloman-transport-quality-life-alternatives-cars/
[82] Beyond HS2, Greengauge 21, May 2018

The measures identified can be characterised as those which:

- ***Improve connectivity from high inequality areas to major opportunity areas – and these are generally found in major cities,*** given the expected development of most employment growth in the 'knowledge-based industries' and support services

- ***Help to create stronger agglomerations*** though good access to jobs and education where it is lacking or deficient

- ***Improve connectivity with international gateways*** and with London

- ***Improve connectivity along coastal corridors.***

On the last point, it is notable that nearby coastal towns and cities are often divided by estuaries and weak public transport connections that undermine their viability and vitality. A 90-minute journey time between Hull and Grimsby (by bus and rail) or 30 minutes by rail between nearby Hartlepool and Middlesbrough, for example weaken sub-regional economies by limiting business and labour catchments. While several new estuarial road crossings have been built in the last 50 years, no new rail connections have been provided (except across the Thames estuary).

Over the next 50 years this particular imbalance needs to be redressed. More generally, there is a need to ensure that along those coastal corridors where inequality scores are high, there is better public transport connectivity. We designed a package to address this focus of high inequality scores down the East Coast as part of our work for the UK 2070 Commission in 2019 (see fig 6.2 below). Modelling using a land-use transport interaction model (by David Simmonds Associates)) showed that it brought an economic boost to the peripheral coastal communities as intended.

In preparing this report, we reviewed both the Beyond HS2 plan that we produced in 2018 and our initial work for UK2070 in 2019. We have added the context of recovery post Covid-19 and taken on board other developments since these reports were prepared. This showed that, sadly, the coronavirus is already showing signs of having increased inequalities and damaging social mobility prospects. This adds to the problem of tackling the 'levelling up' agenda.

The Government's Index of Deprivation has accessibility components in one of its domains (on Housing and Access to services).[83]

We recommend that Government gives consideration in updating the Indices of Deprivation to establishing a new measurable domain: accessibility in all its guises including not only services but employment opportunities and sustainable/affordable transport.

An explicit measure of enhancing connectivity to locations with poor social mobility scores could also be added to transport project appraisals. In the longer term, this could help lead towards setting achievable minimum standards of services/networks for cities, towns, and the communities beyond. There is a need to restate the importance of this as a short term action that builds to the big picture for 2050 set out below, given the current focus on restoring the economy. Some other complementary measures we describe fall into this category – not just in active travel but also making a move on zonal fares and integrating inter-urban bus with the national rail network.

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[83] https://www.gov.uk/government/publications/english-indices-of-deprivation-2015-technical- report

Our long term plan is comprehensive. It covers all four nations. Nowhere is excluded. All regions have been considered, however sparsely populated or remote. The plan incorporates HS2, which is now under construction, and also outlines a much wider set of changes and developments to create the comprehensive connectivity gains we believe the country needs to prosper. It relies on upgrades as well as new-build. It presumes a major switch to active travel locally with a significant re-allocation of road-space.

Overall, the plan, to be fully implemented by 2050 envisages a major infrastructure investment programme for rail:

- nearly 100 miles of new railway lines, as well as completing HS2/NPR

- over 800 miles of route upgrades (of which the three main lines (West Coast, East Coast and Great Western) comprise 66% of route mileage)

- a major route electrification programme

- enhanced city region rail networks, for Birmingham, Bradford, Bristol, Cambridge, Leeds, Liverpool, Newcastle, Nottingham, Manchester and Southampton

- new rail links at *three* international airports (Heathrow, Manchester and Edinburgh)

- new services and upgrades on the West Coast and East Coast Main Lines, complementing HS2

- a programme of investment at 16 stations to create an overall network of 44 national hub stations

- development of three new estuarial rail crossings (one of which would replace a planned new road crossing - Lower Thames)

- a new tunnelled rail crossing to link Northern Ireland to Great Britain

- two new electrified port access routes (for Tilbury/Gateway and for Liverpool) and completion of the Felixstowe – Nuneaton strategic freight route

- a programme to create a set of national mini-hubs to fill gaps in the rail network with commercially-operated interurban buses, with integrated ticketing.

*A sustainable and integrated pan-UK network*

*For **intercity**, we know from work carried out in preparing* Beyond HS2*, where the connectivity weaknesses lie – and the possible remedies. Taking a four nations perspective means thinking about the importance of connections between the key centres in England, Wales, Scotland and Northern Ireland. We also build on recent work by* Transform Scotland *that provides fresh evidence on short-comings, and a north-south imbalance, within Scotland. We incorporate this and also within-Northern Ireland and within-Wales assessments too.*

> *On **Intra-urban**, we identify where transit/metro systems should be introduced (and/or existing networks extended). This embraces the development of metropolitan rail systems (on the Merseyrail Electrics model) and considers the development of bus networks too.*
>
> *On wider **Urban-Rural** places (including those often described as being left behind, post-industrial), we examine innovative work carried out by local authorities and tie this in with earlier Greengauge 21 studies of addressing peripheral areas that are so often overlooked in prioritising transport investment needs.*

The rail elements for intercity infrastructure; for city region rail/metro developments; and for new estuarial crossings to help peripheral areas are illustrated in the overall plan for 2050 is set out in Figure 6.1 below. It incorporates a cross-Irish Sea rail tunnel.

Figure 6.1 Pan-UK rail infrastructure plan 2050
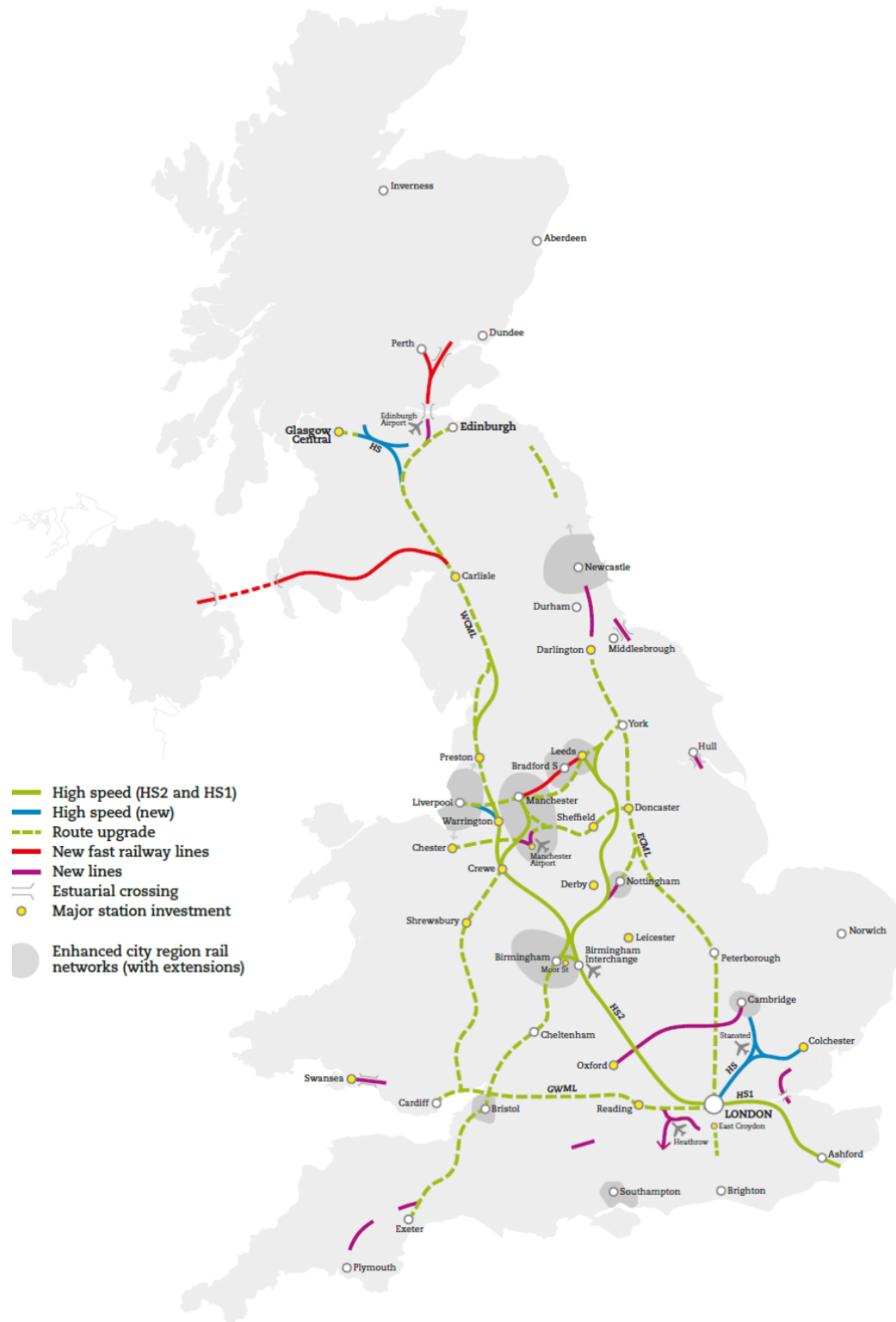
There is also a set of fundamental measures and policy shifts that are necessary to drive this plan, many of which will need to be implemented much earlier than 2050. It is not possible to illustrate them on the diagram above. They are:

- an integrated national zonal fares system across scheduled public transport

- a set of mini hubs to help cross-modal connections

- a programme of national superhubs

- the national rail decarbonisation strategy that includes the rail electrification programme set out in Chapter 3

- the strategic freight network with its multiple distribution centres

- investment to support active travel modes

- re-allocation of road space in favour of pedestrians and cyclists

- the development and support of a national interurban express bus network that connects seamlessly with the rail network through the programme of hubs

- a programme of secondary main line re-openings to transform accessibility in areas 'left behind' by the Beeching/UTA cuts and to add resilience to the national rail network

- the planned programme of Light Rapid Transit (or similar technology) investments across cities of more than 175,000 population

- measures to address the connectivity needs of coastal and rural communities.

An illustration of how a combination of new rail links, new estuarial public transport crossings and integrated express interurban bus lines might address the connectivity transformation needed along England's east coast is illustrated in Figure 6. 2 below. This approach has a wider relevance – to areas that are often regarded as peripheral right across the UK. These include:

- West of England: Cornwall, and large parts of Devon, Somerset and Dorset

- Mid-Wales and the English Marches

- English – Scottish Borderlands

- Scottish Highlands and Islands

- Western Northern Ireland.

Figure 6.2 Transformed connectivity for England's East Coast communities