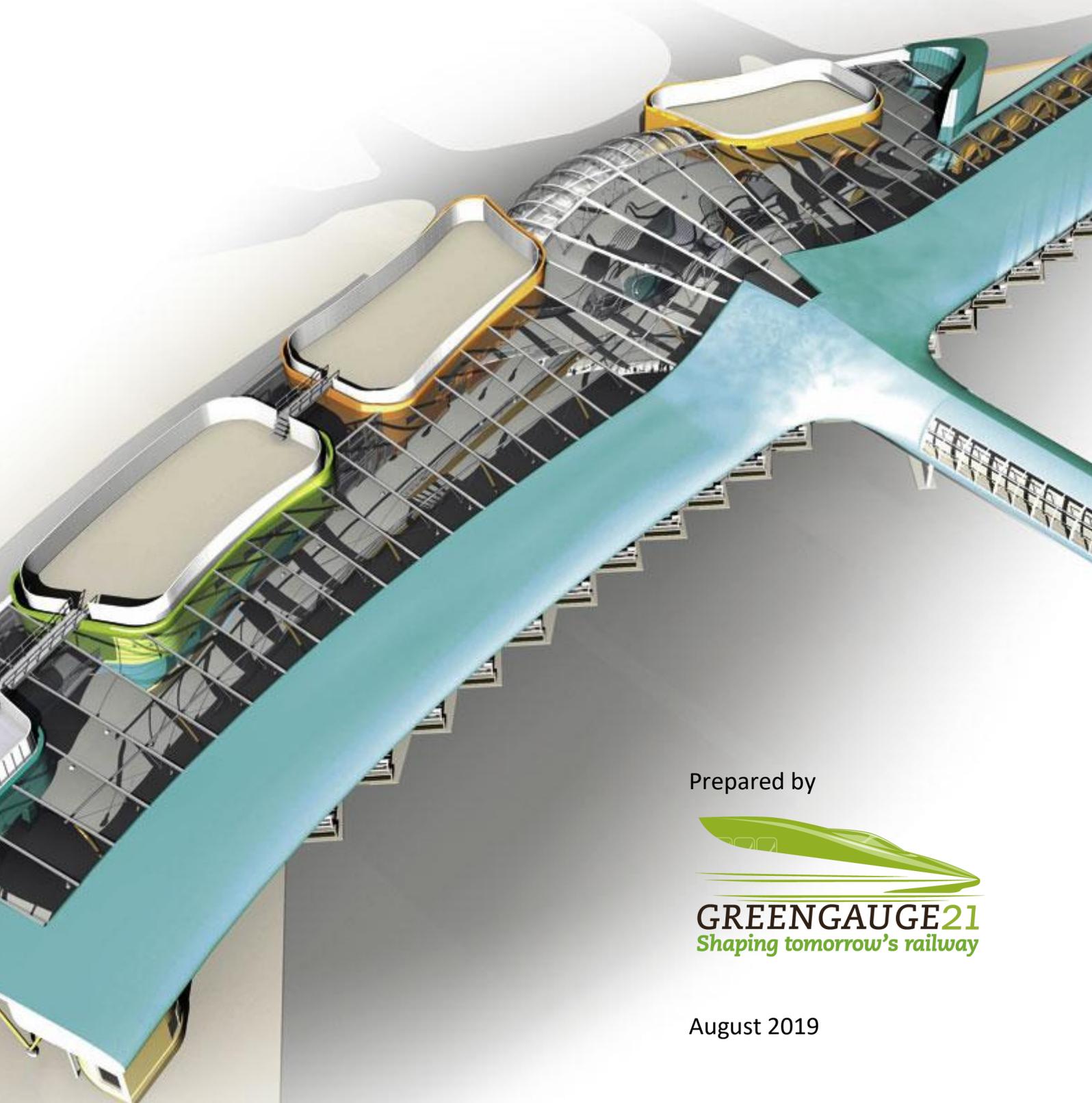


The UK's 2070 transport infrastructure requirement

Prepared for the UK2070 Commission



Prepared by



August 2019

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Cover image: Barnsley bus-rail interchange visualisation (Arup)

UK 2070: the Transport Infrastructure Requirement

Greengauge 21

1. Introduction

The first report of the UK2070 Commission identified the type of inequalities that are holding back the UK (*Fairer and stronger: rebalancing the UK economy*, UK2070, May 2019).

Greengauge 21 was asked to provide a plan which develops a response in terms of the contribution that better sustainable transport connectivity could make to rebalancing the UK by addressing its inequalities.

Although this requirement arises at a national level, clearly a lot of inequalities arise within small-scale geographies. Even prosperous towns contain areas of deprivation and inequality. Here, transport solutions are in general going to centre around making improvements to the way bus services are delivered and ensuring that using them is affordable to access education and jobs. But there is also a wider picture to address.

A sustainable pan-national UK network is needed to address the inequalities identified by the Commission and to build a more productive economy. The vision developed here draws on, and extends, existing Greengauge 21 work in this area published in May 2018¹ – work that analysed the social mobility index² to identify areas of weakness in inequality terms – and centred on how better connectivity could improve economic productivity.

The vision for 2070 concentrates on *scheduled public transport*, reflecting ambitions to establish transport as a basic right, for everybody, including for those without access to a car.³ Given its whole-UK positioning, it is concentrated on rail links – together with interurban bus services – treating public transport (as it perhaps never has been in the UK) as a single system. It identifies the importance of metropolitan city public transport network development and extends this thinking to smaller cities and towns.

It builds on published plans of the various sub-national bodies in England including those of Transport for the North and Midlands Connect and published longer term plans in Scotland, Wales and Northern Ireland.

¹ *Beyond HS2*, Greengauge 21, May 2018

² See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496107/Social_Mobility_Index_-_Methodology.PDF. The Social Mobility Commission devised separate indexes for each of England Wales and Scotland (due to inconsistent data sources). For England the social mobility index is made up of 16 indicators across 4 life stages – early years, school, youth, and working lives – and so embraces a number of indicators relevant to life-chances.

³ Mobile digital technology is making possible new travel choices that avoid dependence on private car-based travel. Examples include Uber, car and ride share Apps, crowd-sourced coach services (such as Sn-ap) and the emergence of electric bicycles, extending the effective range of bicycles. But Mobility as a Service (MaaS) has not taken off as yet. Moreover, as argued in a Greengauge 21 report of April 2018 <http://www.greengauge21.net/the-interurban-bus-network/>, there is in any event an economic value to scheduled transport service since it allows certainty in planning, not just for individual journeys, but also for locational decisions (where to work/where to live).

But it is specifically oriented towards addressing spatial inequalities, including those arising from peripherality (until now addressed through EU-funded programmes).

The vision for 2070 also provides an element that addresses the separate needs of freight/distribution where this is distinct from the capability offered by a common-user network.

Overall, the vision defines a zero-carbon/high quality and high capacity national UK-wide network and presumes it consists of an electrified (or possibly fuel cell or hydrogen powered) rail network plus battery/electric/hydrogen/fuel cell powered interurban bus (or coach) links overlaid on a set of city-region and smaller urban area networks, which will also need to be substantially electrified.

It takes as a given today's highway network (with the addition of fully committed schemes) as the basis for the interurban bus/coach elements and identifies where investment may be needed – not for the reasons usually advanced for road investment – but to ensure the 'bus can get through', to reduce greenhouse gas emissions, and to mitigate the adverse air quality and safety impacts of road traffic, especially on pedestrians and cyclists.

Earlier work by Greengauge 21⁴ identified that express/interurban bus services in Britain are suffering from ever-slower schedules (just like or even more so than their urban counterparts) as road congestion grows. The measures needed to address this type of problem are quite different from the schemes established in Highways' England's 5-year road investment strategy (*RIS*) programmes.

The highway network is considered unsuitable for an expanded role as the framework for sustainable national travel because:

- There is no general means available (other than by long-since abandoned major tax/user road charges) to contain growing congestion levels
- Its conversion into a fully de-carbonised system requires the electrification of a 35m vehicle fleet which in turn requires a doubling of the nation's electrical power generation for which there is no investment plan. The national rail system (40% electrified), on the other hand, accounts for only 0.6% of national electrical power consumption. Further electrification is needed (and perhaps deployment of other technologies including battery and fuel cell on branch lines) but achieving net zero carbon to which the UK is now committed by 2050 will require very much increased use of the national rail network. It also means a near-total replacement of existing bus fleets
- According to the Government's Air Quality Expert Group (AQEG), road transport non-exhaust emissions from vehicle brakes, tyres and road surfaces are a bigger source of health damaging particulates than vehicle exhaust emissions which have been radically reduced through the imposition of progressive engine emission standards⁵
- In unequal Britain, car availability remains beyond the reach of a significant minority, including crucial groups such as young people, those seeking to enter the workforce, and increasingly, the elderly.

⁴ <http://www.greengauge21.net/the-interurban-bus-network/>

⁵ <http://tinyurl/y52e7cop>. This shows that non-exhaust emissions from road transport now accounts for 73% of all road sector PM10 emissions, and notes that a switch to electric road vehicles does not resolve the problem. Whereas cars on average have an emission factor of 8.7 milligrams of PM10 per kilometre from tyres and 11.7 from brakes, for buses the equivalent PM10 values in urban areas are 21.2mg/km and 53.6mg/km.

Instead, the 2070 network offers a comprehensive framework within which concessionary travel can be provided to selected disadvantaged groups – or more generally to operate with fares set at affordable levels.

The vision of a sustainable pan-national transport network is based on:

- What exists now – and established plans where these exist
- What's evidently missing – where there are various categories to consider:
 - Network linkage gaps (where the question of operational viability is a key factor – based on known variability in service economics – and questions of the efficiency of overall network design⁶)
 - Places left poorly connected
 - Key interfaces between modes and between interurban and urban networks
- And has a primary focus on areas that are disadvantaged on at least one of the key inequality indicators (and/or are peripheral).

It provides an alternative to the likely outcome of the current approach based on transport appraisal techniques that acknowledge distributional impacts only in a very minor key and consider investments on an uncoordinated project by project basis.

The vision provides *both*:

- the capacity/quality needed where demand pressures on the sustainable public service networks are apparent in the longer term and where connectivity improvements will act as an economic stimulus to areas with weak productivity levels *and*
- connectivity specifically designed to help counter identified social inequalities.

⁶ So, for example, short shuttle services by rail are *not* favoured, since they spend a large proportion of operating hours in wasteful end-point turn-rounds. Better use of interchanges with timed connections, as pioneered in Switzerland and being implemented in Germany is an ambition for many and has a bearing on how the network should be developed. Alongside this factor which bears on network design lie strategic network design considerations to try to ensure that available line capacity is used to the maximum extent possible, consistent with reliable service operation. By 2070, much greater use of automated train control systems is likely, which will help in this endeavour.

2. Summary of transport-relevant conclusions from national scale inequality assessments

Some key conclusions can be drawn on this subject from the *Beyond HS2* analysis by Greengauge 21 as well as from the preliminary work by UK2070.

The analysis in *Beyond HS2* shows that major city to major city connectivity is weaker (and much slower) where one of the cities is not London. There is an arc of weak direct links stretching from Glasgow and around the east coast to Newcastle, Leeds, Sheffield and Nottingham.

Where major transport improvements connect London with the regions, the impact on business connectivity is greater for regional centres than London. In the case of HS2, for example, a 21-23% improvement in the major city regions of the Midlands and the North is projected but only 9% for London.⁷

So, there is a clear case for better (non-London) inter-regional links because connectivity is poor, limiting the scale of business catchments for many regional centres – *and* for improving links to/from London – which has so many of the national assets that affect business performance and productivity.

(i) Social Mobility Index findings⁸

Across England, out of 40 worst ranking local authority areas, 3 are in NW England, 2 are rural areas in the West Midlands, and 4 are seaside locations in southern/south-west England. As many as 28 areas are on the eastern side of the country, with a large proportion in the East Midlands – 17 authorities – and northwards into South Yorkshire. Many of these places are former coal mining areas. Six are in East Anglia. The six worst scoring places (of 32) in Scotland are all on the east coast. In Wales the worst scoring places are coastal (Conwy and Pembrokeshire) and former mining/industrial areas (Neath-Port Talbot, Blaenau Gwent, Wrexham).

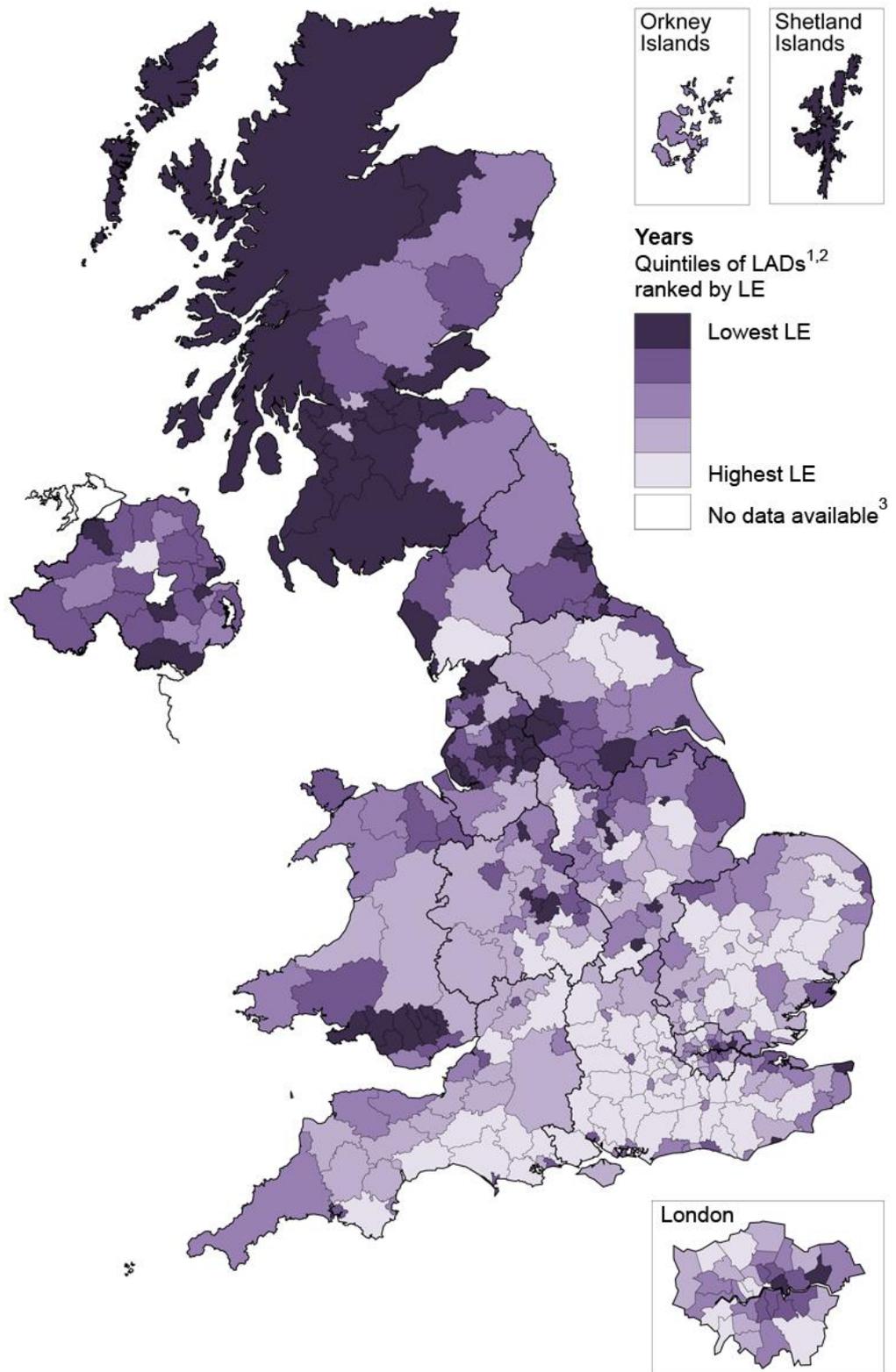
Poor transport is one of four policy areas needed to address these concerns, according to the former Social Mobility Chairman, Alan Milburn.

Key Conclusion: extra attention needs to be given to the eastern side of the country

(ii) Life Expectancy

⁷ See DfT, HS2 Strategic Case October 2013

⁸ Source: Annex A Greengauge 21 *Beyond HS2* May 2018



1 Local authority districts (LADs) include unitary authorities, London boroughs, metropolitan districts and non-metropolitan districts in England and Wales, council areas in Scotland and district council areas in Northern Ireland.
 2 Each quintile comprises 81 LADs with the exception of the quintile with the lowest life expectancy, which has 80.
 3 Life expectancy figures are not available for City of London or Isles of Scilly because of small numbers of deaths and populations.
 Source: Office for National Statistics
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England

Lowest levels of life expectancy can be found mainly in the North (especially: West Cumbria, Tees Valley, across much of Lancashire and South Yorkshire, together with across a number of urban areas in the Midlands (both east and west). In East Anglia, the South East and West, lower life expectancy is notable in coastal towns, but is otherwise rare.

Wales

Here there are two stand-out areas of low life-expectancy: Denbighshire (in the north) and across the valley areas of Mid-Glamorgan in the south.

Scotland

Low life expectancy is apparent across much of Strathclyde and Argyll, East Lothian, all of Fife, around Dundee, the city of Aberdeen and Morayshire; and on the Western and Northern Isles.

Northern Ireland

Here two areas are notably poorly scoring: Derry/Londonderry and Belfast and to the west of Belfast into Antrim.

Key Conclusion: for England (and the UK as a whole) the pattern closely follows the traditional north-south (Wash-Severn) divide and has a strong correlation to income levels⁹.

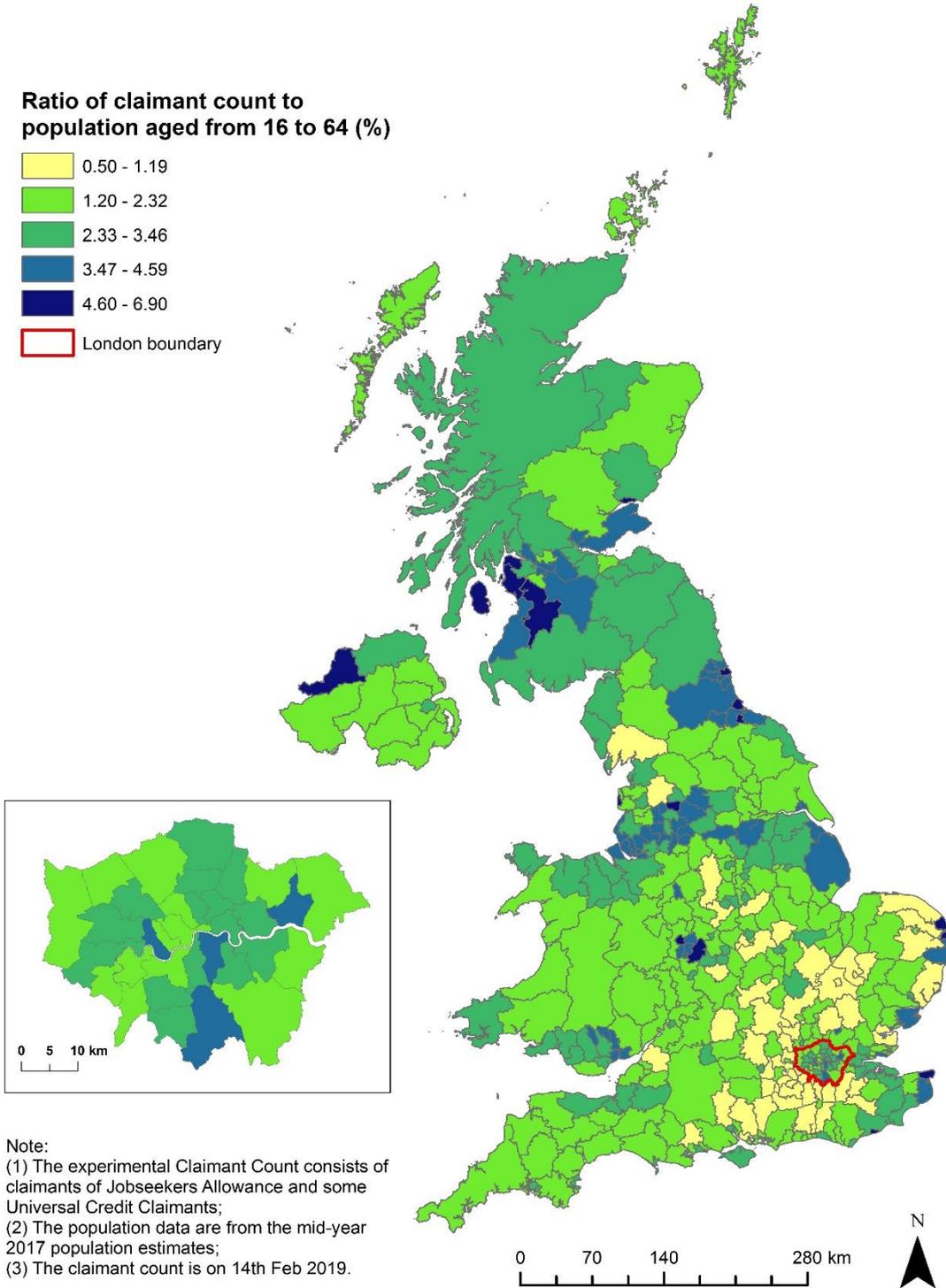
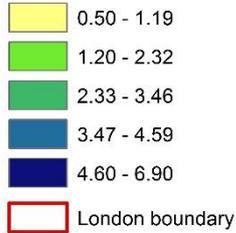
(iii) Claimant levels

Assessments of Claimant count percentages of population have been plotted by UK2070. There are some high levels in specific places in Northern Ireland (Derry/Londonderry) and Scotland (part of Strathclyde stretching from Gourock southwards to Kilmarnock) and Wales (Blaenau Gwent). In England, the only places in the south of note are in some parts of London, places on the east coast (Kent and East Anglia); elsewhere there is a large concentration in the Black Country and a broad swathe from Merseyside through Greater Manchester to South Yorkshire, East Lincolnshire and Hull and Tees Valley, with concentrations in Hartlepool and Sunderland.

⁹ See, for example, <https://economia.icaew.com/opinion/august-2018/income-and-life-expectancy-a-staggering-correlation>

Unemployment rate (claimant count) by local authority in 2019

**Ratio of claimant count to
population aged from 16 to 64 (%)**



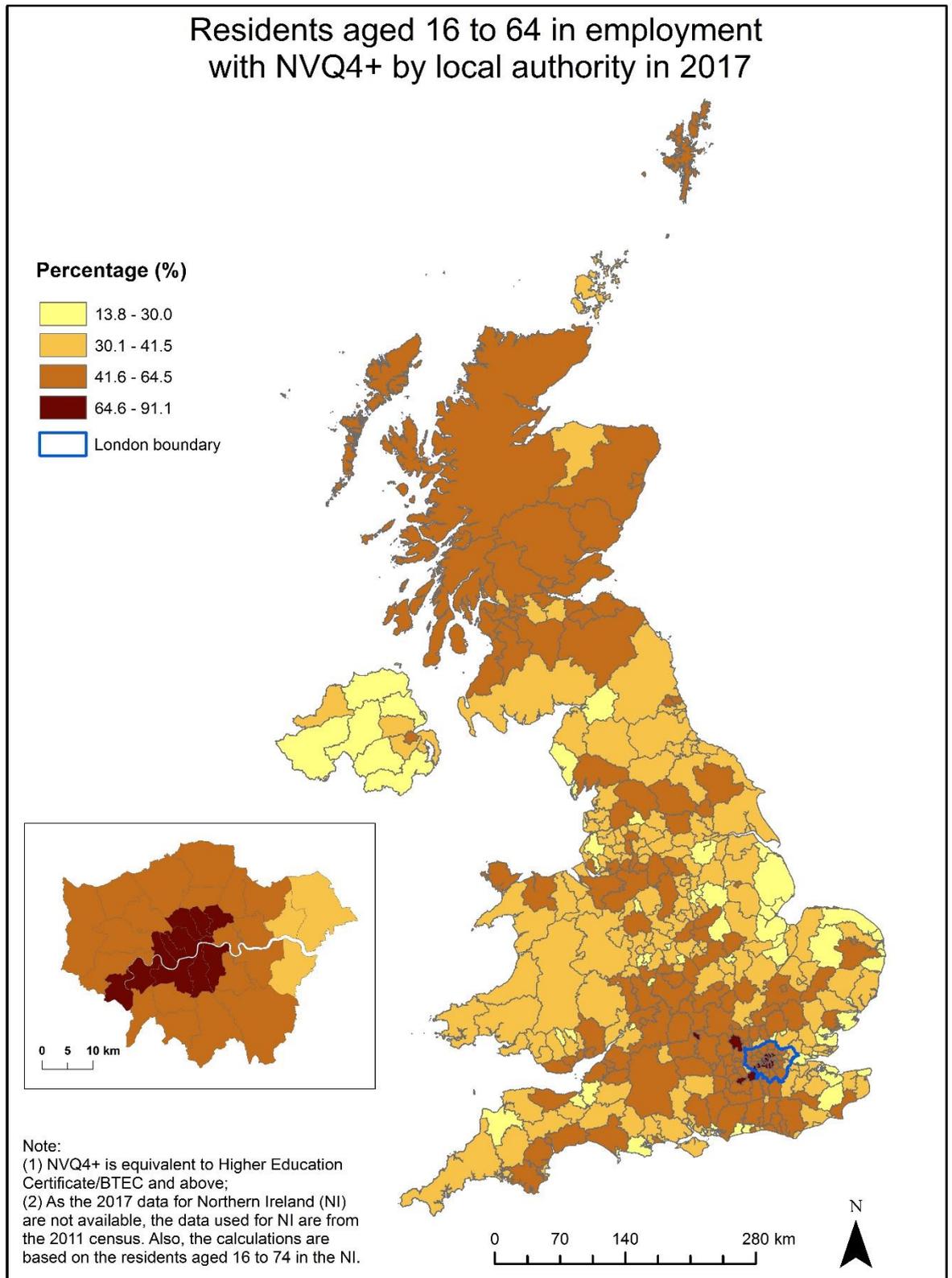
Note:
 (1) The experimental Claimant Count consists of claimants of Jobseekers Allowance and some Universal Credit Claimants;
 (2) The population data are from the mid-year 2017 population estimates;
 (3) The claimant count is on 14th Feb 2019.

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Key Conclusion: Many of the places with a high claimant count are within commuting distance of major, prospering cities. Better city region networks should be able to address these. But there are

exceptions, and these are in North East England (Durham/Tees), East Lincolnshire, and the coastal towns of East Anglia and Thanet which are remote from thriving metropolitan cities.

(iv) Education attainment levels



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Based on the proportion of residents in possession of a NVQ4+ qualification, low attainment levels are very largely a feature of rural areas. Scotland out-performs the rest of the UK on this score. In Wales, only some of the upper South Wales valley areas perform poorly, but in Northern Ireland, only the urban centres of Belfast and Derry/Londonderry do at all well.

In northern England, a few rural districts perform poorly with no obvious pattern. Some rural areas in the East Midlands and the whole of the east side of Lincolnshire perform poorly, as do much of Norfolk, and some of Suffolk, Essex and Kent. Areas of poor performance in the South West can be found in central Somerset, Torridge (Devon) and Purbeck (Dorset).

Key Conclusion: areas remote from urban centres in Northern Ireland need better connectivity to education and employment opportunities where qualifications will matter. Lincolnshire and East Anglia score notably poorly.

Overall Conclusion

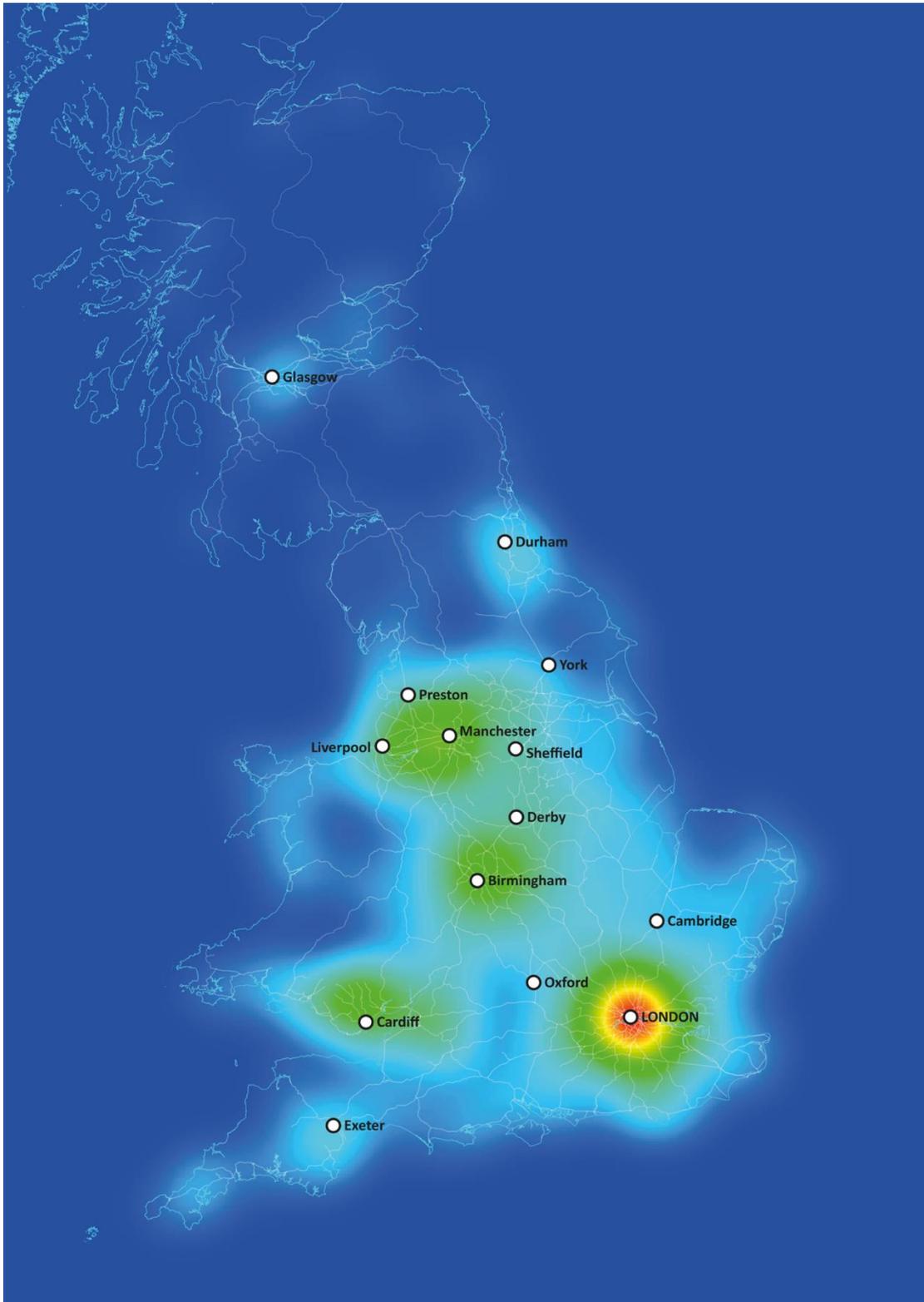
The measures of inequality reveal much of the broader spatial basis of inequality across the UK. In England and Wales, former industrial areas – especially based on coal mining – still decades on from the sector's collapse, are key identifiers of inequality: they haven't moved on. In Scotland, while poor levels of life expectancy are widely spread, so too are (comparatively) good outcomes on education attainment levels which suggests an upward trajectory. Northern Ireland's weaknesses are most prevalent in rural areas, which are generally remote from new job opportunity areas.

There is also a distinct concentration of 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.

The East of England, broadly defined, performs poorly.

The advantage enjoyed by London & south east in terms of connectivity is reflected through its much higher (rail) station density than is available in the rest of Britain (see diagram, next page). London is the governmental, regulatory, cultural, media, financial, and judicial centre of the country and so good connections to it are important for business, and to attempts to even out economic disparities. While other necessary measures, for example in training and education need to be strengthened specifically in the UK regions, part of the transport response to the pattern of national spatial inequality should be measures designed to make London's resources more accessible across the nation.

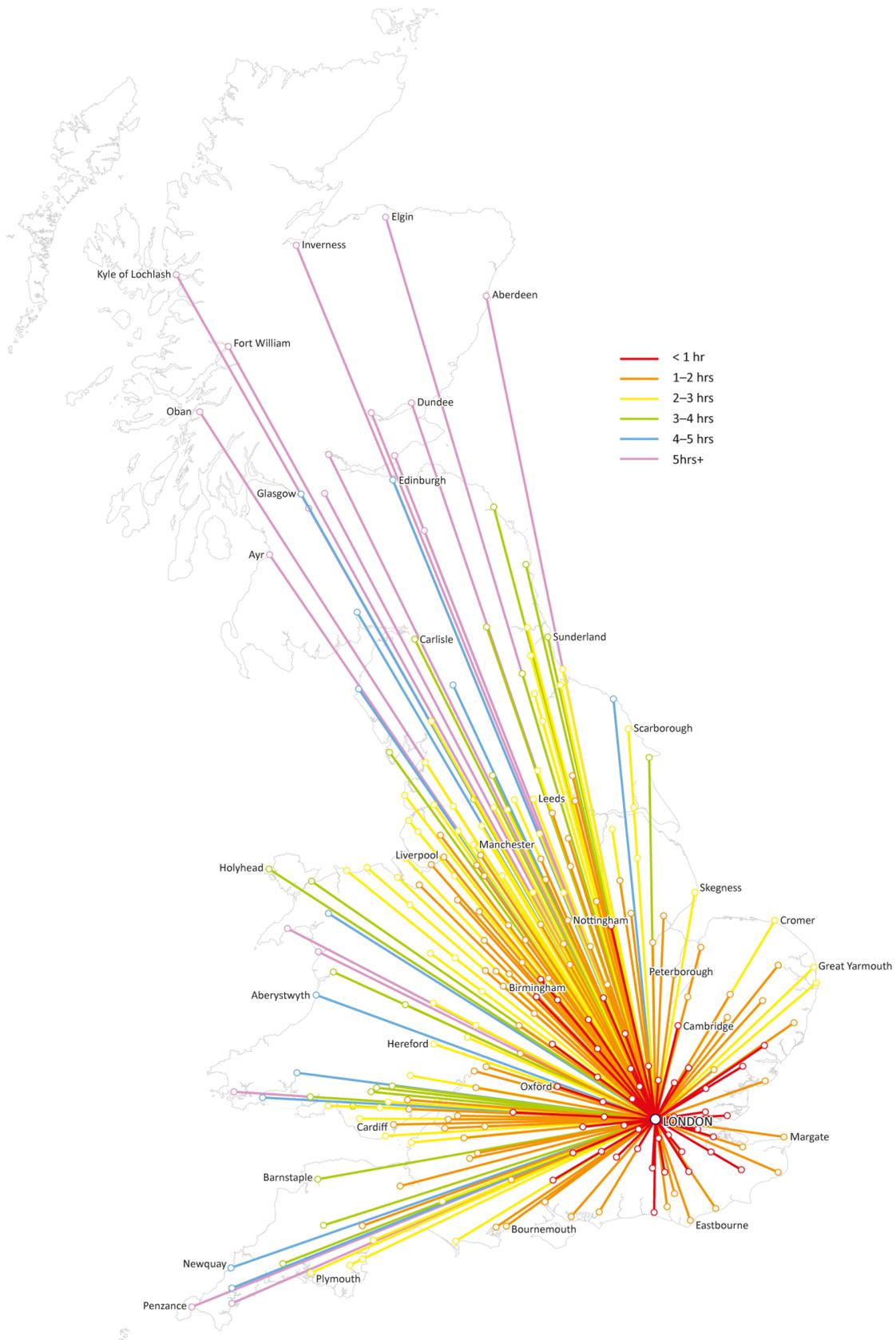
But the most radical change in city-city connectivity available is between regional cities. At a national level, a radical re-think is needed, since the areas suffering most from inequalities are not generally congruent with areas of greatest travel demand. So they are not prioritised for transport investment under current criteria.



Railway station density across Great Britain

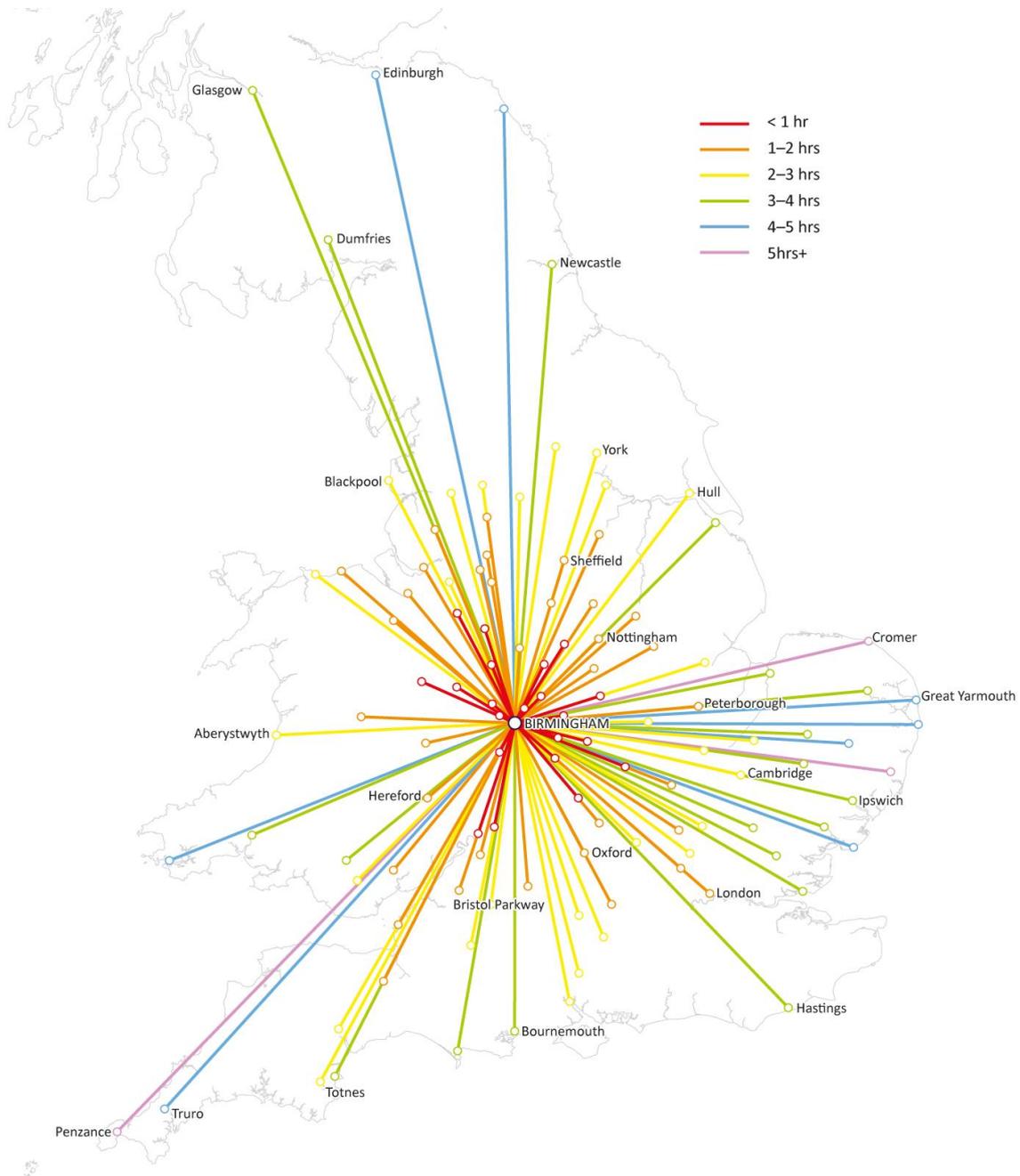
3. Journey time analysis

An analysis of connectivity by rail was carried out using a new rail industry tool that provides the data to look at the overall pattern of rail services and how well different parts of the country are connected. In the diagram below, connectivity to London is illustrated – based on the quickest journey time available.

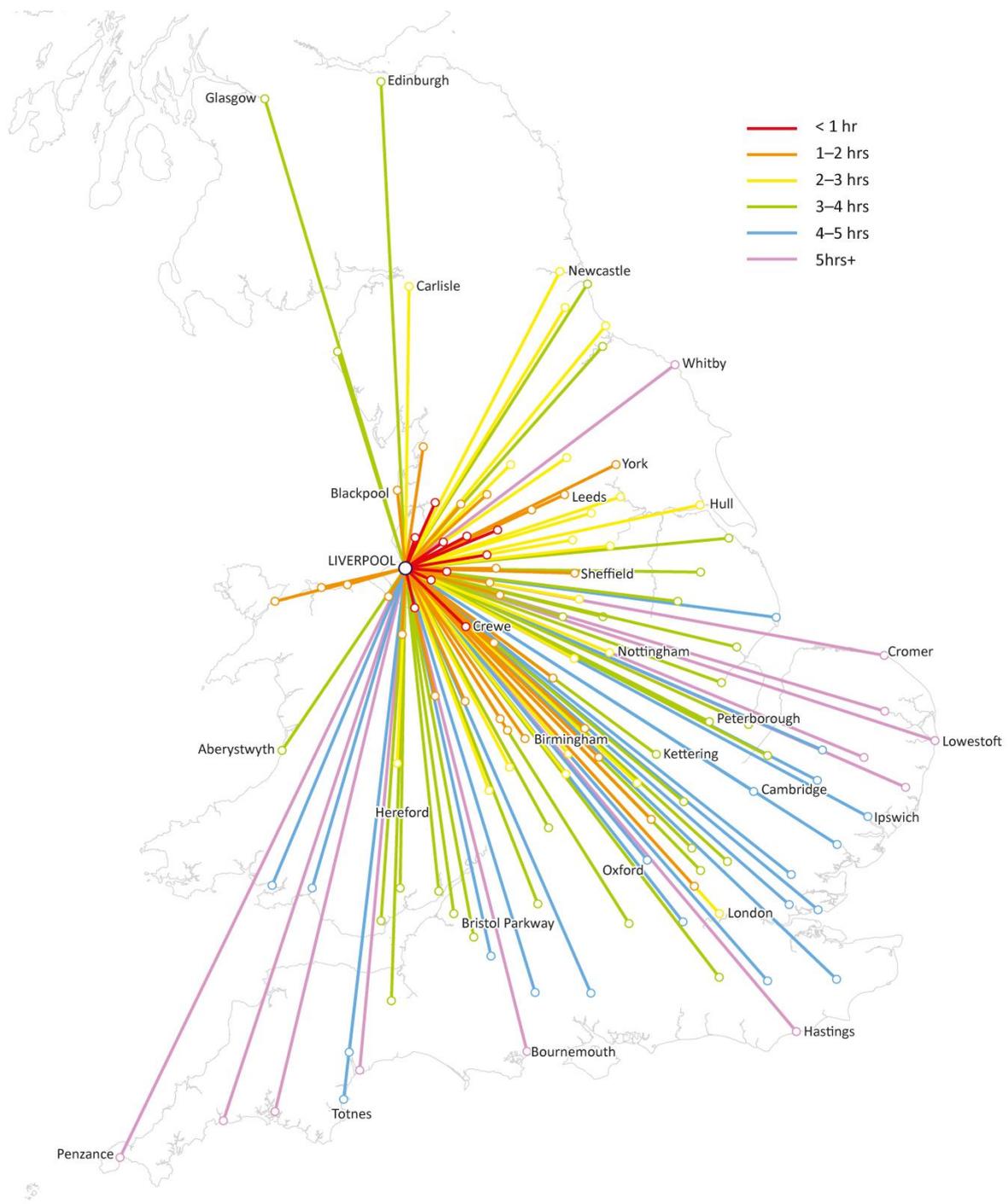


Places on the east coast of England are typically around 3 hours from London at best - more or less regardless of how far north: Lowestoft is 2h32 and Skegness 2h48, almost as distant in time as Hartlepool (2h55). Other places with notably lengthy journey times from London

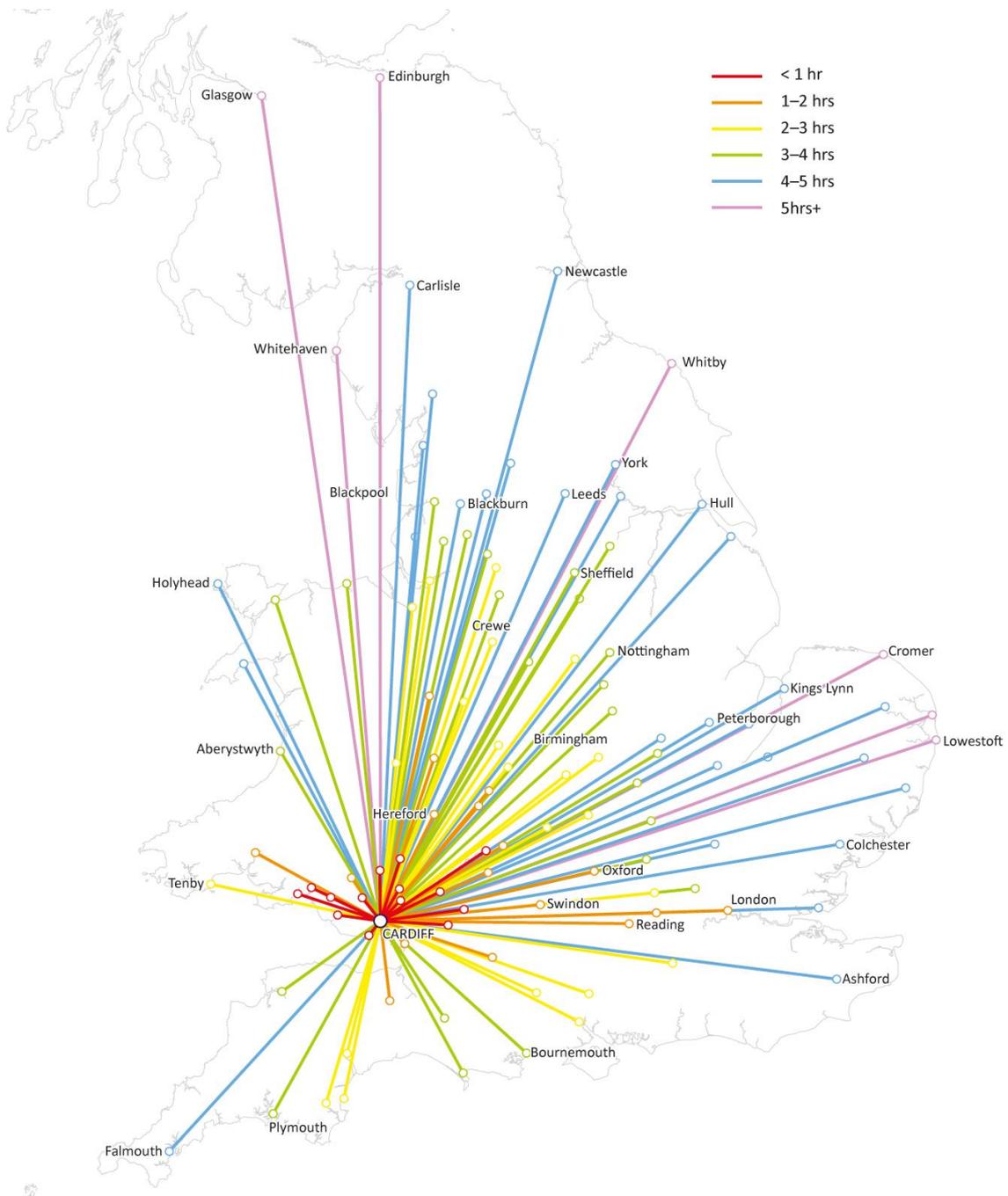
include Mansfield (2h22) and Minehead (a journey which needs a bus connection, 3h46). Indeed, Mansfield is 2 hours by train even from Birmingham (illustrated in the diagram below), reflecting poor east-west connectivity across the Midlands by train.



Travel across the north of England is a challenge that Transport for the North is intent on addressing through its Northern Powerhouse Rail project. Journey times from Liverpool to Manchester (47 minutes), Leeds (1h22), Hull (2h48), York (1h47) and Newcastle (2h52) at least manage straight line speeds in the 40-50 mile/h range. But other journeys are much slower: Blackpool (1h13), Chester (43 minutes), Sheffield (1h42), Bradford (1h49), Doncaster (2h12), and Grimsby (3h10) offering straight line journey speeds of 24, 21, 37, 31, 35 and 37 mile/h respectively.



Wales has a notorious north-south connectivity challenge, and this is reflected in journey times from Cardiff of 2h21 to Wrexham, 3h14 to Rhyl and 3h50 to Bangor in North Wales. Mid-Wales is no better, with Aberystwyth 3h59. All of these journeys use the 'North and West' line along the English border, through Hereford and Shrewsbury.

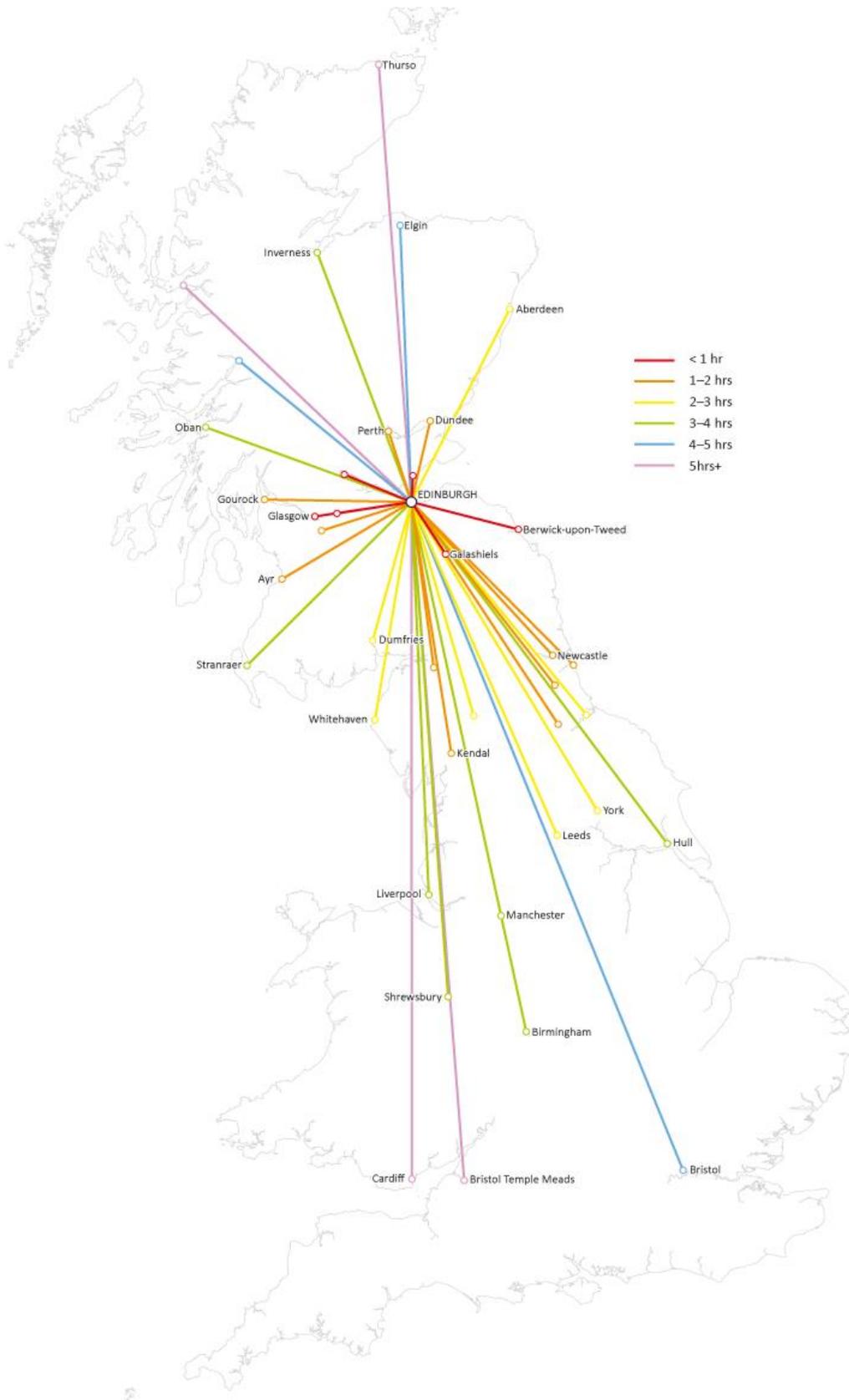


Even journeys within South Wales are slow: 51 minutes from Cardiff to Swansea, 1h11 to Llanelli and 2h42 to Milford Haven.

In terms of direct city to city connectivity, Cardiff is the worst placed of all the major cities in Britain, it was found in earlier Greengauge 21 studies.¹⁰

¹⁰ http://www.greengauge21.net/wp-content/uploads/Beyond_HS2WEB.pdf

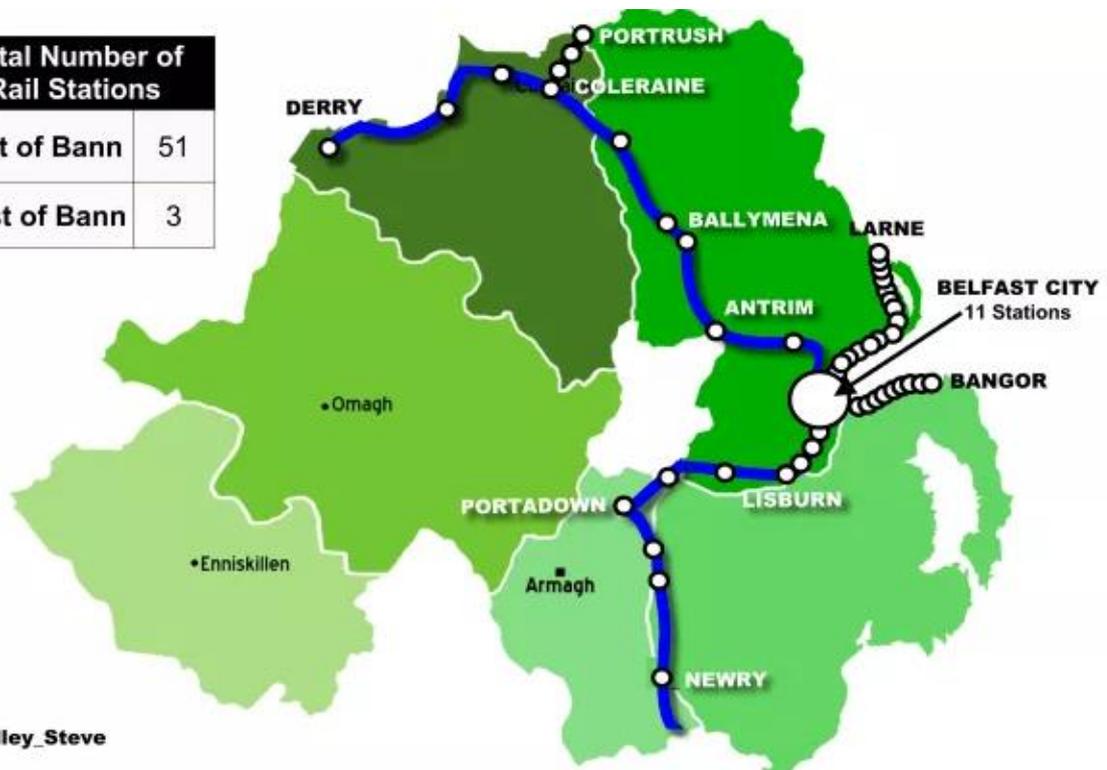
Scotland has a highly developed rail network across the central belt. Beyond that, the railways are much constrained by topography, but unlike the heavily invested road network, remain largely unimproved, with journey times to match. So, the best rail journey times from the Scottish capital include 2h19 to Aberdeen, 1h04 to Dundee, 1h15 to Perth, 1h47 to Ayr, and 3h02 to Inverness. These represent journey speeds (assessed on a straight-line basis) of 40 mile/h, 33 mile/h, 25 mile/h, 37 mile/h and 34 mile/h respectively. With all of these routes being at least partly paralleled by motorways, rail market share is meagre and coach connections are often quicker.



Northern Ireland has a very limited rail network, with commuter lines radiating from Belfast to Larne (which has a busy ferry connection to Scotland at Cairnryan, which is not rail served, as the previous destination at Stranraer was) and to Bangor, together with a main

line to Antrim, Ballymena, Coleraine and Derry/Londonderry and a route to Dublin *via* Portadown and Newry. Fully 51 of the 54 rail stations in Northern Ireland are east of the river Bann (see map, below).

Total Number of Rail Stations	
East of Bann	51
West of Bann	3



@Bradley_Steve

4. The transport contribution to solving inequalities visible nationally

(i) Addressing social Immobility in England, place by place¹¹

A pre-requisite to helping overcome poor performance on social mobility is a truly integrated public transport system that works for passengers across modal boundaries between bus and rail in particular, with targeted concessionary fares and financial support for service provision through the morning and evening peak travel periods to provide ready access to education and employment opportunities. In some cases, there is a need for new infrastructure in terms of modern bus-rail interchange hubs. Well-designed, these can have the beneficial effect on a smaller scale that major new city centre transport hubs have achieved, achieving smaller-scale – but still valuable – cluster/agglomeration benefits.

With so many problem places lying on the English coasts, a general policy of strengthening coastal links and filling in missing elements is required. This may include creating new public transport (rail) estuarial crossings (noting that while many estuaries have had new road crossings, only the Thames has received new rail crossings over the last 100 years or so).

In the table that follows, we illustrate actions that could be adopted to address the connectivity needs of places with poor scores on social mobility.

¹¹ See Annex A Beyond HS2 Greengauge 21, May 2018 for social mobility rankings

Social mobility rank (highest =worst)	Place	English region	Potential transport service mitigation	Infrastructure Implications
324	West Somerset	SW	Franchised peak period train services using existing heritage branch line (WSR)	Route upgrade to allow speeds over 25 mile/h
323	Newark	EM	Hourly fast Lincoln-Newark-Nottingham-London rail service (potentially <i>via</i> HS2)	Newark flat crossing grade-separated
322	Weymouth	SW	Upgraded south coast express bus Exeter-Weymouth; and/or new chord at Yeovil Junction for direct Weymouth-Exeter trains	A35 improvements; small—scale rail link at Yeovil junction
321	Corby	EM	Extend passenger services northwards to Oakham, Melton Mowbray and Leicester; Corby – Peterborough express bus service upgrade	Route electrification; highway improvements
320	Carlisle	NW	Provide HS2 service and create a multi-modal hub at Citadel station	HS2 Phase 1/2a and WCML route upgrade (including through Carlisle)
319	Allerdale	NW	Local bus service enhancement (and as 320)	
318	Wellingborough	EM	Bus transit system for Wellingborough-Rushden-Northampton	Bus-only road links
317	Ashfield	EM	Rail link to Toton HS2 station	Upgrade freight-only railway
316	Derby	EM	New direct rail link to Manchester <i>via</i> Hope Valley	Electrification of MML and Hope Valley line
315	Mansfield	EM	Rail link to Toton HS2 station (as 317)	Upgrade freight-only railway
314	Waveney	EE	Lowestoft-Ipswich-London service upgrade	Electrification Ipswich-Lowestoft
313	Blackpool	NW	Extend Blackpool tram	LRT extension
312	Nottingham	EM	Extend NET; add HS2 connections (north and south)	LRT extensions; additional HS2 connections
311	South Derbyshire	EM	Introduce Burton-on-Trent – Leicester passenger rail service	Upgrade existing freight line and connection to MML
310	Wychavon	WM	Open and expand services at Worcester Parkway	Further re-doubling of north Cotswold railway line

309	NE Lincolnshire	EM	Introduce Grimsby-London direct rail services; integrated bus/rail service hub at Barnetby (and see 298)	Route electrification and East Lincolnshire Railway re-instatement
308	Fenland	EE	Upgrade express X1 interurban bus service; recreate March-Wisbech-Kings Lynn rail link	Bus priority routes along X1 route; freight line re-opening and extension
307	North Warwickshire	WM	New rail service into Moor Street-Curzon Street HS2 hub	Midlands Hub rail scheme
306	East Northants	EM	Connect E Northants towns (<u>Thrapston</u> , Rushden, Oundle, Raunds, Irthlingborough and Higham Ferrers) with Kettering and Wellingborough by express bus	On-highway bus priorities
305	Hinckley and Bosworth	EM	New rail service into Moor Street-Curzon Street HS2 hub	Midlands Hub rail scheme
304	Crawley	SE	Better London rail services	East Croydon rail upgrade
303	Forest of Dean	SW	New rail service connecting to Shrewsbury/Hereford (northwards) and Gloucester/Swindon/London (Southwards) from Ross on Wye/Mitcheldean	New/re-instated rail link Gloucester – Ross-on-Wye – Hereford
302	Amber Valley	EM	Toton HS2 hub and feeder services; new Erewash Valley train services	Ilkeston station re-opening
301	Kettering	EM	Improved rail-bus integration; interurban express bus links to Peterborough and Northampton (and see 306 above)	MML electrification; bus-rail interchange and bus priority infrastructure
300	Breckland	EE	Upgraded X1 bus route	Highway infrastructure improvements with bus priority
299	Hastings	SE	Southeastern HS1 services extended from Ashford to Hastings	New dual-power trains or route electrification
298	Doncaster	YH	Fast connection to Manchester and Manchester Airport	Hope Valley and Sheffield-Doncaster line electrification; new connections into Manchester

				Airport; possible HS2 services
297	King's Lynn	EE	Bus-rail hub facility and upgrade of X1 interurban bus route; new rail link to Wisbech, March and Peterborough	Bus priority infrastructure; rail re-opening
296	Nuneaton/Bedworth	WM	New Leicester-Coventry rail service, part of Midlands Rail Hub plan	New dive-under of WCML at Nuneaton
295	Scarborough	YH	Rail-express bus interchange and service integration; better rail services to York (connectivity with HS2)	Intermodal hub
294	Norwich	EE	Bus-rail hub facility and upgrade of X1 interurban bus route. Faster London and Stansted Airport services	New East Anglia main line
293	Great Yarmouth	EE	Bus-rail hub facility and upgrade of X1 interurban bus and local rail services	Norwich-Yarmouth line electrification and New East Anglia main line
292	Wakefield	YH	New rail services post HS2 (Bradford and Cambridge); better commuter service to Leeds	HS2 eastern arm
291	Barnsley	YH	Barnsley Dearne Valley parkway station; better rail services to Sheffield and Leeds	Highway improvements to support new station
290	Northampton	EM	New direct intercity rail links to NW England post HS2 (see also 301/6)	
289	Leicester	EM	Faster London rail services; HS2 services northwards to Leeds, York and Newcastle; see also 296	HS2 eastern branch, MML electrification and Midlands Rail Hub
288	Northumberland	NE	New rail service to Newcastle over the Ashington, Blyth and Tyne railway	Upgrading of existing freight line
287	Chichester	SE	Better London rail services; integrated hub for rural bus services	East Croydon rail upgrade; bus-rail hub
286	Bolsover	EM	Direct rail service to Toton (HS2) and Derby	Upgrading of freight line
285	Chesterfield	EM	HS2 service	HS2 eastern branch

It is striking that, reflecting the concentration of poorly performing places in a number of geographic clusters, that a relatively small number of transport investments are needed to provide a

comprehensive response. A number of interventions serve multiple places in England that appear in the table as scoring poorly in terms of social mobility:

- Over the X1 express bus route, Norwich-Lynn-Wisbech-Peterborough, line of route bus priority/upgrade
- Freight line upgrade to provide a direct rail service to Toton from north Derbyshire/Nottinghamshire
- HS2 – especially its eastern branch – and additional capacity from East Anglia into London (requiring a new fast line *via* Stansted Airport)
- Specific passenger rail line re-openings from freight-only status lines in three locations: in Northumberland, the Fens, and Leicestershire
- A number of rail electrification schemes – to improve journey times and provide the opportunity to avoid the need to interchange
- Existing LRT system extensions (Blackpool, Nottingham, West Midlands)
- The published Midland Rail Hub schemes.

In other places, the proposed remedy is a one-off arrangement designed to suit local circumstances (for example, an interurban express bus network in Northamptonshire; a rail line re-instatement in Gloucestershire serving the Forest of Dean; provision of a service to suit commuters using a heritage railway line in West Somerset and extension of existing high-speed rail commuter services to serve Hastings).

For Scotland, a long-standing proposal for a new, faster, much more direct north-south railway line from the Forth railway bridge northwards to Perth and to Dundee addresses connectivity needs for several places scoring worst on social inclusion. For Wales, the South Wales metro proposals centred on Cardiff, along with a plan to reinstate rail connections from the Cardiff valleys westwards to the Vale of Neath and Swansea are needed; and for Wrexham and the North Wales coast better links to Liverpool and Manchester.

(ii) Addressing Life Expectancy variations

The pattern of life expectancy, the UK20270 Commission has revealed, follows a north-south divide (along a line drawn between the Wash and Severn estuaries).

There are three overarching transport policy responses needed:

- Re-dressing the imbalance of investment in public transport service support across the regions & nations
- Reducing the harmful impacts of road traffic on air quality
- Improving travel conditions to reduce stress levels – and this includes making much better provision for those with restricted mobility for whatever reason -and includes ensuring that there is good access for people without a car available to health care facilities.

In terms of specific locations which have low life expectancy, investment programmes in hand – and specifically: South Wales Metro, Transport for the North's wider rail investment strategy that embraces towns as well as major cities, and the continuing programme of rail service enhancement across Scotland (especially if it is integrated with the extensive network of bus services across less populated rural areas) – will contribute. In the English Midlands, clearly the Black Country is a

problem area, and attracting investment to it through the creation of new rail links to Curzon Street HS2 hub station would seem to be a critical need.¹²

Two further problem areas to be addressed are:

- the border areas in Northern Ireland where public transport provision is very poor; better bus services – which will need to operate cross-border in many cases – would help provide access to health facilities; a re-established rail link between Belfast and Derry/Londonderry via Omagh and serving Enniskillen would provide for the possibility of commuting from these remoter rural areas to better-paid jobs in the cities and open up wider tourism access
- coastal towns in southern and north west England. Here local bus transport service improvements would help. Along the southern coast, rather than thinking in terms of ‘completing the A27 improvements’ consideration needs to be given to making better use of existing rail lines in conjunction with feeder bus services. For the Cumbrian Coast, investment will be needed to protect the existing rail line from weather-related damage and much-improved services to key hub stations at Lancaster and Carlisle are needed.

(iii) Addressing areas of high unemployment/claimant count levels

Here, we can concentrate on the very worst performing places and consider whether better transport links to education, training and work opportunities could help. These are:

- Derry/Londonderry
- The Black Country
- Hastings
- Part of west Central Scotland stretching from Kilmarnock to Gourock
- Part of the Colne Valley in Lancashire
- Sunderland – Hartlepool – Middlesbrough on the north east coast
- East Lincolnshire
- Thanet

The first three have arisen under the examination of Social Mobility and Life Expectancy, but the remaining five need consideration.

West Central Scotland

This is territory in the catchment of Glasgow that already enjoys an extensive rail commuter catchment. But better services would follow electrification of the lines to East Kilbride and Kilmarnock which at this time remain diesel-operated. The recently published Glasgow Connectivity Commission points a way forward.

Colne Valley

The long-standing ambition of re-opening the Skipton-Colne railway line could provide commutable access across the Pennines to Leeds (and Bradford). The re-instatement of the Todmorden curve allowed the operation of a new Manchester service from Burnley (and Accrington/Blackburn), but it is too early to expect this facility to have had discernible impacts.

¹² A chord line near Smethwick Galton Bridge could allow a hugely valuable and quick new rail service to be provided from Black Country stations to Moor St/Curzon St *via* Snow Hill, ensuring that the very best use is made of the valuable cross-Birmingham Snow Hill-Moor Street tunnel.

Sunderland-Hartlepool-Middlesbrough

The Durham coast line connects these three cities with Newcastle, but journey times are lengthy (Sunderland – Middlesbrough, about one hour) because of a lengthy detour around the River Tees. This could be addressed by a new tunnelled rail crossing of the Tees. Not only would this reduce cross-Tees journey times by 20 minutes, it would create a route that would allow longer distance services (such as to Leeds and London) to operate viably on a regular interval basis *via* the coast and bring much better accessibility to these places. A speedy Sunderland-Hartlepool-Middlesbrough - York-Leeds connection would be of great value and should be a viable addition to the current service mix.

East Lincolnshire

Here the main railway line that linked Peterborough with Spalding, Boston, Louth and Grimsby was largely abandoned some 50 years ago. It leaves this part of England, which has a largely unimproved road network, remote from work opportunities beyond its own largely rural catchment. Re-instating this line is problematic, because sections of it have been converted into roads. One approach would be to make further road improvements and create a long-distance interurban bus route (this corridor is poorly served by interurban buses at present except to/from Lincoln). But this would miss the potential advantage of a rail service which could be operated at higher speeds and as an extension of London-Peterborough rail services. Given the remoteness from job markets, a rail service is the better option, with the prospect of a new cross-Humber rail crossing opening up the opportunity to link in Hull too. A north-south rail link – based as substantially as possible on the original 1840s rail alignment which is aligned for much higher speed operation than it ever achieved before closure in 1970 – would be well-complemented by the set of commercially viable interurban bus links from towns along the coastal region to Lincoln.

Thanet

Recent development of the South eastern high-speed commuter service to operate ‘around the Thanet coast’ and then to/from London *via* HS1 has had a very significant uplifting impact on the local economies.

(iv) Addressing places with low levels of educational achievement

Within the overall pattern of variability on the proportion of the working age population with at least NQ4+ level so education attainment, several places stand out as being poor performers. Typically, these are in rural areas.

Sustainable transport measures for areas with poor NVQ4+ scores that have already been discussed under earlier inequality headings arise particularly in:

- mid-Kent, rural and coastal East Anglia, the Fens and Lincolnshire;
- parts of the East Midlands/South Yorkshire and parts of Cumbria;
- across the whole of rural Northern Ireland.

In addition, some parts of south west England – including NW Devon – also have poor NVQ4+ scores. Better rail access here is possible, with a speed-up on the Barnstaple line needed (to get service times under 1 hour to Exeter so that a regular interval pattern service can be provided efficiently) and the creation of the second main line between Exeter and Plymouth with stations at

Okehampton and Tavistock (needed for service resilience for Plymouth and Cornwall, given the problems with the line *via* Dawlish).

5. Vision: the 2070 transport plan

In this section, we draw together the various assessments covered in chapter 4 and set out a provisional 2070 transport plan to address places with marked social and economic inequalities.

In general, it is apparent from earlier work that places with poor social inequality scores (as measured by social mobility) also very often experience low levels of economic outputs as measured by Gross Value Added.¹³ This applies for instance to places such as Barnsley, Blackpool, the Forest of Dean, Mansfield and Weymouth. But other places that score poorly on social mobility terms do well in terms of economic output: Derby, Nottingham, North Warwickshire and Chichester fall into this category. There are also some places that score well on social mobility but have low levels of economic output – the adjoining rural areas of Rushcliffe (Nottinghamshire) and Kesteven (Lincolnshire) being a case in point. And as we saw in Chapter 2, there are also contrasting results when other inequality measures are examined.

The 2070 transport plan is designed to address the overall pattern of social and economic inequalities. It was produced by combining a ‘bottom up’ case-by case analysis, drawing on existing plans and aspirations where these have been formulated by local and regional authorities, to formulate a coherent – although obviously highly provisional – overall plan.

The main lines of the national rail network are typically multi-purpose, just like the strategic road network, carrying freight as well as passenger services and local as well as longer distance passenger services. Each service type may have quite different operating characteristics in terms of line speeds and stopping patterns. An efficient network design therefore needs to have regard to likely demand trends in each of these service types and seek to ensure that combinations of differing train types don’t fritter away valuable line capacity. The needs of freight and logistics traffic by rail are considered separately (see below).

We can characterise the interventions needed under the following headings:

- Core national/regional capacity and capabilities (rail network)
- City region (and smaller urban area) transport systems – with extensions into rural hinterlands
- Measures needed to meet environmental standards (for example: electrification to meet the national carbon target in 2050), and other investment to address global warming including sea level rise expected by 2070
- Measures to address identified spatially-based social and economic inequalities.

Core national/regional capacity and capabilities (rail network)

¹³ See Greengauge 21, *Beyond HS2*, Annex A, for full dataset.

Under this heading, expanding capacity and improving connectivity on the main lines is essential to support better balanced economic growth through a sustainable transport mode. Further route electrification of all but secondary/branch lines is needed to ensure efficient overall network utilisation.

The investment needed may take the form of new lines (high-speed or otherwise) noting that where these serve cities, they have the side-benefit of freeing existing line capacity to improve commuter rail services and hence expand labour markets. It is notable that in areas such as the East Midlands which score poorly on social mobility, the second phase of HS2 has a role to play, even though it is designed primarily for metropolitan city inter-connectivity.

Connecting the south end of HS2's eastern limb by using the proposed Midland Rail hub and upgrading the Birmingham-Bristol line in effect changes the HS2 network from a 'Y' to an 'X' shape. This, together with the plan for Northern Powerhouse Rail and a set of further important line upgrades, will achieve a transformation to the connectivity of the first tier of British regional cities and make a significant contribution to improving economic productivity across Great Britain.

Other measures to maintain network resilience, plus a limited set of new/re-opened lines are needed along with completion of a strategic freight network so that capacity utilisation can be optimised.

One area that requires special consideration is the question of connectivity between Northern Ireland and Great Britain. From time to time, ambitious plans for tunnelled connections are made. But there are particular problems associated with a tunnel from SW Scotland where the Irish Sea is at its narrowest point. Our recommendation is that a feasibility study is carried out nonetheless, and that in the shorter term, rail access is re-created to serve the port of Cairnryan.

City region (and smaller urban area) transport systems – with extensions into rural hinterlands

The major city regions will require much more investment in public transport to support the patterns of growth expected (as well as to connect disadvantaged places with opportunity areas).

Cities as small as 150,000 population in France are gaining urban Metro/LRT systems; in Britain cities even as large as Leeds do not. 'Metros' may take the form of LRT or conventional rail-based systems or bus-based transit as well as the various forms of metro technology. How these are developed will be for individual city authorities to decide – and we make no attempt here to second guess their preferences. City authorities will wish to achieve a coherent alternative to continuing car use. They will need a major slice of devolved funding.

Measures needed to meet environmental standards and to address global warming

Here (again) electrification (rail and - in an appropriate form - bus transport systems) is critical, noting that on shorter routes and where service frequencies are lower, other means of de-carbonising may prove possible, most likely battery, according to a recent RSSB report. On the global warming front, the need to retreat from the existing coast line in places where the railway network provides the current land defence is going to need to be reviewed. Critical areas include sections of the Cumbrian, North Wales and South Devon coasts. More generally, the expectation of more extreme weather conditions will place stresses on existing surface transport networks and require investment to counter the risks of flooding and heat damage.

Measures to address identified spatially-based social and economic inequalities

This is the area of central concern to the Commission but really cannot be considered usefully without recognition of the other three types of intervention into the 2070 plan. The central aim is to find feasible and plausible transport interventions that will materially change the well-being of every one of the specific areas and authorities that the UK2070 and the Social Mobility Commissions have identified as needing attention to achieve a more balanced society and economy.

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
- Attempt 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 Hartlepool and Middlesbrough, for example weaken 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, and the plan achieves this for the English south and east coasts in particular.

Achieving the 2070 connectivity Vision

In the diagram below, significant new sections of railway line are marked in red; major missing links that could be provided by upgrading road infrastructure to allow faster inter-urban bus journey times (which have been increasing year-by-year as congestion levels rise) *or* by a new or re-instated rail link are shown in yellow. In practice, it could make sense to upgrade express interurban bus connections to build the market while rail re-opening/new builds are progressed through design and planning. For simplicity, in the tabulations of infrastructure requirements either one or the other option has been selected but in practice this will of course need to be a matter of case by case examination.



Overall, there are 765 miles of new or re-instated railway lines; some are major new schemes (HS2, Northern Powerhouse Rail), while others are short (but not necessarily inexpensive) missing connections – some of them involving tunnelling – as summarised in Table 1.

Table 1: New/re-opened railway lines

Nation	Route	Mileage (approx.)
England		
	HS2	330
	<i>North</i>	
	Liverpool – Ulleskelf (Northern Powerhouse Rail)	90
	Durham cut-off/new capacity	10
	Cross-Tees tunnel	5
	Bradford cross city link and Wortley Chord	2
	Humber crossing	10
	Manchester Airport western links	3
	Ashington Blyth and Tyne	15
	<i>Midlands</i>	
	Spalding-Boston and Firsby-Grimsby	69
	Smethwick chord	1
	Bordesley chords, Moor Street (Midlands Rail Hub)	4
	Nuneaton dive-under	2
	HS2 link to Nottingham	2
	Toton-Kirkby	5
	Newark flyover	2
	Gloucester-Ross on Wye-Hereford	20
	<i>South & East</i>	
	Oxford-Cambridge (EWR)	66
	Stratford-Stansted-Audley End/Marks Tey (<i>New East Anglia Main Line</i>)	69
	March-Wisbech-King’s Lynn	17
	Essex-Kent N-S connections	9
	Croxley Link	2
	Old Oak-Kilburn (Crossrail 1/Elizabeth Line extension)	2
	Heathrow north western, south western and south eastern connections	8
	<i>South west</i>	
	Exeter-Tavistock-Plymouth: new chord north of Cowley Bridge and Okehampton-Bere Ferrers re-instatement	26
	Yeovil Junction chord	1
Wales		
	Swansea Bay cut-off	5

	Neath-Hirwaun-Aberdare	19
Scotland		
	Rutherglen-Carstairs	26
	Inverkeithing-Bridge of Earn & Cross Tay link	30
	Newhouse-Shotts	6
	Curriehill-Edinburgh Gateway	3
	Galashiels-Carlisle	64
	Castlekennedy-Cairnryan	6
Northern Ireland		
	Portadown-Omagh-Derry/Londonderry	69
	(Sligo)-Enniskillen-Omagh	73
UK	Overall Total	771

A substantial level of upgrade of existing lines is needed – totalling an estimated 1121 miles as shown in Table 2. All of these lines will need to be electrified (where not already) along with all other lines where service frequency levels are at 30-minute intervals or better.

Table 2: Route Upgrades

Route (preliminary assumptions)¹⁴	Mileage (approx.)
ECML King's Cross-Darlington	232
ECML Newcastle-Edinburgh	125
WCML Edinburgh-Carstairs-Wigan	207
Manchester-Huddersfield-Leeds (north trans Pennine route upgrade)	32
Sheffield-Stockport/Altrincham/Manchester (south trans-Pennine upgrade)	42
Sheffield-Doncaster (part of)	5
Chester-Altrincham	30
Crewe-Shrewsbury-Newport ('North and West' line)	127
Bromsgrove-Bristol Parkway	74
Marks Tey-Colchester	5
GWML Didcot-Cardiff/Oxford	102
BML Croydon area	2
Reading-Taunton (Berks & Hants)	107
Leicester-Burton-upon-Trent passenger re-opening	31
Total	1121

Both the east and west coast main lines north of the new HS2 lines would need to be upgraded as shown in Table 2. All of the lines are either electrified already or would need to be electrified.

¹⁴ Note: these are overall route upgrade lengths; in practice, some sections will not need to be upgraded

The inclusion of the Bromsgrove-Bristol Parkway line together with the adoption of the Midlands Rail Hub investment at Moor Street and a new south end connection to the existing railway at the southern end of HS2's eastern limb allows the HS2 network to be regarded as an 'X' shape rather than a 'Y' shape, increasing its value and adding south west England and South Wales into the regions benefitting from HS2. It means that the eastern limb of HS2 can be used for much more valuable 'cross-country' trains on the NE/SW axis.

Such connections do not allow for cross-country trains to join the western limb of HS2 between the Midlands and the North West and so instead the shorter route between Newport and Crewe is shown as being upgraded and electrified and it could be used to radically improve the connectivity between south Wales and the north of England and Scotland as well as between south and mid/north Wales.

Key interurban express bus lines where highway investment is needed to maintain competitive journey times are shown in Table 3. Note that there are many other routes which could be identified for similar treatment, and that across Wales, the highly successful existing *Traws Cymru* network is gradually being extended.

Table 3 Express interurban bus lines requiring infrastructure priority – selected sample

Connecting		Current service frequency
Scotland		
Inverness	Fort William	8/day
St Andrews	Leuchars	8/hour
Leven	Kirkcaldy	Twice hourly
England		
Scarborough-Whitby	Middlesbrough	Two-hourly
Harrogate	Ripon	Every 20 minutes
Norwich	Kings Lynn	half hourly
Kings Lynn	Spalding	Every 20 minutes
Barnetby interchange	Hull	n.a.
Peterborough	Kings Lynn	Half hourly
Peterborough	Corby	Hourly
Exeter	Weymouth	Twice hourly +
Bristol	Wells, Glastonbury & Street	Twice hourly

Metropolitan city region networks

The major cities of Glasgow, Newcastle, Manchester, Liverpool, Nottingham and Birmingham/West Midlands already enjoy major electrified rail networks, some of them in the form of LRT systems. Each of these has the potential for major further development through plans generated by the various city authorities. To these city regions, it is essential to add Bradford (for which a cross city rail link is proposed) and Leeds (for which an LRT network is under consideration again, and where an RER/S-bahn approach would also have major benefits), Leicester and Bristol where better use of existing rail infrastructure is being investigated.

Table 4 Major city regions – metro expansion

	Existing Metro expansion	New metro
Edinburgh	*	
Glasgow	*	
Newcastle-Sunderland	*	
Leeds		*
Bradford		*
Manchester	*	
Liverpool	*	
Sheffield	*	
Nottingham	*	
Leicester		*
Birmingham/West Midlands	*	
Bristol		*

There is also the committed plan for the South Wales Metro centred on Cardiff which addresses each of the key valley areas that face hardship, and to which the UK2070 plan adds a connection between Aberdare and Neath and Swansea, providing valuable east-west rail connectivity.

There are further developments which can help address more localised areas of economic and social deprivation than are apparent in the measures of inequality identifiable at a national scale by the Commission. So additional public transport measures that might take the form of LRT or metro-style operations along with busway schemes should be included for:

- Cambridge (which astonishingly has very high levels of income disparity within its thriving economy)
- The east Northamptonshire towns (as noted above)
- Tees Valley
- Swansea
- Southampton-Portsmouth
- Hertfordshire (Watford-St Albans-Hatfield-Welwyn Garden City-Hertford)
- Blackpool (where the existing modernised tramway can be developed and extended)

Rural areas also experience hardships and rural bus services have been severely cut back over the last 10 years. In some cases, there is scope to use rail to address the problems, but more generally bus services are going to be necessary. The problem to be addressed is that centres of higher education and employment opportunities are usually in larger urban areas and peak hour travel by road is often very slow through congested conditions. Moreover, bus priority measures are typically devised to help *urban* buses with the lower frequencies of services coming from rural areas not considered to be of great significance. So, as part of the overall strategy, town and city authorities will need to recognise the importance of creating strategic channels which prioritise access for both rural and urban services and which ensure that journey times are attractive.

More generally, there is huge scope for bus-rail service integration in information and ticketing systems that, as described earlier, must be taken as being an under-pinning of the national sustainable transport network. In infrastructure terms, there is a need to develop attractive bus-rail interchanges, with a presumption that the services of these two modes *always* connect.

Freight and Distribution

A sustainable logistics system is likely to rely extensively on electric road-based vehicles for 'last-mile' or even last 5-mile deliveries. While electrically powered lorries on dedicated motorway lanes are not impossible, the climate change imperative suggests that predictable line-haul freight movements should be accommodated on rail where zero-carbon traction can be provided most efficiently over electrified routes.

There are four components to the network needs for rail freight:

- The creation of a joined-up electrified network of high-gauge routes suitable for carrying high gauge 9'6" containers that is able to support long (775m/850 yards) freight trains at a volume of at least 2 trains/hour (in each direction) through the operating day/week¹⁵. This supports in particular flows to and from ports, and also long-distance internal train-load traffics
- The provision of facilities at terminals for the deployment of high-speed (that is to say, passenger train speed) logistics services using the main line network alongside passenger services. Network capacity and customer demand considerations are likely to lead to this approach being a largely night-time operation
- The ability to operate conventional rail freight – such as stone/aggregates for the construction sector – more generally, recognising that the patterns of demand are likely to shift over time (the 50 years of this plan)
- A set of strategic freight interchanges to maximise the environmental and efficiency contribution that rail freight offers.

A strategic freight network has been identified to meet the needs of the first category (775m high-gauge) and it is illustrated overleaf.

¹⁵ Noting that the recent Rail Industry Decarbonisation Task Force report to Ministers of July 2019 concludes that for rail-freight, there is no available alternative to route electrification if decarbonisation targets are to be met



This network connects with major ports including those at Felixstowe, Southampton, Tilbury/London Gateway, Liverpool, Immingham, Hull, Tyne Dock and Teesport as well as with the channel tunnel. It provides access to major terminals in many locations including NW London, terminals in Lancashire and Yorkshire, the English Midlands and Scotland.

It is designed to avoid the current situation in which freight services are routed across urban centres, inhibiting the best use of line capacity. So, it makes use of a new lower Thames rail crossing to connect the rail networks of Kent and Essex, and fashions a trans-Pennine route *via* Ormskirk,

Accrington and Hebden Bridge, to remove the operation of slow, lengthy container trains from the rail networks of central London, Leeds and Manchester.

The availability of line capacity to make a success of this arrangement is critically dependent on other schemes that create capacity on the rail network, including HS2 and the planned new line from East Anglia into London *via* Stansted. It also requires the construction of a number of new short connecting freight lines. And then, in turn, the existence of the strategic freight network which allows freight to be concentrated on specific routes allows a set of improvements in connectivity for passengers – mainly through better services on other lines freed of the need to accommodate Railfreight.

The high-speed logistics service network is likely to use main lines and it may be possible too to use passenger rail terminal platforms at night times for loading/unloading. This network would also need a terminal at Heathrow Airport to interface with airfreight, and similar arrangements might prove worthwhile at East Midlands and other airports that major in this market.

There are several other major freight flows that either exist today or can be anticipated over the next 50 years. Each of them has implications for the way the multi-use rail network is developed, for example:

- To serve South Wales: the S Wales main line and connections to the strategic freight network at Crewe and the West Midlands could become of greater importance. This could entail the need for capacity enhancements along the 'North and West' route identified for upgrade along the English border and – more substantially – the need to re-instate the Stourbridge-Walsall freight line (for which protections have been made in current Midlands Metro plans) to avoid compromising major rail passenger service developments in Birmingham
- To serve the South West, where there is an existing major flow of aggregates traffics from the Mendips to London and where there should be the opportunity of distribution of food/*fcmg* goods by rail, most likely to/from distribution centres in the Midlands and the North.

Other freight flows are likely to arise over the period to 2070 that will create the need for freight paths on the rail network that will be hard to find. Currently an infrastructure scheme is under consideration for limestone traffics from the Peak District – re-opening the Buxton-Matlock line. Such schemes could have potential for passenger services as well. All of these additional routes for Railfreight will need to be electrified.

Creating an integrated network: case study

The eastern side of the country, especially coastal areas (but also the East Midlands) were identified as needing particular attention to make good social and economic inequalities. An illustration of how the measures identified here come together is shown below taking this geography as an exemplar.



As this diagram shows, the idea is to create a set of multi-modal interchanges – at Norwich, King’s Lynn, Wisbech, Peterborough, Barnetby, Hull, Scarborough, Whitby and Middlesbrough. Not shown in the diagram is the set of successful interurban bus routes in this area that complement the interurban routes that are shown: these provide valuable connections radiating from Lincoln to the Lincolnshire towns of Louth, Skegness, and Boston, for example.

The interchange at Barnetby is intended to provide a quicker bus-rail route across the Humber. But better still, a new cross-Humber rail link should be provided in due course. This would allow operation of rail services from Hull to the re-instated coastal route through Grimsby and Boston, to Lincoln and thence Nottingham and London, and *via* Brigg and Gainsborough to Worksop and Mansfield and Sheffield.

There are a number of ways by which Lincoln could gain a better London rail service. Since May 2019, a new two-hourly service to the capital is being provided by LNER, with a journey time of around 2 hours. With a southern connection from HS2 into Nottingham, and a speed-up of the line of route onwards *via* Newark to Lincoln and grade-separation of the 'flat' crossing at Newark, as shown in the diagram above, it would be possible to create a new fast and valuable route to Lincoln. It would mean journey times of London-Nottingham of c50 minutes and London-Lincoln of c1h20 minutes – both transformational changes to the connectivity of these two East Midland cities.

Summary of transport policy measures needed to address inequality

In infrastructure and service terms, these are – for rail:

- Closed line-re-instatements
- Re-opening of some freight-only lines for passengers
- Extensions of some existing main line (and high-speed) services to serve remoter places
- New chords (short connecting lines)
- New lines (including a new fast route to link East Anglia with London, and Perth/Dundee with Edinburgh; new lines to serve the eastern part of Ulster)
- An extensive programme of upgrades to existing lines
- Arrangements to operate peak hour services on heritage railways
- New estuarial crossings (Tay, Humber, Thames and Neath)
- Using the need to provide resilience to climate change to bring services to remote locations

together with the implementation of existing programmes, including:

- Midlands Rail hub schemes – with the addition of new connections to link the Black Country to HS2
- The wider enhancement strategy of Transport for the North
- East-west rail
- South Wales Metro (extended to link in Swansea/Neath)

measures to enhance inter-urban express bus services:

- through targeted highway improvements
- the creation of a set of integrated multi-modal transport mini-hubs

and mass transit systems (electric bus/LRT etc):

- for city regions
- smaller cities and large towns
- to create sub-regional transit networks, linking medium/small size towns e.g. for Northamptonshire and Hertfordshire

and a rural area transport programme:

- to ensure that everywhere has a connection (whether scheduled or not) to places of employment opportunity, higher education and regional healthcare.

To be effective, this programme will need to be complemented by attention to fare affordability to ensure that services can be used by everyone, and not just by, for example, job-seekers and school-children (for which some support programmes exist today).

6. Conclusions

Better transport service provision is an important – but by no means the only – means by which the serious imbalances across the nation in social and economic well-being should be addressed.

The UK2070 Commission has shown, in its statistical assessments in its first report, dramatic variations across the nation in life chances, life expectancy, educational potential and achievement, and the likelihood of being able to find employment – each varying hugely according to where people happen to live. We have added an analysis of the data collected by the Social Mobility Commission and of productivity levels in economic sub-regions to complete the picture.

We summarised in Chapter 2 what the data tells us. It is a complex but fathomable picture, with biases against areas outside south east England scoring well, a north-south divide, and very different outcomes across the four nations making up the UK. On some measures, rural areas fare worse, on others urban areas. There is notably poorer performance in England on its eastern side; and a number of coastal towns in England suffer significantly, on both eastern and southern coasts.

It is evident that the patterns that emerge are deep-seated, with areas of post-war industrial decline, for example, still suffering the consequences 30 or more years after the loss of local industries.

We see little sign currently of policy initiatives – in transport or other sectors – designed to address the problem. Indeed, leaving the EU will undoubtedly worsen it, since replacement of its funding to the many parts of the UK that are ‘peripheral’ (in EU terms), or simply weak in economic terms – remains uncommitted just a few years hence. It could disappear altogether. And the economic impacts of leaving are projected to affect disadvantaged areas more seriously.¹⁶

Our analysis of existing journey times (Chapter 3) highlighted the problems of peripherality and made clear that across much of England, Wales and Scotland, travel by rail is slow – often in the 20-40 mile/h range even for travel over longer distances between towns and cities. Travel by bus – even by express bus – is in general even slower than by rail and getting slower still year by year as road traffic conditions worsen. Exceptions to this pattern of relative modal speeds arise in Scotland, Wales and Northern Ireland where the rail network is sparse across large rural areas.

Realistically, this means that people seeking a job or higher education in many places will need to move out and find housing elsewhere. Losing more able citizens from local communities is not a new phenomenon, but it continues.

In Chapter 4 we looked at the worst performing places identified by the Social Mobility Commission (40 in England, 6 in Scotland, 5 in Wales) and the worst performing places on the set of scores examined in the UK2070 Commission’s first report and set out a series of transport measures that could be applied to improve matters.

Our aim was to develop a Vision for the UK in 2070 that ignores the limitations of current policies and transport appraisal methodologies in respect of distributional impacts (which are in practice effectively ignored). We avoided concerning ourselves with demographic and overall national economic forecasts – which at this time of major Brexit-related uncertainty would no doubt have required consideration of diverse projections of GDP and population (and hence travel demand) levels. But we can be reasonably confident that the pattern of the spatial inequalities identified by

¹⁶https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760484/28_November_EU_Exit_-_Long-term_economic_analysis_1_.pdf

the Commission will remain to be addressed in 2070 unless the radical set of transport initiatives proposed here *is* adopted in the meantime (along with other complementary measures).

Look forward 50 years/look back 50 years

It is reasonable to ask if the approach has been too timid; or too presumptive that what exists today will still be as relevant in 2070; or too focussed on timetabled services.

If we look back 50 years, we can see a partially completed national motorway network. While airports haven't since relocated or shifted in terms of primacy, air travel volumes were much lower in 1969. But the rail network was very similar to today's with just a few significant line closures yet to happen. Metropolitan authorities were just at the beginning of their journey to develop (under the 1968 Transport Act) plans to create urban public transport systems that the London Transport Board had begun 35 years earlier: the Tyne & Wear Plan was in preparation (and would lead to the Metro system a decade later). So, while now a great deal busier and more congested, the nation's transport systems have changed relatively little in 50 years. Even transformational projects like the channel tunnel have not much changed this picture.

The emphasis taken here on scheduled services is vulnerable to the disruptive impact of new technology through changes in consumer behaviour using digital platforms, which can provide users with bespoke travel arrangements, algorithmically picked to best meet travel needs. Yet service provision choices will remain constrained by infrastructure, and the virtues of collective travel vehicles rather than personalised ones will remain subject to the same advantages in terms of route utilisation, environmental impact and network capacity efficiencies, whether using autonomous control systems or not.¹⁷

The pace of change ahead may be quicker or slower than the last 50 years. But two factors are likely to dominate in the direction of technological change in transport:

- New control systems – and with them some new modes, notably drones – so much less need for drivers, in short
- Environmental concerns – so total decarbonisation of transport (mainly through a switch from fossil fuel to electrical power) – and a need to address other concerns, including air quality (which not only means a switch out of diesel, but also a solution to the problems of particulates from tyres and from braking systems).

Transport systems that don't relate to person travel – so, in essence, the distribution and logistics sector – is changing fastest already and is likely to continue on a trend towards automation.

But overall, 50 years hence, the rail and highway networks, ports and airports, are likely to remain put, meeting a largely unchanged set of local, regional and national needs for personal travel and freight/logistics. And because it is so much easier to electrify railways than the 35m+ national road vehicle fleet, rail is likely to be playing a more important role in 2070 than today.

The 2070 transport vision

The vision for the transport system in 2070 developed here (and set out in Chapter 5) addresses social and economic inequality set in the context of developments likely to be found necessary both

¹⁷ The UITP Global Public Transport Summit held in Stockholm in June 2019 focused on innovations in autonomous control systems and on-demand services such as Uber. The latter were seen to be most appropriate as a complement to an effective public transport network, particularly in low-density areas. The agreement by Uber to provide flat-fare suburban feeder services to trams in Nice is an example.

to meet increased travel demand arising from general economic growth and to meet environmental imperatives.

The elements in the UK2070 vision comprise:

- Core national/regional capacity and capabilities (rail network)
- City region (and smaller urban area) transport systems – with extensions into rural hinterlands
- Measures needed to meet environmental standards (for example: electrification to meet the national carbon target in 2050), and other investment to address global warming including sea level rises expected by 2070
- Specific measures to address inequalities and peripherality.

In the fourth category, the measures to address inequalities and peripherality are often relatively low-cost measures, including re-instatement of passenger rail services over freight-only lines, for example. In some cases, they build upon measures that arise under one of the three other headings. So better connectivity for Mansfield, for example, is expressed in terms of a new rail link to the planned HS2 station at Toton. This means there is an inter-dependency and it risks delaying a localised improvement for inequality reasons, awaiting a national investment project. But in this and other similar circumstances, it would be possible to break this inter-dependency and proceed right away with a suitable scheme for Mansfield. This would take the same local rail project, still link it to the main line network at Toton – and here, absent HS2, the new service could be extended instead southwards over the Midland Main Line, linking Mansfield with a number of major opportunity areas, potentially including the capital.

In other cases, the measures needed are more substantial capital programmes, for instance to address the absence of sustainable links across estuaries that diminish the effective catchment and economic prospects of a number of coastal towns and cities.

The over-arching aim is to ensure that people living anywhere in mainland UK can access employment opportunity areas, higher education facilities and regional health facilities on a day trip basis. Questions of affordability imply the need to provide financial support where appropriate – for instance for job-seekers, and those on lower pay levels for whom the cost of travel would be disproportionate.

Overall, the 2070 plan ensures that the UK regions - and its four nations - should be well connected (speed and frequency) with each other as well as with London; and that economic sub-regions should be well connected internally and with their neighbouring sub-regions. The plan provides for:

- A major programme of rail electrification (noting that Scotland already has a stated ambition to electrify its entire rail network)
- A series of new lines, re-openings and major railway route upgrades, totalling around 1900 miles – needed to improve connectivity, increase capacity and service reliability
- A strategic electrified rail-freight network linked to ports in both the north and south of the country
- A new policy initiative to create bus priorities along express interurban bus routes
- A presumption of a joined-up public transport network, with fares/ticketing available across travel modes and a series of mini-hubs established where passengers need to interchange

- A set of measures which together provide for a public transport corridor along the south and east coasts of England, where there are a number of significantly disadvantaged places in terms of connectivity
- A set of metropolitan area transit systems, both for city regions with existing LRT/Metro systems where extensions will be needed and others where new systems need to be established, bringing a better public transport alternative to smaller cities and towns
- A programme to retain connectivity in rural areas, where use of demand-responsive rather than scheduled transport is likely to feature. In some cases – notably in Northern Ireland – the absence of rail connectivity precludes the opportunity of accessing opportunities and facilities in Belfast
- A programme of new estuarial rail crossings – in England, Scotland and Wales.

Overall, 771 miles of new lines are identified (of which 142 are re-openings of long-closed lines in Northern Ireland) – which over a 50-year period amounts to around 15 miles/year – along with 1121 miles of route upgrades. The strategic freight network and a programme of metropolitan rail schemes can be added, and together this points to the need for commitment to a long-term investment programme as the basis of a zero/very low carbon national transport network that will help address spatial inequalities.

There are some choices in terms of which *modes* of transport should feature in the vision. To generate the transport plan, the frequently recurring choice was between road-based interurban express bus/coach services and rail services. There is little doubt both will continue to be needed. Indeed, fostering service enhancements on interurban bus/coach in the short term can help build the market base for new rail links over time.

Of course, local urban and rural transport services will remain of paramount importance, since many spatial inequalities arise at a very local level – on individual housing estates, for example – below the radar of even the detailed scrutiny the Commission has applied. The 2070 plan therefore envisages a comprehensive programme to sustain and enhance urban services, and these it can be imagined will continue to use the best LRT/bus/metro systems available at the time. What will undoubtedly need to happen is that existing systems will need to be expanded in the metropolitan areas, as well as major investments in smaller cities and in towns. While these might use an evolution of existing technologies (suitably decarbonised), in rural areas it is more likely that road-based demand responsive services are going to be increasingly needed, connected to key transport hubs as well as key destinations such as hospitals.

At the national spatial level on which the Commission is operating, a significant part of the overall programme of investment, complementing and extending the pattern of existing programmes which are focused on areas of greatest demand, is designed to address specifically disadvantaged areas. Typically, here demand levels will be lower, and cost:benefit performance will appear weaker on current appraisal criteria. Yet the economic value of lifting up the GDP performance and self-reliance of disadvantaged areas is huge, if under-valued in current appraisal methodologies. Green Book guidance should be adapted to strengthen its distributional component, if the common aim of increasing national level GDP is to be more successful.

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