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Current Issues Note 60

Transport expenditure in London

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Executive summary

This current issues note looks at the case for continuing transport expenditure in London, and specifically in relation to transport investment. It considers the demand for transport services, the rationale for investment, and the levels of investment, who funds it and who pays.

Highlights

1. London's size and geography are unique compared with other UK cities and regions. Its transport system supports large numbers of commuters and visitors as well as residents. This translates into unique transport needs.

- London is the only UK region which is entirely an urban area.
- It's more reliant on its catchment population outside the city for workers than other large areas.
- In 2011, the Built-Up Area of London had a population of 9.8 million while the administrative area had a population of 8.2 million.
- In 2017, the usual daytime population of London had 2 million more people than its usual resident population of 8.8 million people.
- The characteristics of London mean that rail is the travel mode of choice. 63% of rail journeys in Britain are at least in part in London, coming to 0.9 billion journeys in 2017/18. This is without counting the 1.4 billion journeys on London Underground in the same year.

2. London's geography means that it is much more reliant on public transport (especially rail transport) than the rest of the UK. Public transport expenditure in London is needed, cost-effective, and proportionate to the size of the economy.

- Some 58% of all journeys on public transport in Britain are at least in part in London. Unlike in England, the share of journeys on public transport is rising.
- Congestion in the capital is worse than other UK cities. In the morning peak a significant proportion of passenger journeys in London are made in crowded conditions: 70% of London Underground journeys; 41% of National Rail journeys; 42% of Docklands Light Railway journeys; and 59% of Tram journeys.
- Public sector expenditure per rail passenger journey in London was around £8 in 2017/18. That was below the GB average of around £12 and was only higher than the other regions of the Wider South East.
- Public sector transport expenditure in London in 2017/18 was 2.1% of economic output. While this is higher than the UK average of 1.8% it is less than for the North West, Wales and Scotland.

3. Public transport investment in London should not be seen to be at the expense of other cities and regions and can generate tax revenues that flowback to the rest of the UK.

- The National Infrastructure Commission has concluded that within the fiscal remit that HM Treasury has set for gross public investment in economic infrastructure (between 1.0-1.2% of GDP for each year from 2020 to 2050) there is scope for meeting the needs of London while meeting the claims of other parts of the country for significant transport investment.

- Transport projects generate additional tax revenues, and London raises more in tax than it receives, so there is a flowback to the rest of the UK.

4. London contributes directly to its transport projects, and the share of transport expenditure borne locally is likely to increase in the future.

- 55% of the cost of Crossrail will be met by London funding sources. All of the costs of the Northern Line Extension will be met by London funding sources.

- Transport for London receives no grant from central government. Funding has fallen by £1 billion a year from 2016/17 and is £3.3 billion lower than it was in 2010/11 in cash terms.

5. Current funding mechanisms are insufficient to pay for London's future long-term transport infrastructure needs, and new funding mechanisms will need to be considered. Fiscal devolution provides one means to do this.

- London's transport investment needs from 2018-41 are approximately £445 billion.

- There is a public sector funding gap of £32 billion over the period.

Main findings

Having a good transport system that is efficient and reliable is essential for supporting economic growth, and to unlock housing. It can reduce costs to both businesses and consumers by reducing travel times, alleviating congestion and enabling better access to markets. It can also promote agglomeration benefits whereby businesses and consumers benefit from being close to each other and enable a more efficient allocation, and productive use, of resources. In addition, it can help to stimulate private sector investment by increasing expected returns. The National Infrastructure Commission (NIC) recognises the benefits of transport and other infrastructure in the first National Infrastructure Assessment (NIA) in November 2018[1].

The benefits of an efficient and reliable transport system are of particular relevance to London given that it is a global business capital, which has attracted investment, skills and visitors from all over the world, and has specialised in a number of internationally competitive sectors. These industries benefit from having access to a highly skilled labour force and both suppliers and customers, which is partly a result of having a good transport network.

London has benefited from significant public sector investment in transport, and in 2017/18 received 28% of public sector transport expenditure in the UK. This has funded developments as diverse as the redevelopment of King's Cross station, and the East London Line extension[2]. However, congestion and overcrowding can potentially dampen these benefits and raise questions as to whether London's transport infrastructure can continue to support economic growth in the future. For example, there were around 31.5 million daily journey stages in London during 2017 – over a third higher than in 1995. And there has been a marked shift towards the use of public transport from 29% of journeys to 43% over this period. In consequence congestion in the capital is worse than other UK cities.

The latest estimates suggest that £9.1 billion was spent by the public sector on transport in London during 2017/18. Over two-thirds (72%) of this was capital expenditure, which was close to the highest share among the UK regions. At face value, London would appear to receive the most transport expenditure in the UK of any region or nation (historically between 20 and 30% of the UK total), and this is true even after accounting for differences in resident population. However, these simple regional comparisons are not necessarily made on a like-for-like basis nor in a 'rational' manner.

There are a number of factors to consider when assessing London's need for continuing investments in transport infrastructure:

- **London is an entirely urban area, whereas other UK regions include a mix of urban and rural areas. Regional comparisons are therefore not like-for-like as transport is likely to represent a larger proportion of public sector spending in an urban area.** Other large metropolitan areas lie within Combined Authorities (CAs), but the geographic level at which expenditure data is available is the regional level. A fairer comparison would be to look at transport expenditure for the Wider South East (WSE)[3] which is more 'balanced' in terms of land use. Here, spend per head for the WSE was around three-fifths that for London on its own, though still above the UK average.

- **London as a place where people live and work spills well beyond its administrative boundaries, and it does so to a much greater extent than any other large metropolitan area in the UK.** In 2011, the Built-Up Area of London had a population of 9.8 million[4] while the administrative area had a population of 8.2 million.

[1] See National Infrastructure Assessment 2018 - National Infrastructure Commission
[2] See TfL Investment Programme 2009/10 to 2017/18 – London Datastore
[3] This includes London, the South East and East of England.
[4] This is the last year for which ONS has published population statistics for Built-Up Areas

- **London relies on workers commuting from outside the city more than other large metropolitan areas.** Rail is the mode of choice for long-distance commuting and therefore the capital is relatively more reliant on rail infrastructure, which is expensive to provide and maintain. 63% of rail journeys in Britain are at least in part in London.

- **London's size and geography also mean that London is more reliant on public transport than other cities**, as indicated by the rising share of journeys on public transport. There has not been a shift in mode of transport use elsewhere in England, and the use of public transport is markedly less common. 58% of all journeys on public transport in Britain are at least in part in London.

- **The dynamics of growth are placing greater pressures on London than other cities, and connectivity in London is worse than connectivity in smaller urban areas.** Population and employment are growing faster in larger urban areas, and are growing fastest for London. The connectivity of large cities in terms of ease of getting around is worse than for smaller urban areas, and London's connectivity is comparable to connectivity in other large UK cities.

- **Comparing regional transport expenditure in terms of pounds per resident does not properly account for the need or demand for transport.** If account is taken of the number of commuters, visitors, and tourists in London then transport spend per this workday population is four-fifths of the spend per usual resident, although still above the UK average. Pertinently, three fifths of some or all of the journeys taken on public transport in Britain are in London – there will be significant capital expenditure on renewing and maintaining existing infrastructure.

- **Compared with the size of the economy, transport expenditure in London and in the Wider South East are broadly in line with the UK average.** Transport is essential in supporting an economy and measuring transport expenditure as a proportion of output is consistent with how other economic indicators are compared, i.e. national debt and R&D investment are usually referred to in terms of a share of economic output. Transport spending in London as a share of economic output (as measured by GVA) is largely on par with Wales and Scotland; while for the WSE more generally, it was broadly in line with the UK average.

- **It is also worth considering public sector expenditure in London in terms of the amount of tax revenue that London generates.** On this basis, transport expenditure in the capital as a share of tax revenue was above the UK average, but was generally in line with this when including the WSE. In addition, if considering all public sector spending in the capital, then **London raises more in tax than it receives**, making it a net contributor to the Exchequer.

IPPR North[5] has concluded that planned transport investment in London is 2.9 times higher per capita than in the North. The methodology includes a number of choices which systematically overstates London's share of national public transport investment. Specifically, using a per capita weighting to compare across regions does not take into account the large numbers of commuters, tourists and visitors in London.

Investing in London's transport network should not be seen as being at the expense of other parts of the UK.

First of all, the NIC has concluded that within the fiscal remit that HM Treasury has set for gross public investment in economic infrastructure (between 1.0% and 1.2% of GDP for each year from 2020 to 2050[6]) there is scope for meeting the needs of London while addressing the claims of other parts of the country for

[5] See Transport investment in the Northern Powerhouse: 2019 update | IPPR
[6] See Remit letter to the National Infrastructure Commission - GOV.UK

significant transport investment. Over 90% of infrastructure investment over the 30 years to 2050 should be on transport, and a little over 10% of transport funding would be for TfL (including Crossrail).

Secondly, investing in London's transport system should not be seen as a 'zero-sum game' as essentially when London grows, the rest of the UK grows. There are many different mechanisms through which these spillover benefits materialise. The rest of the UK is London's most important trading partner and trade is broadly in balance, so an increase in London's output will generate greater demand for goods and services from the rest of the UK. Enhanced business productivity from greater agglomeration economies (enabled by improved transport links) increases Exchequer receipts, which flow back to other parts of the country. Like Londoners, commuters from the WSE also benefit through higher wages and higher house prices.

Indeed, the fact that **London is directly contributing to the cost of its transport projects** is not shown in the public sector expenditure data used above. Expenditure data focuses on who is responsible for the spending (with TfL categorised as being local government for instance) rather than on how expenditure was funded. For example, more than half of the cost of Crossrail 1 is funded directly by London businesses and Londoners. This includes the Crossrail business rate supplement which is an additional tax on London businesses only and, being a new tax, does not 'subtract' funds from other transport projects. Similarly, the Northern Line Extension is being financed by future growth in business rates paid by London firms, as well as developer contributions. More generally, almost half of Transport for London's (TfL's) budget comes from fare revenue alone (i.e. it comes from the users of London's transport network). Thus, a simple comparison of this transport expenditure data may give a misleading view of the national contribution to London's transport infrastructure, of which significant sums are financed by taxes set in London specifically for this purpose.

The share of transport expenditure borne locally is likely to increase in the future as Londoners and London businesses benefit most from new investment. Since April 2017, the GLA has been responsible for the TfL investment grant in return for a higher proportion of locally raised business rates income. And, TfL has received no central government support for operating costs since April 2018. Funding to TfL from central government has fallen by £1 billion a year from 2016/17 and is £3.3 billion lower than it was in 2010/11 in cash terms. **Current funding mechanisms are insufficient to pay for London's long-term transport infrastructure needs, and new funding mechanisms will need to be considered. Fiscal devolution provides one means to do this.**

1 Introduction

The UK Government has placed renewed emphasis on infrastructure. It established the NIC in April 2017 to carry out an overall assessment of the UK's infrastructure requirements once every 5 years. The NIC published its first NIA in November 2018[7].

This paper helps to make the case for London, and specifically in relation to transport investment. It updates and develops a 2017 GLA Economics Current Issues Note 54[8]. The analysis looks at who uses public transport in London and beyond, why, and the experience of these services – it compares London with other parts of the UK. There is consideration of the economic reasons for investing in public transport, and how London justifies investment. Finally, it examines current and possible future levels of public investment in transport services for London and the other regions of the UK, who is paying for this in London, and how some of the benefits spread across the rest of the UK.

Research by other organisations has also previously looked at regional transport investment to some extent – for example, the Centre for Cities[9] and IPPR North[10]. However, they do not necessarily discuss transport investment in its entirety, but rather certain aspects of the investment picture. Subsequently, this paper takes a more holistic approach to transport expenditure.

The main paper has three chapters which consider:

- Travel patterns, and the level of demand for services
- The rationale for investment in transport infrastructure
- The level of transport investment, how it is funded, who pays, and how the rest of the UK benefits.

The historic analysis of public sector expenditure in this paper is for 2017/18, as this was the data that was available at the time of conducting the analysis. Subsequently, HM Treasury has published figures for 2018/19[11].

[7] See National Infrastructure Assessment 2018 - National Infrastructure Commission
[8] See Transport expenditure in London | London City Hall
[9] See Mapping Britain's public finances | Centre for Cities
[10] See, for example, Transport spending has risen twice as much per person in London than in the North since launch of Northern Powerhouse | IPPR
[11] See Country and regional analysis: 2019 - GOV.UK

2 Travel patterns and numbers

2.1 Introduction

This chapter presents key travel statistics and indicators for London and other areas of the UK that help to illustrate distinctive features of travel in London. These in turn can inform and place into context the discussion about the case for investing in transport in London that follows in the rest of the report.

The demand for transport provision in an area depends on:

- The size of its population, and that of the surrounding area;
- Choices made by residents and visitors of where, how often and how to travel for both work and leisure purposes;
- How easy and appealing it is to get around.

This chapter looks at these issues by:

- Looking at populations, employment and commuter patterns for some of these geographies;
- Providing data on public transport journey numbers for London and Great Britain;
- Considering how easy and appealing it is to get around in London and other urban areas.

The chapter makes use of the geographies defined in Appendix A, which compares London and other areas in terms of administrative and statistical geographies. London is distinguished from other regions in that it is the only region which is almost entirely urban. The WSE, combining London, the East and the South East of England, is more balanced in its land use, and so provides a more like-for-like comparison with other regions in terms of urban development. The Combined Authorities (CAs) of the West Midlands, Greater Manchester, and Liverpool are as built up as London, but it is only London which in its entirety is a city.

2.2 Populations, workers and commuter patterns

It is possible to analyse Census data directly to consider populations, workers, and commuter patterns to large metropolitan areas. For example, only London of the large metropolitan areas has a higher population for the Built-Up Area (BUA), 9.8m in 2011, than the administrative boundary, 8.2m, (Table 2.1).

Table 2.1: Populations of Large Metropolitan Areas, by devolved authority and BUA, 2011

	administrative boundary	BUA
London	8.20m	9.79m
Greater Manchester	2.69m	2.55m
West Midlands	2.74m	2.44m
West Yorkshire	2.23m	1.78m

Source: ONS

A broader definition of Core Cities has been used in research on the evolving performance of UK cities[12], and in addition to the large metropolitan areas includes in England and Wales Bristol, Cardiff, Liverpool, Nottingham, and Newcastle[13].

[12] See The Evolving Economic Performance of Britain's Cities | Centre for Cities

[13] This analysis defines city areas in terms of TTWAs. This does not correspond to the ONS definition based on the 2011 Census as there is only TTWA for London in this research.

Further, the NIC has commissioned external work to consider transport connectivity[14]. This analysis uses 863 of the 5,493 BUAs for England and Wales[15]. In 2011 these 863 areas accounted for 90% of the population of BUAs, or 85% of the population of England and Wales. The 5,493 BUAs altogether account for 95% of the population of England and Wales[16]. The accompanying dataset supports the analysis of the next section[17].

Across all these classifications of urban areas, population has been growing faster than for England and Wales, but it is only for Core Cities and larger areas that employment has been growing faster than the national average. For all categories of urban area employment is growing faster than population. Further, across types of area the larger is employment or population the faster it is growing. Growth has been fastest in London, with population rising by 7.1% between 2011 and 2016, and employment rising by 14.6%, (Tables 2.2 and 2.3).

Table 2.2: Population change by classification of urban area, by BUA in England and Wales, 2011 and 2016

	2011	2016	% change	% 2016 population
London	9.8m	10.5m	7.1%	17.9%
Large Metropolitan Areas	16.5m	17.5m	5.8%	29.9%
Core Cities	19.9m	21.0m	5.4%	36.0%
Prime Urban Areas	31.8m	33.3m	4.9%	57.0%
NIC Built Up Areas	47.9m	50.0m	4.4%	85.7%
England and Wales	56.2m	58.4m	3.9%	100.0%

Source: GLA Economics calculations of National Infrastructure Commission data

Table 2.3: Employment change by classification of urban area, by BUA in England and Wales, 2011 and 2016

	2011	2016	% change	% 2016 employment
London	5.2m	6.0m	14.6%	21.5%
Large Metropolitan Areas	8.3m	9.1m	10.5%	32.9%
Core Cities	9.9m	10.9m	9.6%	39.2%
Prime Urban Areas	15.6m	16.8m	7.8%	60.3%
NIC Built Up Areas	22.7m	23.8m	4.8%	85.6%
England and Wales	25.7m	27.8m	8.3%	100.0%

Source: GLA Economics calculations of National Infrastructure Commission data

The NIC has noted[18], "The UK's highest value jobs continue to be in London and it is projected to grow faster than anywhere else, with employment growing 18 per cent to 6.7 million by 2041."[19]

[14] See Transport connectivity discussion paper - National Infrastructure Commission and supporting dataset
[15] The NIC analysis is for Great Britain, while the coverage of this paper is England and Wales to reflect the availability of data from the Office for National Statistics (ONS)
[16] See 2011 Census - Office for National Statistics
[17] ONS only provides population and employment data for BUAs for 2011 from the Census. The NIC has also produced estimates for 2016, which allows analysis of change over time
[18] See National Infrastructure Assessment 2018 - National Infrastructure Commission. GLA Economics has estimated that the number of jobs in London will reach 6.9 million by 2041, see London labour market projections 2017 | London City Hall
[19] These projections are not the projections produced by GLA Economics available at London labour market projections 2017 | London City Hall

In relation to the Large Metropolitan Areas, London is more than three times as large as the other areas in terms of workers who live in the area, all workers, population, and catchment population in 2011, (Table 2.4 and Map 2.1). Some comparisons for London and the next largest metropolitan area are:

- 2.93m people who both live and work in London, compared with 0.90m in Greater Manchester;
- 3.72m people work in London compared with 1.06m in Greater Manchester;
- 8.20m people live in London, compared with 2.74m in the West Midlands;
- 14.21m people form the catchment population for London, compared with 4.01m in the West Midlands. Catchment population is defined as those Middle Super Output Areas (MSOAs) where 10% of more of the workers work in the nearby large metropolitan area.

London is also much more reliant on its catchment population for workers than other Large Metropolitan Areas. Around 58% of London workers live in London compared with 68% for the West Midlands, and around 80% for the other large metropolitan areas, Table 2.4 and Map 2.1. So, a comparatively low proportion of its workers live in London at 79%, rising to 81% for the West Midlands, up to 89% for West Yorkshire[20]. In consequence, the ratio of all workers to population is higher for London at 45% than the other large metropolitan areas.

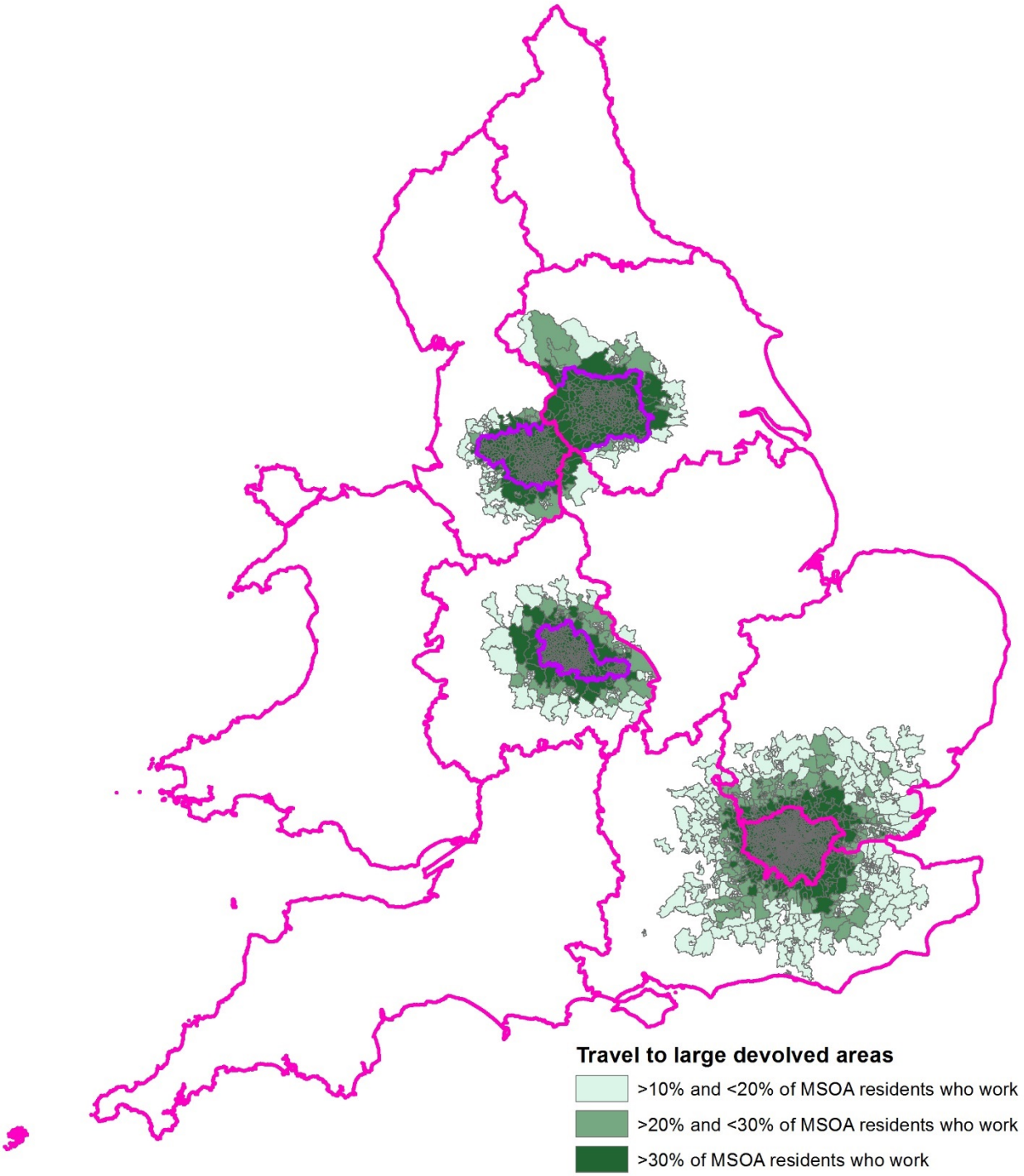
[20] There is some commuting between Greater Manchester and West Yorkshire. For example, there are 5 MSOAs in West Yorkshire where more than 30% of workers work in Greater Manchester. Each MSOA has only be attributed to one row in Table 2.2 by the order of the rows.

Table 2.4: Commuter patterns by MSOA to large metropolitan areas, and populations, 2011

Area of work	Residence	Workers	% Workers	Catchment Population	% Catchment population	All Workers/ Population
		2011	2011	2011	2011	2011
GLA	within London	2.93m	79%	8.20m	58%	45%
	MSOAs outside London					
	>30% of workers commute	0.27m	7%	1.56m	11%	
	>20%-<30% of workers commute	0.14m	4%	1.41m	10%	
	>10%-<20% of workers commute	0.18m	5%	3.04m	21%	
	<10% of workers commute	0.21m	6%	n/a		
	Total	3.72m	100%	14.21m	100%	
GMCA	within Greater Manchester	0.90m	85%	2.69m	78%	39%
	MSOAs outside Manchester					
	>30% of workers commute	0.03m	3%	0.20m	6%	
	>20%-<30% of workers commute	0.01m	1%	0.11m	3%	
	>10%-<20% of workers commute	0.03m	2%	0.44m	13%	
	<10% of workers commute	0.08m	8%	n/a		
	Total	1.06m	100%	3.44m	100%	
WMCA	within West Midlands	0.84m	81%	2.74m	68%	38%
	MSOAs outside West Midlands					
	>30% of workers commute	0.06m	6%	0.34m	9%	
	>20%-<30% of workers commute	0.03m	3%	0.35m	9%	
	>10%-<20% of workers commute	0.03m	3%	0.57m	14%	
	<10% of workers commute	0.06m	6%	n/a		
	Total	1.03m	100%	4.01m	100%	
WYCA	within West Yorkshire	0.78m	89%	2.23m	82%	40%
	MSOAs outside West Yorkshire					
	>30% of workers commute	0.01m	1%	0.08m	3%	
	>20%-<30% of workers commute	0.01m	1%	0.11m	4%	
	>10%-<20% of workers commute	0.02m	2%	0.30m	11%	
	<10% of workers commute	0.06m	7%	n/a		
	Total	0.88m	100%	2.71m	100%	

Source: GLA Economics calculations of ONS Census data

Map 2.1: Commuter patterns by MSOA to large metropolitan areas, 2011, shaded areas are where 10% or more of people who work in an MSOA travel to a large metropolitan area

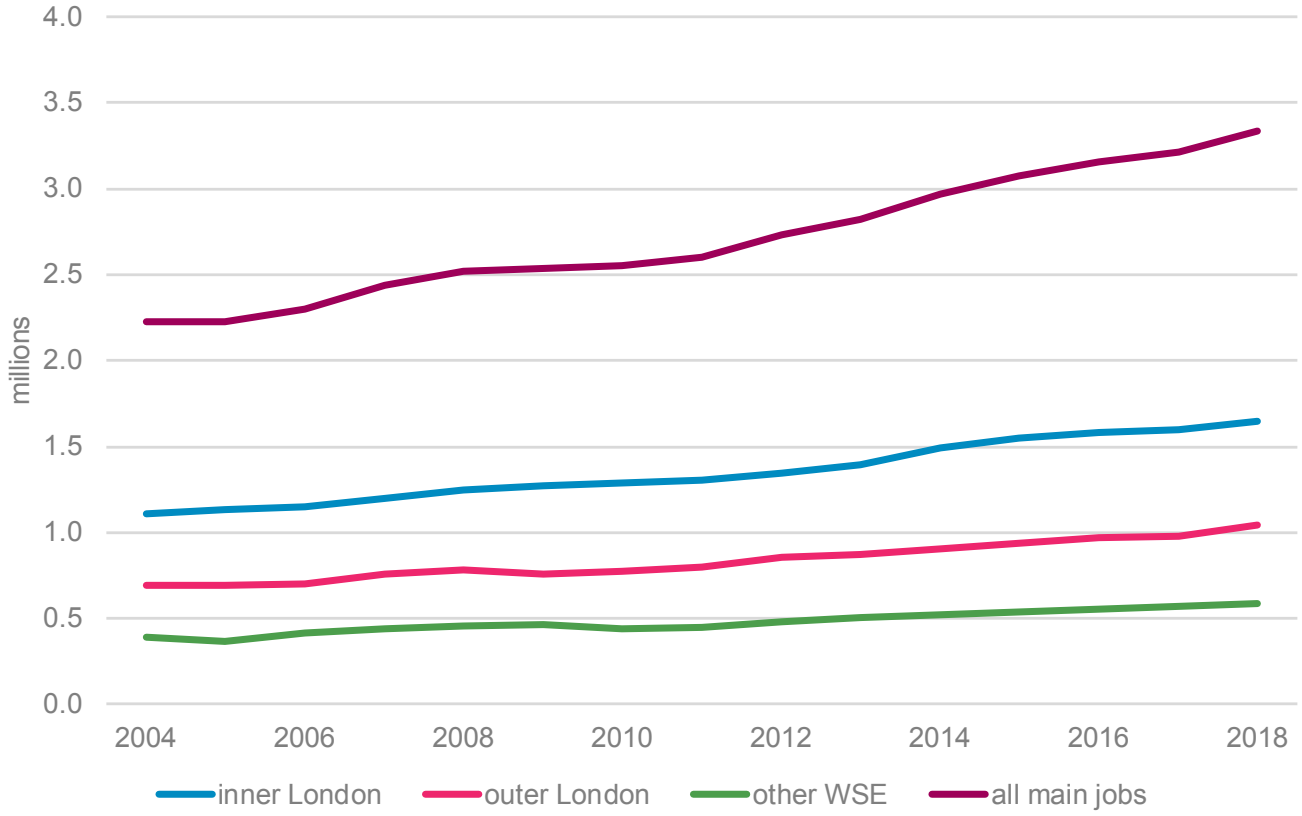


Source: GLA Economics calculations of ONS Census data

And commuting has made an important contribution to the development of the London labour market, both in absolute terms, and over time. This is particularly so for the inner London labour market. Between 2004

and 2018 the number of workers[21] in London rose from 3.8 million to 5.0 million. While the number of workers in outer London increased by 0.1 million from 1.6 million to 1.7 million in this time, the number of workers in inner London rose by 1.1 million from 2.2 million to 3.3 million. Further, while the proportion of workers in outer London who live in outer London is 75%, the corresponding proportion of workers who live and work in inner London is 50% - these proportions have been stable over time. The growth in workers in inner London of 50% has been met equally (in proportionate terms) by workers from inner London, outer London, and the rest of the WSE, (Figure 2.1)[22].

Figure 2.1: Number of main jobs in inner London by location of residence, 2004-2018



Source: ONS Annual Population Survey

2.3 Journey numbers

Pressures on public transport systems depend on the numbers of people making trips. This in turn will depend on the mode of transport, and the reason for travel.

All regions have a higher daytime population than a usual resident population – Box 2.1 explains these concepts, and the purpose for travel. London's population increases by nearly 2 million over the course of a day from 8.8 million to 10.8 million. For the WSE it increases from 24.1 million to 27.4 million.

[21] Formally the analysis is by main job. Around 5% of working respondents to the Annual Population Survey say they have a second job. Some of these jobs may be in a different area to the first job.
[22] The data not included in the Figure is available at Commuting estimates of London residents and workers, 2004 to 2018 - Office for National Statistics. The Figure uses the ONS definition of inner London.

Box 2.1: Usual resident and daytime populations

The usual resident population shows the number of people living in a particular region on any given day. The ONS produces estimates of the usual resident population by UK region and is primarily based on Census data[23].

The daytime population in this publication refers to the number of people who are in a particular region on any given day regardless of whether they live in that region. The definition of the daytime population used here is the number in employment by place of work, number not in work by place of residence, number of school children by place of education, the number of adults in full-time education by place of residence, the number of infants by place of residence and the number of international and domestic visitors by place of visit[24]. It also uses several sources of data including the Office for National Statistics (ONS) Annual Population Survey, Department for Education School Census, ONS International Passenger Survey, Visit Britain GB Tourism Surveys and ONS Mid-year Population Estimates.

Overall, the estimates of the usual resident and daytime populations by region are shown in Table 2.5. As some people are resident in one region, and part of the daytime population of another all regions have a higher daytime population than resident population.

Table 2.5: Usual resident and daytime populations by English region in 2017, millions

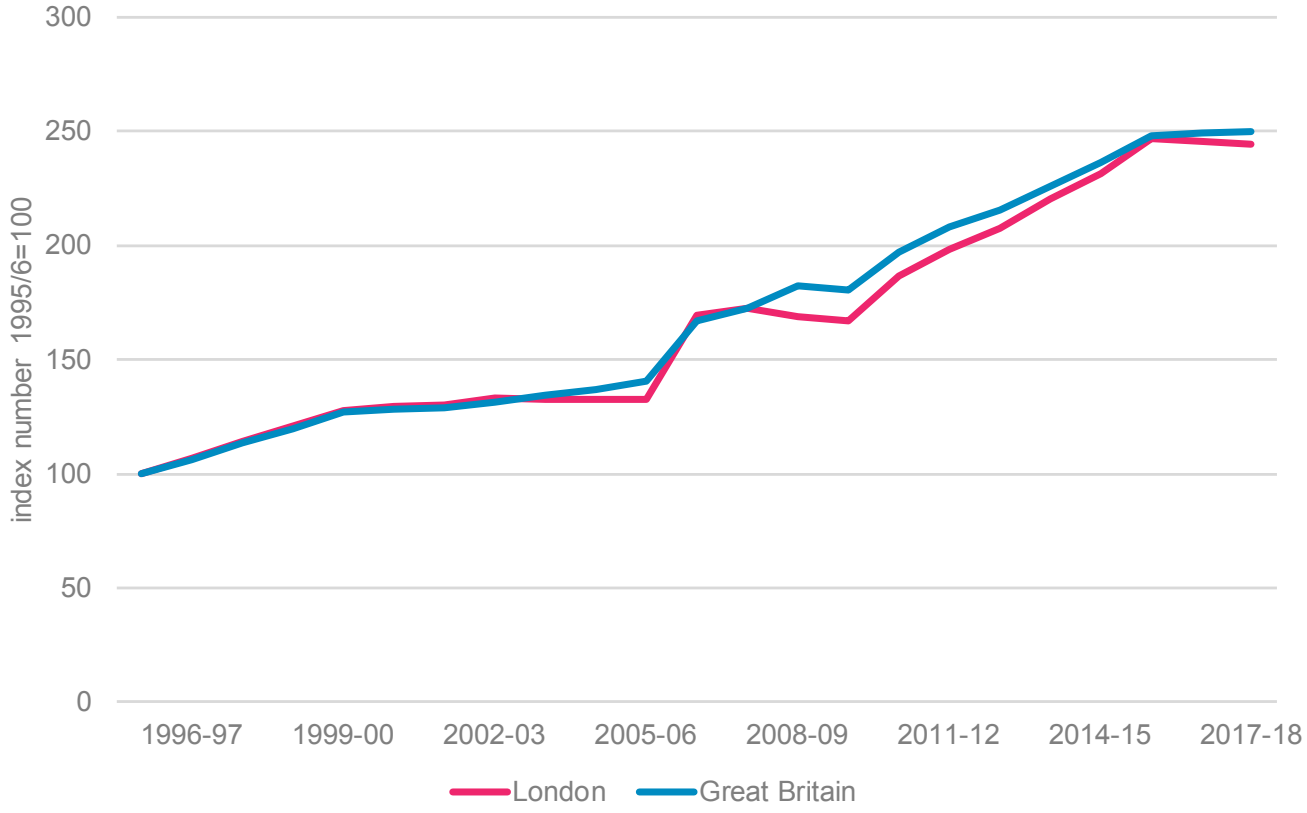
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East	London	South East	South West
Usual resident population	**2.6**	**7.3**	**5.5**	**4.8**	**5.9**	**6.2**	**8.8**	**9.1**	**5.6**
Usual daytime population	**3.0**	**7.8**	**6.2**	**5.3**	**6.5**	**6.6**	**10.8**	**10.0**	**6.4**
Of which:									
In work	1.2	3.6	2.7	2.3	2.8	2.9	5.0	4.5	2.9
Not in work	0.8	1.7	1.6	1.4	1.7	1.7	2.0	2.4	1.5
Infants (0-4yrs)	0.1	0.4	0.3	0.3	0.4	0.4	0.6	0.5	0.3
School students (5-15yrs)	0.4	1.1	0.9	0.7	1.0	1.0	1.4	1.4	0.8
Other full-time education	0.1	0.3	0.2	0.2	0.3	0.2	0.5	0.3	0.2
Visitors	0.3	0.7	0.5	0.4	0.4	0.5	1.3	0.9	0.7

Source: ONS Population Estimates, ONS International Passenger Survey, ONS Annual Population Survey, DfE School Census, Visit Britain GB Tourism Survey, Visit Britain GB Day Visits Survey

By mode of travel, rail journeys have increased by 150% in Great Britain over the period 1995/6 to 2017/8, and by a similar proportion for London, (Figure 2.2). In London there were 927 million journeys in 2017/18, and across Great Britain there were 1,475 million. That is, a part of over three fifths of all journeys were in London.

[23] ONS MYEDE Population estimates for high level areas (via Data Explorer)
[24] It updates an earlier methodology developed by GLA City Intelligence Unit, see Daytime population - London Datastore

Figure 2.2: Passenger rail journeys in London, and Great Britain, 1995/6 to 2017/8



Source: Office of Rail and Road

Indeed, in 2017/18 nine out of ten railway stations with most entries and exits in Great Britain were in London, from Waterloo with 94.3m entries and exits to King's Cross with 33.9m, (Table 2.6). The exception is Birmingham New Street with 43.7m entries and exits.

Table 2.6: The ten railway stations with most entries and exits in Great Britain, 2017/18

Railway station	Entries and exits
Waterloo	94.3m
Victoria	75.0m
Liverpool Street	67.0m
London Bridge	48.5m
Euston	44.7m
Birmingham New Street	43.7m
Stratford	40.1m
Paddington	36.6m
St Pancras	34.6m
King's Cross	33.9m

Source: Office of Rail and Road

The WSE is closely connected with London, (Table 2.7):

- 61m (or 15%) out of 408m inter-regional rail journeys to or from London are with the rest of Great Britain outside the WSE. The corresponding proportion is lower for the East and the South East of England.
- 144m (or 94%) out of 154m inter-regional journeys to or from the East of England are with London.
- 203m (or 91%) out of 222m inter-regional journeys to or from the South East of England are with London.
- Intra-regional journeys are a lower proportion of all journeys for each region of the WSE than for Great Britain as a whole.

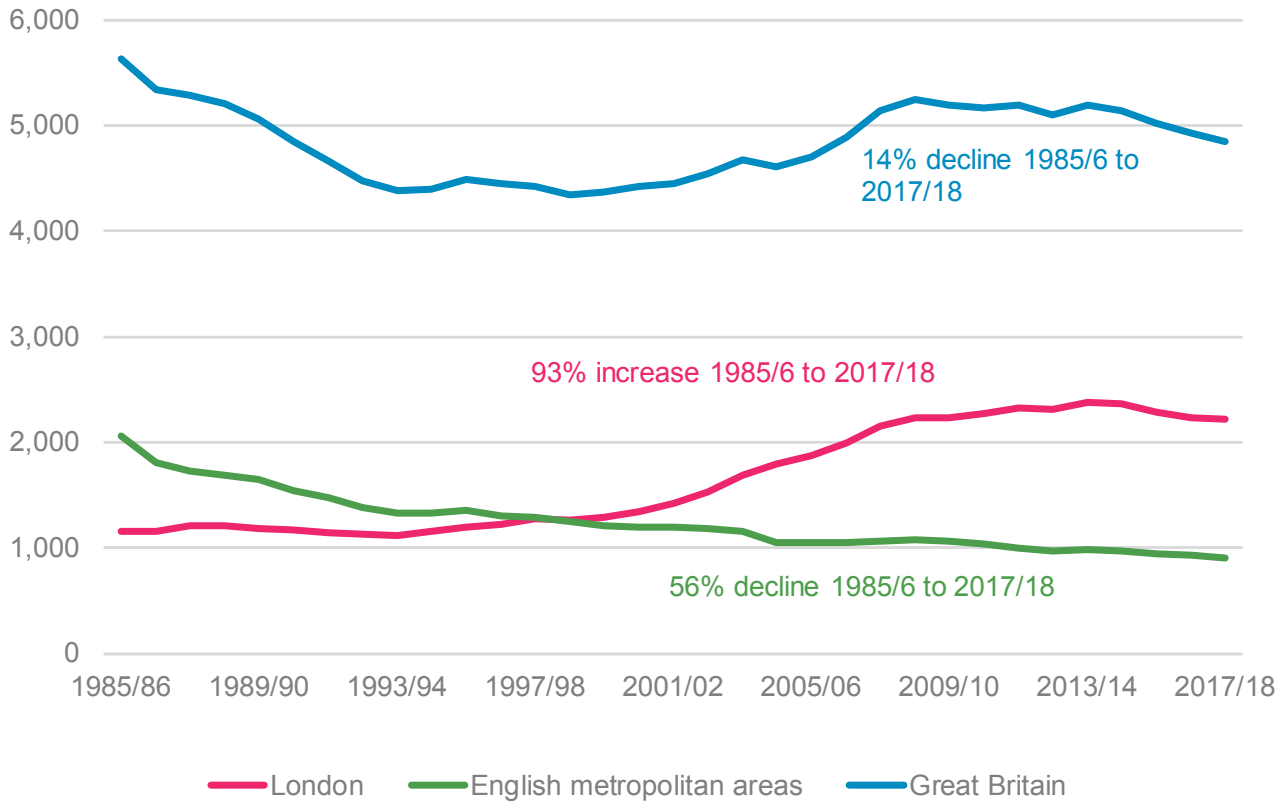
Table 2.7: Rail journeys within the Wider South East and the rest of Great Britain, intra-regional and inter-regional, 2017, millions

To and from	London	East	South East	Rest of Great Britain	inter-region	Great Britain
London		144	203	61	408	
East	144		4	6	154	
South East	203	4		15	222	
Rest of Great Britain	61	6	15		82	
inter-region	408	154	222	82		483
intra-region	519	35	82	356		992
all	927	189	304	438		1475
intra-region share	56%	18%	27%	81%		67%

Source: GLA Economics calculations of Office of Rail and Road data
Note: The sum of inter-regional journeys is greater than the total number of inter-regional journeys in Great Britain because of double counting

London is also more reliant on buses than other parts of the country. In 1985/86 there were 5.6m bus journeys in Great Britain of which 1.2m (20%) were in London. By 2017/18 while the number of journeys in Britain had declined to 4.8m the number in London had risen to 2.2m (or 46% of all journeys). This contrasts with the trend in bus use for English metropolitan areas which has also declined from 2.1m to 0.9m journeys over the period, (Figure 2.3).

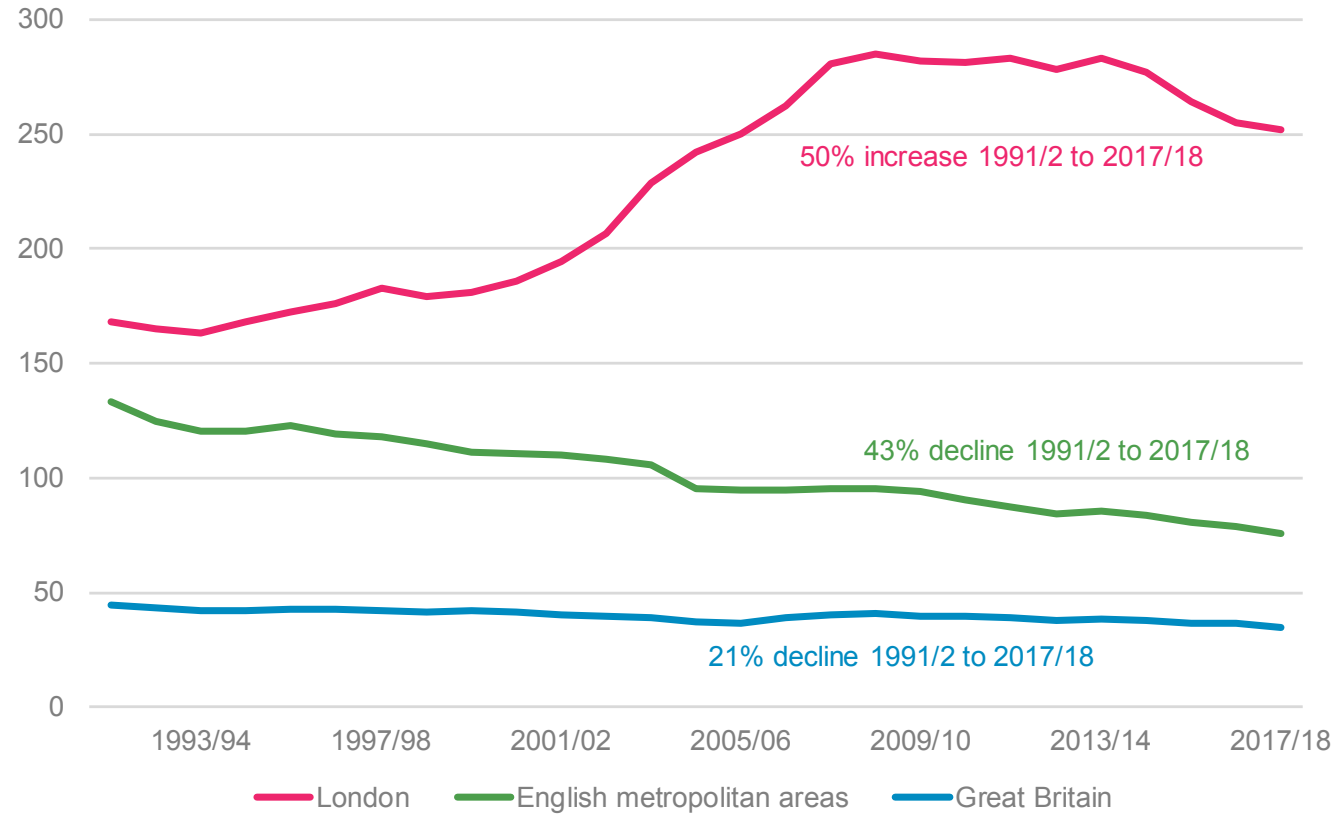
Figure 2.3: Bus journeys, London, English metropolitan areas, and Great Britain, 1985/6 to 2017/8, millions



Source: Department for Transport

Bus journeys per head of population are significantly higher in London than elsewhere as well, (Figure 2.4). In 2017/18 for London there were 252 bus journeys per head, compared with 76 for the English metropolitan areas, and 35 for Great Britain as a whole. The number of journeys per head has declined outside London, while in London it has increased.

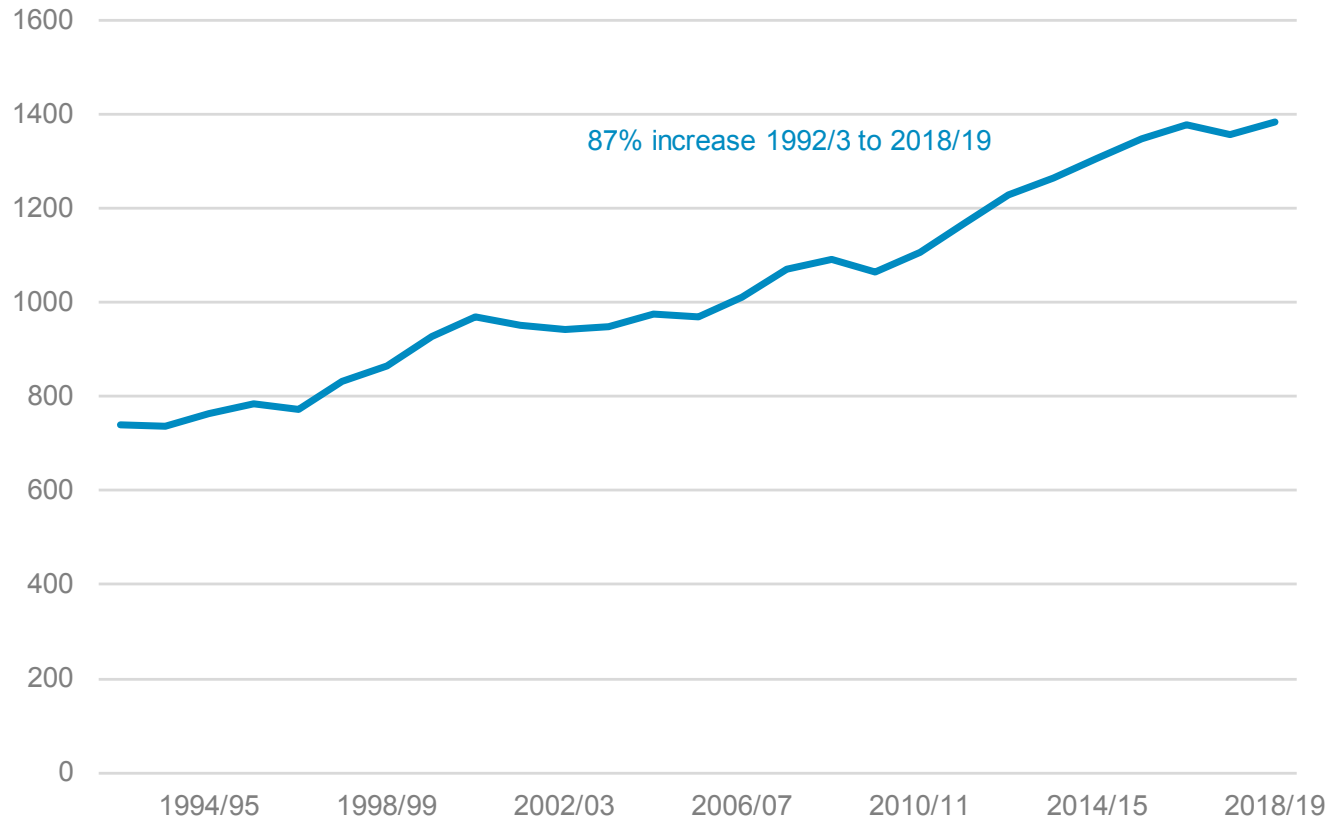
Figure 2.4: Bus journeys per head of population, London, English metropolitan areas and Great Britain, 1991/2 to 2017/8



Source: Department for Transport
Note: There is a slight break in the series from 2004/5 outside London due to a change in methodology

Additionally, London has the London Underground. Again, journeys have risen from 739m in 1992/3, to 1,357m in 2017/8, and 1,384m in 2018/9, (Figure 2.5).

Figure 2.5: London Underground journeys, 1992/3 to 2018/9, millions

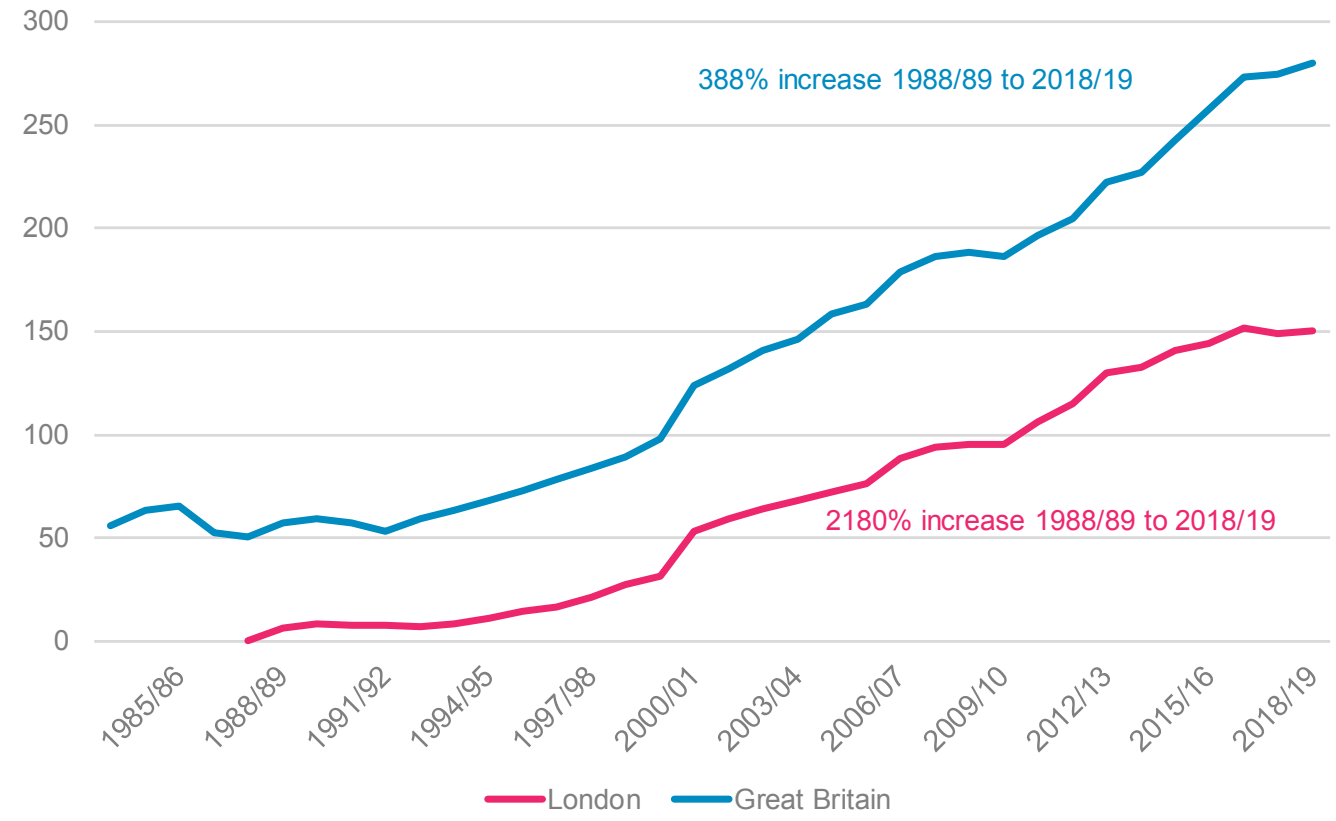


Source: Transport for London

In contrast, the Department for Transport (DfT) also provides journey statistics for Glasgow Underground. In 2018/19 there were 13.1 million journeys, compared with 13.5 million journeys in 1992/3.

The other form of public transport for which the DfT provides statistics is trams and light railways. There has been an incremental development in these services across Britain, and so year-on-year comparisons will not be like-for-like in the coverage of services across the country. For example, in London, the Docklands Light Railway (DLR) came into service in 1988/9, and the London Tramlink began in 2000/1, while the Edinburgh Tram became operational in 2014/5. The number of journeys in Great Britain has increased from 56 million in 1983/4 to 280 million in 2018/9, while in London there were 150 million journeys in 2018/9, (Figure 2.6).

Figure 2.6: Light railway and tram journeys, London and Great Britain[25], 1983/4 to 2018/9, millions



Source: Department for Transport

In summary, around three fifths (58%) of some or all of the journeys taken on public transport in Britain are in London, (Table 2.8)[26]. There were 4.7 billion journeys in London in 2017/18, and 8.0 billion in Great Britain.

Table 2.8: All journeys on public transport, London and Great Britain, 2017/18, millions

	London	Great Britain	London's share
Bus	2,225	4,844	46%
Underground	1,357	1,370	99%
Rail	927	1,475	63%
Light rail and trams	149	275	54%
Total	4,657	7,963	58%

Source: GLA Economics calculations of Department for Transport and Transport for London data

Indeed, Londoners are more likely to use private transport which is publicly regulated than residents of other regions. 38% of licensed vehicles in England whether taxis, or private hire vehicles operate in London, (Figure 2.7). There are 109,000 in London, and 285,000 in England.

[25] Great Britain consisting of DfT statistics publications for England and Edinburgh. The England statistics include the Docklands Light Railway, London Tramlink, Nottingham Express Transit, Midland Metro, Sheffield Supertram, Tyne and Wear Metro, Manchester Metrolink, and Blackpool Tramway

[26] This assumes that each journey only makes use of one mode of transport.

Figure 2.7: Licensed vehicles by English region, 31 March 2018

Source: Department for Transport

And, to emphasise the dependence of London on public transport provision the city accounts for only 4% of the length of the national road network, (Table 2.9).

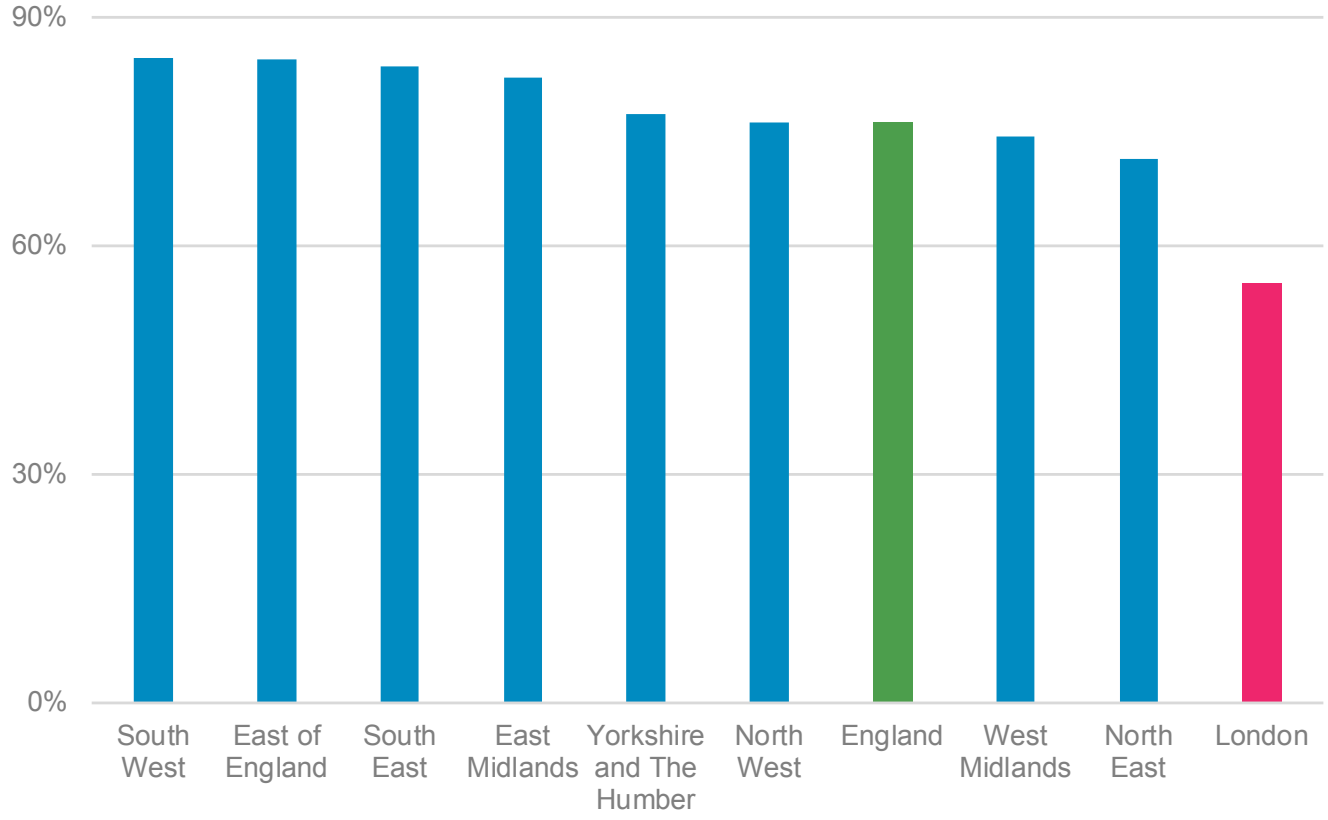
Table 2.9: Length of road network, kilometres, London and Great Britain by type of road, 2017/18, millions

	London	Great Britain	London's share
Motorways	38	2313	2%
'A' roads	1085	29440	4%
Minor roads	8078	214944	4%
All roads	9201	246697	4%

Source Department for Transport

Londoners are less likely to own a car than residents of all of the other regions of England, (Figure 2.8). Less than three-fifths (55%) of households in London own at least one car, while for England as a whole it is three-quarters (76%).

Figure 2.8: Proportion of households with one or more cars, English regions, 2017/18

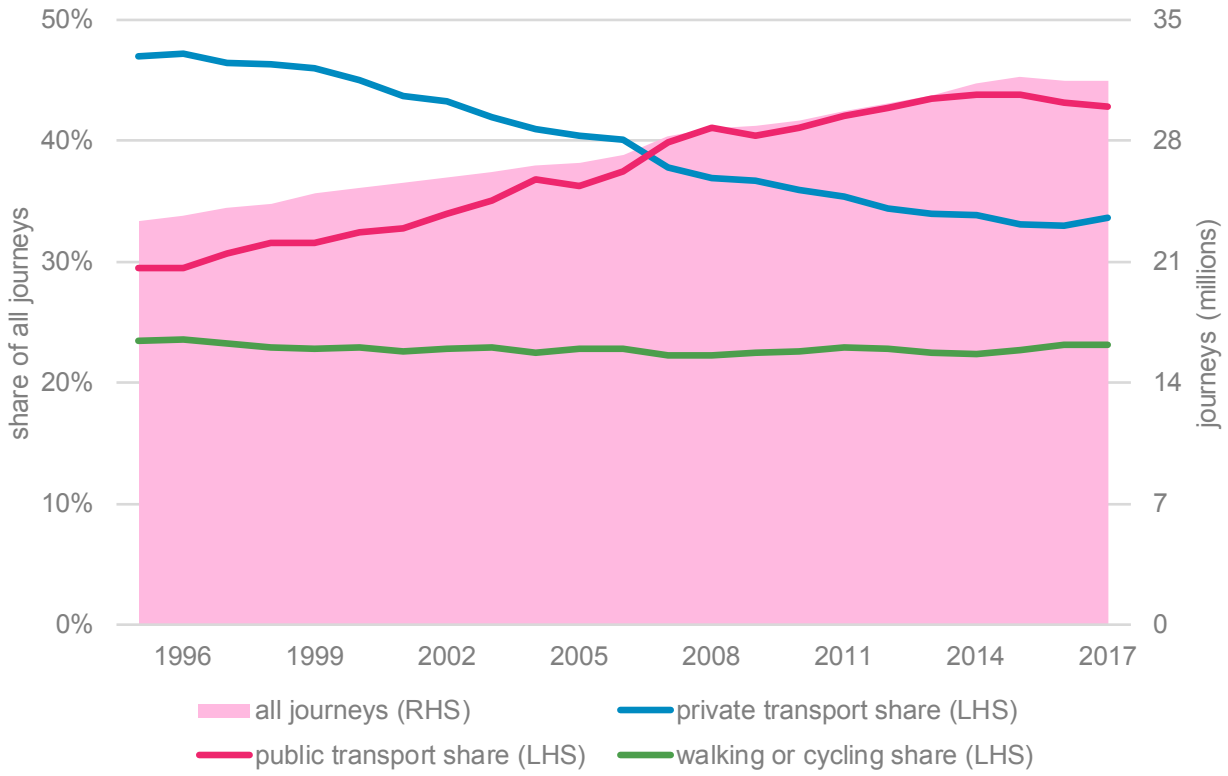


Source Department for Transport, National Travel Survey

While the trend in all journey stages in London is upwards there has been a shift away from private vehicle use to public transport, and walking and cycling. Over the period from the 1995 to 2017, (Figure 2.9):

- the number of journey stages rose from 23.4m to 31.5m;
- the share of private transport use declined from 47% (11.0m journeys) to 34% (10.6m journeys), and;
- the share of public transport rose from 29% (6.9m journeys) to 43% (13.5m journeys);
- the share of walking and cycling remained largely unchanged at 24% (5.5m journeys) in 1995 and 23% (7.3m journeys) in 2017.

Figure 2.9: Number of journey stages in London, and share by mode of travel, 1995-2017, seven day week



Source: TfL, Travel in London, and GLA Economics calculations
Note: private transport is car, motorcycle, and taxi/private hire vehicle use

Outside London there has not been a shift in transport mode for trips[27], and the relative lesser importance of public transport is marked. For England (excluding London), the mode share of trips remained almost unchanged between 2002/3 and 2017/18 with private transport accounting for 67% of trips, and public transport being used for 6% in the latest data, (Table 2.10). In contrast, in London in 2017/18 private transport accounted for 37% of trips, and public transport made up 28% of trips.

Table 2.10: Share of main mode of trips, London and England excluding London, 2002/3 and 2017/18

	2002/3	2017/18
London		
private transport	47%	37%
public transport	24%	28%
walking and cycling	29%	35%
England (excluding London)		
private transport	68%	67%
public transport	6%	6%
walking and cycling	26%	27%

Source: DfT National Travel Survey, and GLA Economics calculations
Note: private transport is car, van, motorcycle, and taxi/private hire vehicle use

[27] A trip can have more than one journey stage

2.4 Accessibility and attractiveness of city centres

While London has a more extensive transport network than other parts of the country, and it is heavily used it does not follow that the experience of travellers is better. This links to the notion of connectivity, while Chapter 3 reviews the evidence on congestion. This section considers two aspects of connectivity[28]:

- Accessibility provides an assessment of ease of travel movements – this compares observed travel times to a city centre with crow-fly travel times.
- Attractiveness rates the appeal of journey to a city centre relative to other city centres nearby – this compares observed travel times to a city centre relative to those for other city centres nearby.

The NIC has published transport connectivity indicators of the accessibility and attractiveness of city centres of BUAs[29] for people who live within and outside the area. The analysis is available for 2011 and 2016. The paper also does this both for commuter and other journeys and normalises the metrics to allow comparisons between cities. Box 2.2 sets out the approach which has been adopted.

Box 2.2: Derivation of NIC metrics for connectivity[30]

Transport connectivity measures the ease with which people can get around within, and between, different places. It can be used to quantify how well a transport network connects destinations. The metrics are a way to bring together notions of numbers of people travelling, travel time and distance. These are available for public transport and car travel. There is no single conceptually correct way to do this, but there has been checking of the robustness of the results to different assumptions.

Urban connectivity (connectivity within places) is calculated using the average of travel times between each point in the place and its centre, weighted by demand (population or employment) in each point. The measure is calibrated so that places that are further away from the centre are given less weight, to reflect the impact of travel time/distance on willingness to travel. Centres are defined as the Output Area (OA) or areas with the highest employment density in each place. In almost all cases the centre is defined as a single OA, or as a set of adjacent OAs. In the case of London, two distinct centres are used: the West End and the City of London.

The connectivity measures are normalised (ie divided) by secondary measures. The normalised connectivity measures represent the effectiveness of the network in providing access to the centre of a place, taking into account the physical proximity of people's locations.

As such, the measure captures both the speed of travel and the directness of the route, allowing for the likelihood people will want to make any particular journey.

Appendix B provides more detail on the formulas used.

There are a number of limitations to this approach:

- Over-reliance on city centres – it treats city centres as the primary employment location in each city. While there is a concentration of jobs in London in the CAZ and the Northern Isle of Dogs (NIoD) they still only accounted for around 38% of jobs in the city in 2017.

[28] These are not the only ways to consider connectivity, but they are the concepts for which there is associated published data for London and the rest of Great Britain at Prospective: Transport connectivity report - National Infrastructure Commission

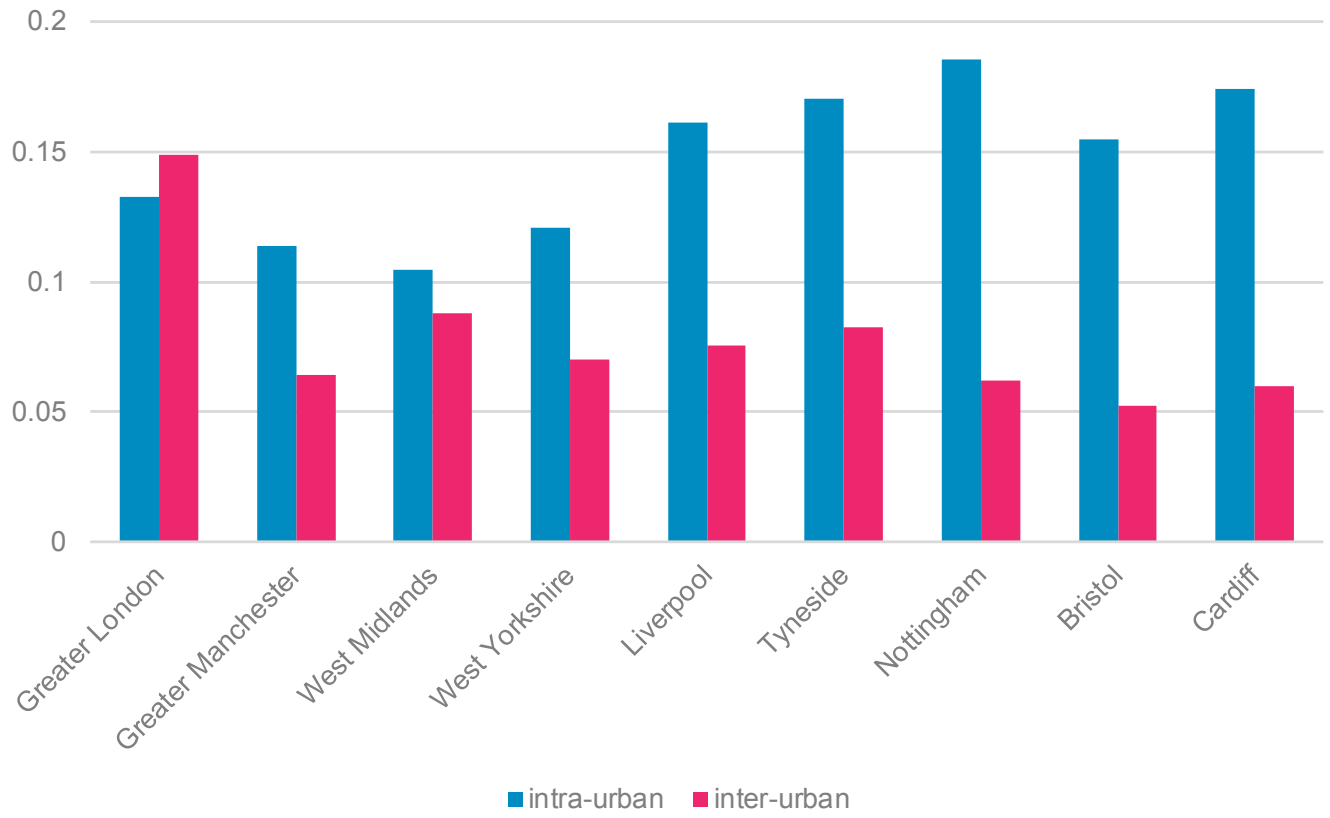
[29] See Transport connectivity discussion paper - National Infrastructure Commission and Prospective: Transport connectivity report - National Infrastructure Commission

[30] The description of connectivity in this box follows Transport connectivity discussion paper - National Infrastructure Commission, and the explanation of limitations is from Prospective: Transport connectivity report - National Infrastructure Commission

- The effects of capacity constraints – the approach does not consider where transport infrastructure suffers from bottlenecks, and what impact this might have on location of home and work, and mode of travel. Chapter 3 considers the evidence on congestion.
- No accounting for travel costs – the indicators are based solely on travel time, and do not consider the impacts on demand of the cost of travel such as parking costs, fares etc.
- Imperfect reflection of visitor numbers – London is an important destination for visitors. While day visitors will be captured in this analysis it will less adequately incorporate journeys within London of visitors from further afield whether domestic or international.

The NIC reports that accessibility to an urban area is worse the larger is an area[31], that is areas with higher scores are relatively more accessible. So, this section focuses on the core cities as comparators with London. Intra-urban normalised population and employment accessibility to London by public transport is slightly better than for the other Large Metropolitan Areas, but worse than for the other Core Cities. While, inter-urban normalised population and employment accessibility is better for London than all other Core Cities, (Figures 2.10 and 2.11). There have been improvements in absolute employment and population accessibility to all Core Cities by public transport between 2011 and 2016, (Figure 2.12).

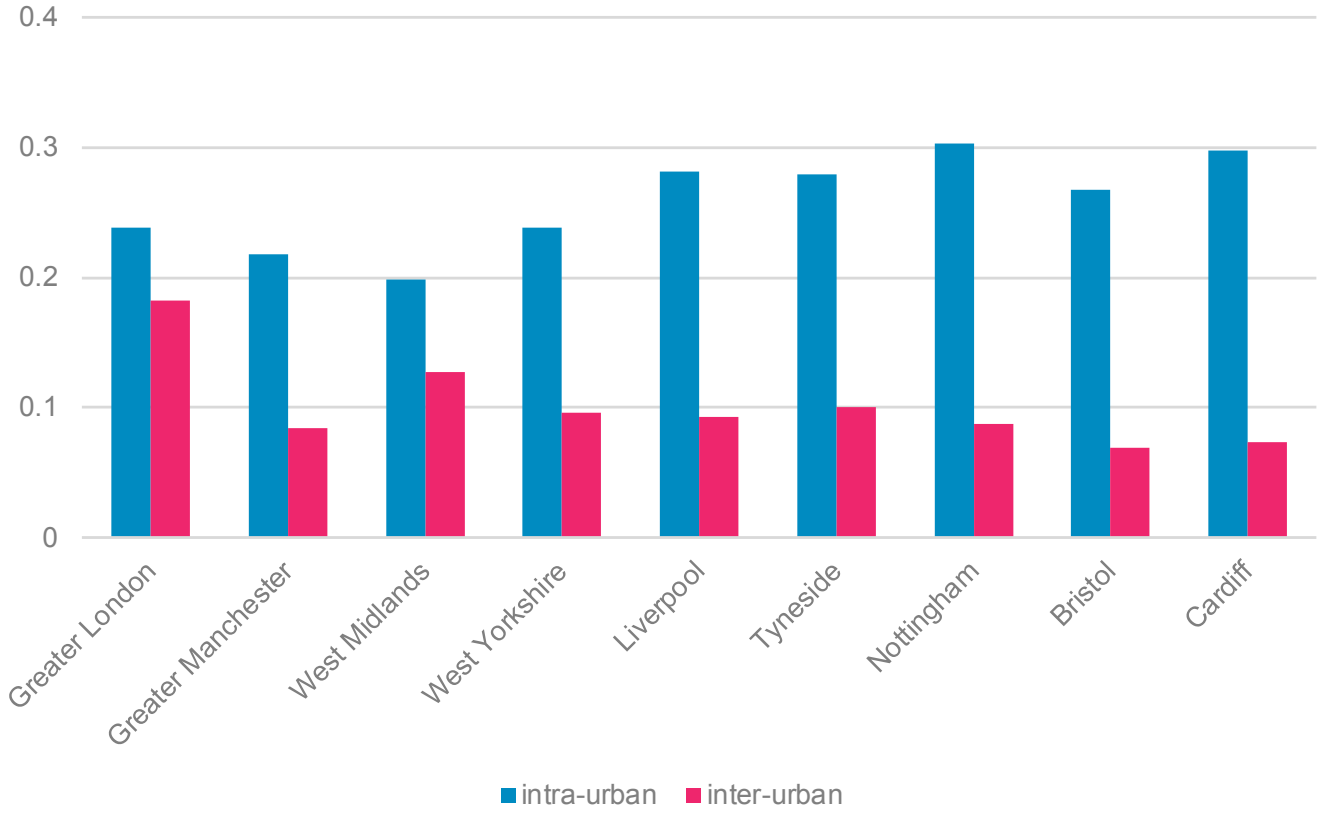
Figure 2.10: Normalised population accessibility to Core Cities by public transport, 2016



Source: GLA Economics calculations of NIC connectivity dataset

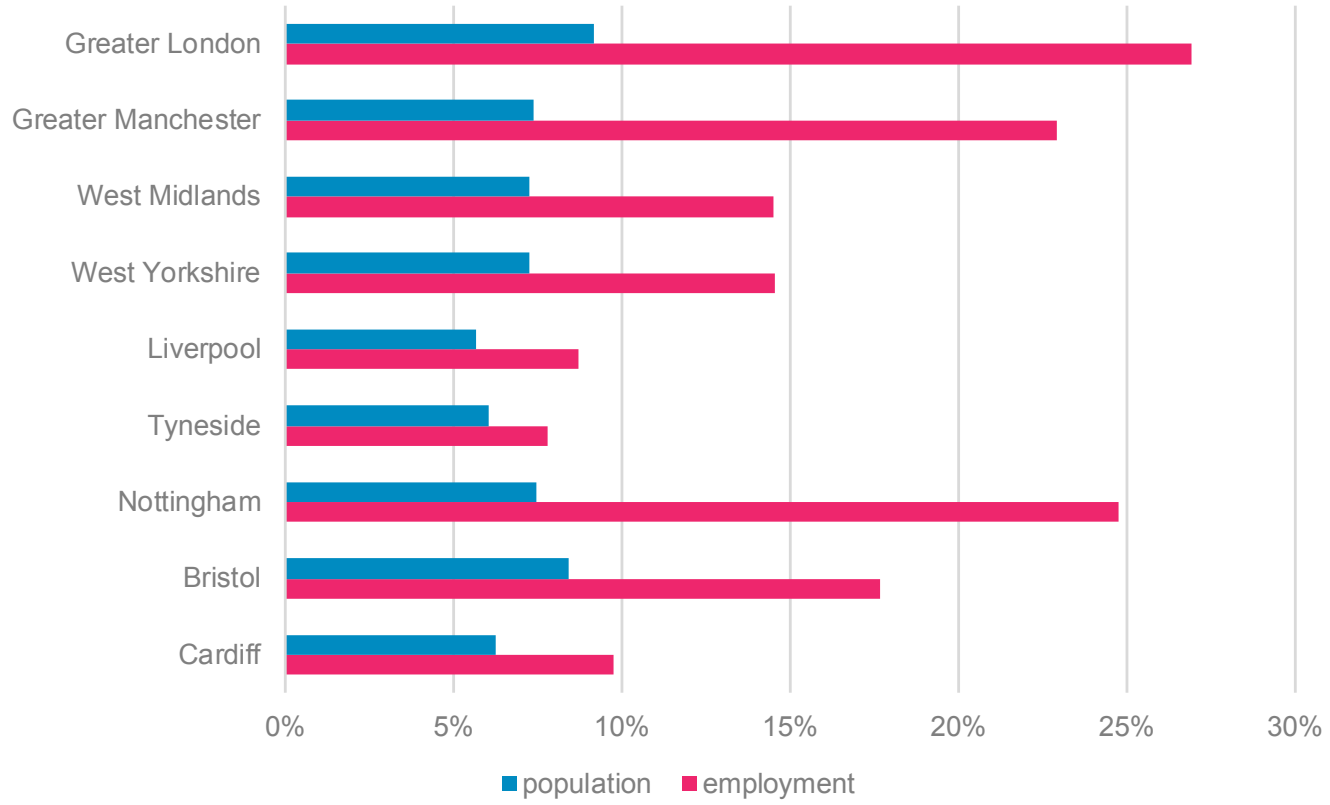
[31] See Transport connectivity discussion paper - National Infrastructure Commission

Figure 2.11: Normalised employment accessibility to Core Cities by public transport, 2016



Source: GLA Economics calculations of NIC connectivity dataset

Figure 2.12: Change in absolute population and employment accessibility to Core Cities by public transport between 2011 and 2016



Source: GLA Economics calculations of NIC connectivity dataset

Appendix B provides the corresponding figures for intra-urban normalised population and employment attractiveness by public transport. By this metric London is comparable with other Core Cities. As with accessibility there have been improvements in absolute employment and population attractiveness of all Core Cities by public transport between 2011 and 2016.

3 The rationale for investment in transport infrastructure

3.1 Introduction

Capital expenditure is an important driver of economic growth. This chapter considers the case for investment in transport infrastructure, and necessary conditions for it to be successful. It compares the situation of London with other cities in the UK and looks at who benefits from transport infrastructure.

The organisation of the chapter is to provide an overview of how transport interventions can improve economic performance, and what transport interventions should be addressing to improve growth.

3.2 Transport investments and economic performance

There are two main channels through which transport investments can affect economic performance. By reducing travel time and/or improving travel conditions, transport investment will benefit commuters and therefore lead to greater productivity. In addition, by easing congestion of existing provision, or by establishing a new and speedier route, transport investment can facilitate agglomeration effects. This can lead to increased productivity and growth. It improves connectivity for firms and workers who are already located in a particular area. In addition, transport investment can unlock land for housing or business development and attract new people and business activity to an area, thereby further enhancing agglomeration effects. This is the so-called dynamic agglomeration effect, which is additional to static agglomeration effects.

Benefits of improved connectivity flow to:

- Businesses through higher profits from additional, and more productive activity;
- Workers through higher wages, more jobs, and more productive jobs;
- Property owners, whether individuals or businesses, from higher land values of opened up areas, and heightened competition for land use where there is agglomeration.

The strength of the links between investment in transport infrastructure and economic performance is the subject of academic and policy debates. A meta-analysis of international studies suggests that on average a 10% increase in indicators of agglomeration (which measure economic density, and improved transport connectivity can heighten) can increase output by between 0.4% and 0.5%[32]. A recent meta-analysis looking at the impacts of all infrastructure found they could have GDP impacts ranging from a 0.6% reduction to a 5.2% increase depending on the type of infrastructure, location and economic sectors under consideration. The more reliable estimates tended to be closer to zero than the less reliable ones[33]. An earlier meta-analysis had concluded that a 10% increase in transport infrastructure would increase output by 0.5%[34]. Even though, this impact may seem small it can be large in monetary terms – for example, Crossrail has been estimated to have a present value over the life of the project of £3 billion where a 10% increase in employment increases productivity by 0.6%[35].

[32] Graham D J and Gibson S (2018), Quantifying Wider Economic Impacts of Agglomeration for Transport Appraisal: Existing Evidence and Future Directions.
[33] Holmgren, J. & Merkel, A. (2017). 'Much ado about nothing? – A meta-analysis of the relationship between infrastructure and economic growth', Research in Transport Economics, 63(C):13-26.
[34] Melo P C, Graham D J and Brage-Ardao R, The productivity of transport infrastructure investment: A meta-analysis of empirical evidence, Regional Science and Urban Economics, vol 43, pp695-706.
[35] See Transport investment and economic performance (TIEP) - GOV.UK

On the other hand, the empirical evidence on the strengths of these links is more mixed and suggests these are likely to be investment and location-specific[36].

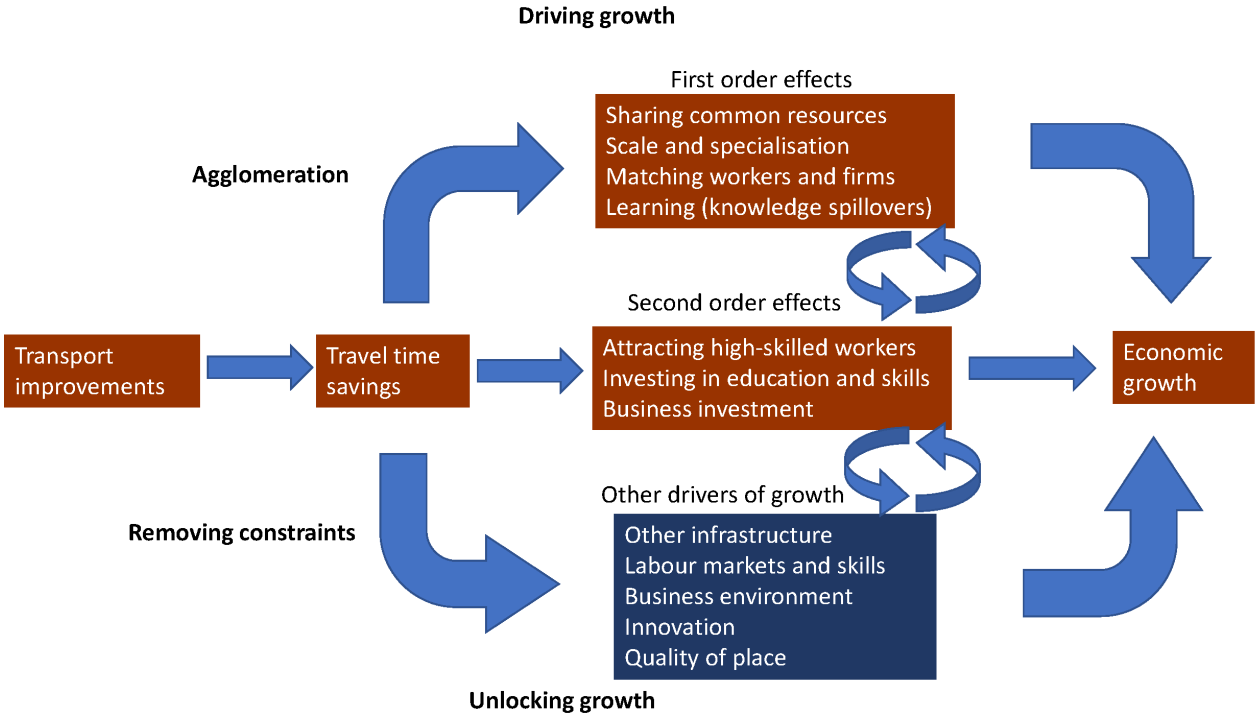
In addition to transport infrastructure and the efficiency of the local transport system there are other drivers and constraints of growth that local development policies may need to address (including skills, innovation and other forms of infrastructure) and which may be more important constraints on growth in certain places, (Figure 3.1). The NIC[37], for example, notes, "there is also evidence that fragmented local governance leads to lower economic growth" and that, "the Humber Bridge has done little to support regeneration of the region".

The available evidence suggests that modern cities become successful through the achievement of agglomeration economies to support specialisation in the provision of services, which benefits from a large pool of skilled labour, and knowledge spillovers. Focusing on dynamic effects, the NIC also argues that there are, "powerful virtuous or vicious cycles of success and decline. Places with strong growth have desirable feedback loops: they attract skilled workers because wages are high (interactions between skilled workers boost productivity) and the presence of other skilled workers makes them nice places to live (shops and amenities are geared to the desires of skilled workers). Firms locate there because they can attract skilled employees. The reverse is true in places with weak growth. These forces can be very powerful, although congestion and rising house prices push back the other way."

Specifically, a combination of historical evidence, business case evidence and the current and predicted severity of congestion on the London transport network suggest that transport investment in the capital will continue to be key to maintain agglomeration economies, manage congestion and other externalities and unlock new homes[38].

[36] See Transport investment and economic performance (TIEP) - GOV.UK
[37] See Economic growth and demand for infrastructure services - National Infrastructure Commission
[38] See the 'Productivity levers in London' report at Productivity in London | London City Hall

Figure 3.1: Model of transport interventions and economic growth



Source: Frontier Economics[39]

In summary, the literature[40] identifies three specific mechanisms by which transport infrastructure spending can support economic growth, and covered in the following sections:

- the role of transport infrastructure in enabling London's agglomeration economies and successful specialisation;
- the evidence of increasing congestion posing a threat to London's future growth; and,
- the role for transport infrastructure investment to unlock land for development in the capital

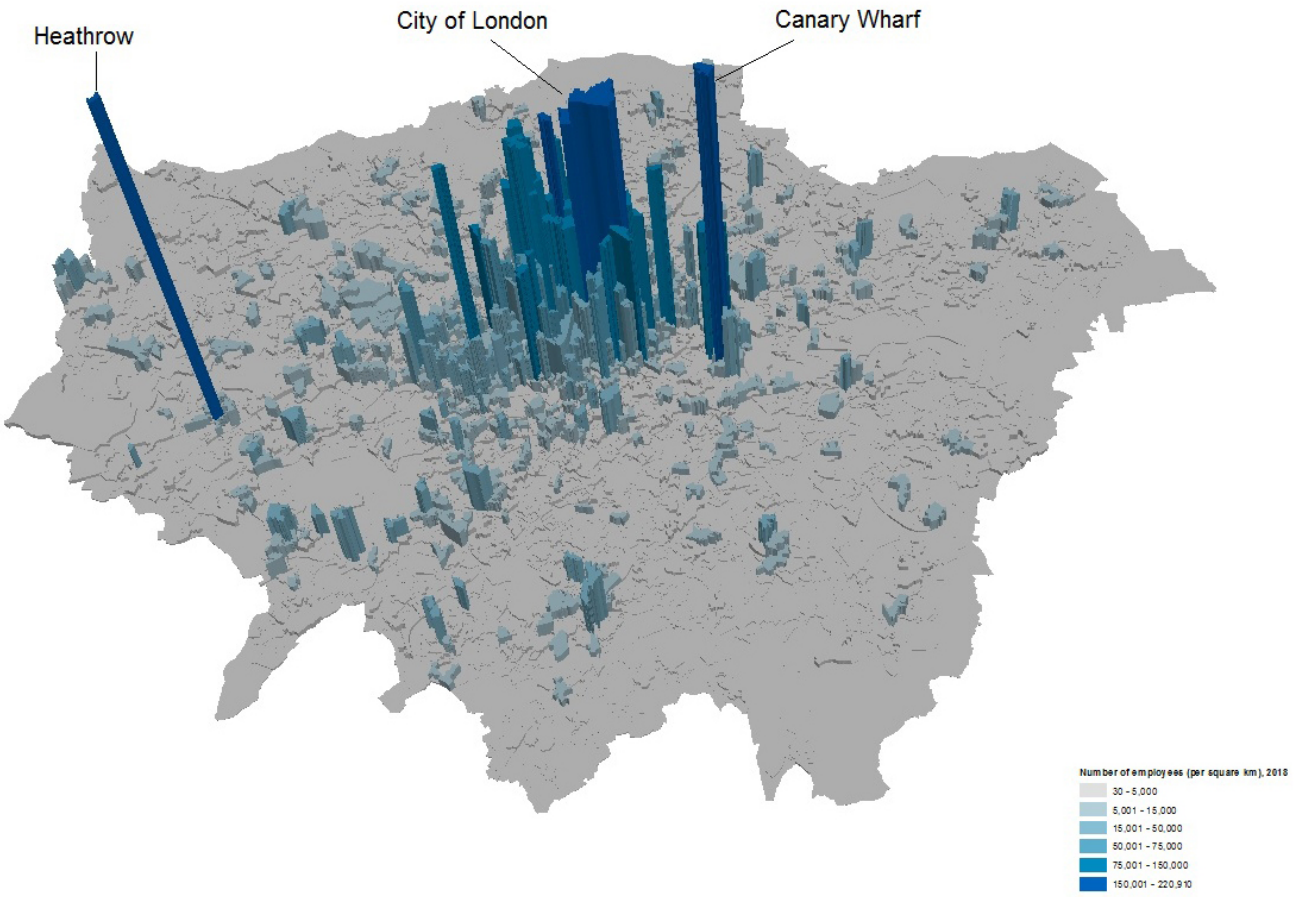
3.3 Transport interventions and agglomeration

It has already been noted that modern cities become successful through the achievement of agglomeration economies to support specialisation in the provision of services. These areas are associated with higher productivity, which in turn generates tax flowbacks. Improved transport infrastructure can maintain the virtuous cycle of increasing the available labour supply to generate well paid jobs, and the higher output can encourage trade to the benefit of other areas. This is important to London which is a global business capital, and attracts investment, skills and visitors from all over the world[41].

The conditions for agglomeration economies exist in London with very high concentrations of jobs (in excess of 150,000 per square km) in the centre of the city and by Heathrow airport, (Map 3.1).

[39] See The benefits of intercity connectivity | Frontier Economics
[40] See, for example, Transport investment and economic performance (TIEP) - GOV.UK
[41] See Developing the evidence base for London's Local Industrial Strategy | London City Hall for more information

Map 3.1: Employee jobs per square kilometre, London, 2017



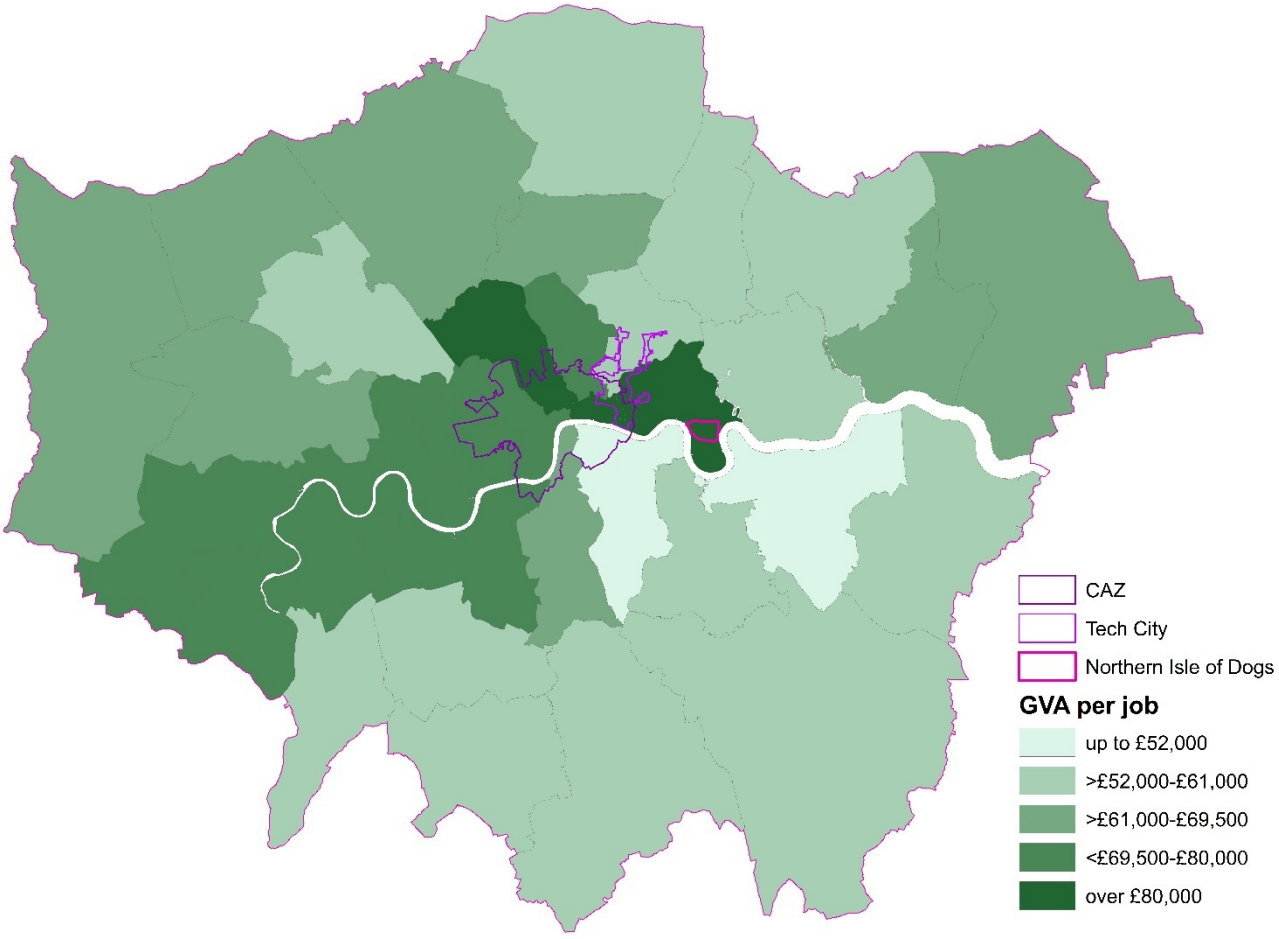
Source: ONS, BRES

Specifically, within Inner London certain areas have been defined, which reflect the importance of transport connections to realise agglomeration effects:

- The **Central Activities Zone (CAZ)**, a strategically important area characterised by a unique agglomeration of strategic functions and transport hyperconnectivity.
- The **Northern Isle of Dogs (NIoD)**, which is a satellite of the CAZ and has similar characteristics.
- **Tech City**, which is also of strategic importance as a technology hub. It covers the North East part of the CAZ, and some of Hackney.

The presence of agglomeration is associated with higher productivity levels in the centre of London - only Westminster and Tower Hamlets have GVA per job over £80,000, while 23 local authorities (out of 33) have a GVA per job below £69,500, the London average. GVA per job in Tower Hamlets of £90,000 is nearly double that of Greenwich at £46,000. Two local authorities, Greenwich and Southwark, have a GVA per job below the average for England and Wales of £52,000, (Map 3.2).

Map 3.2: GVA per job for London local authorities, 2017, and boundaries of the CAZ, NIoD, and Tech City



Source: ONS, and GLA Economics calculations of GVA and Workforce Jobs, BRES and APS statistics
Note: London jobs total has been aligned to Workforce Jobs employee and self-employed jobs. BRES has been used to derive the distribution of employee jobs across local authorities, and the APS has been used for the distribution of self-employed jobs

3.4 Transport interventions and congestion

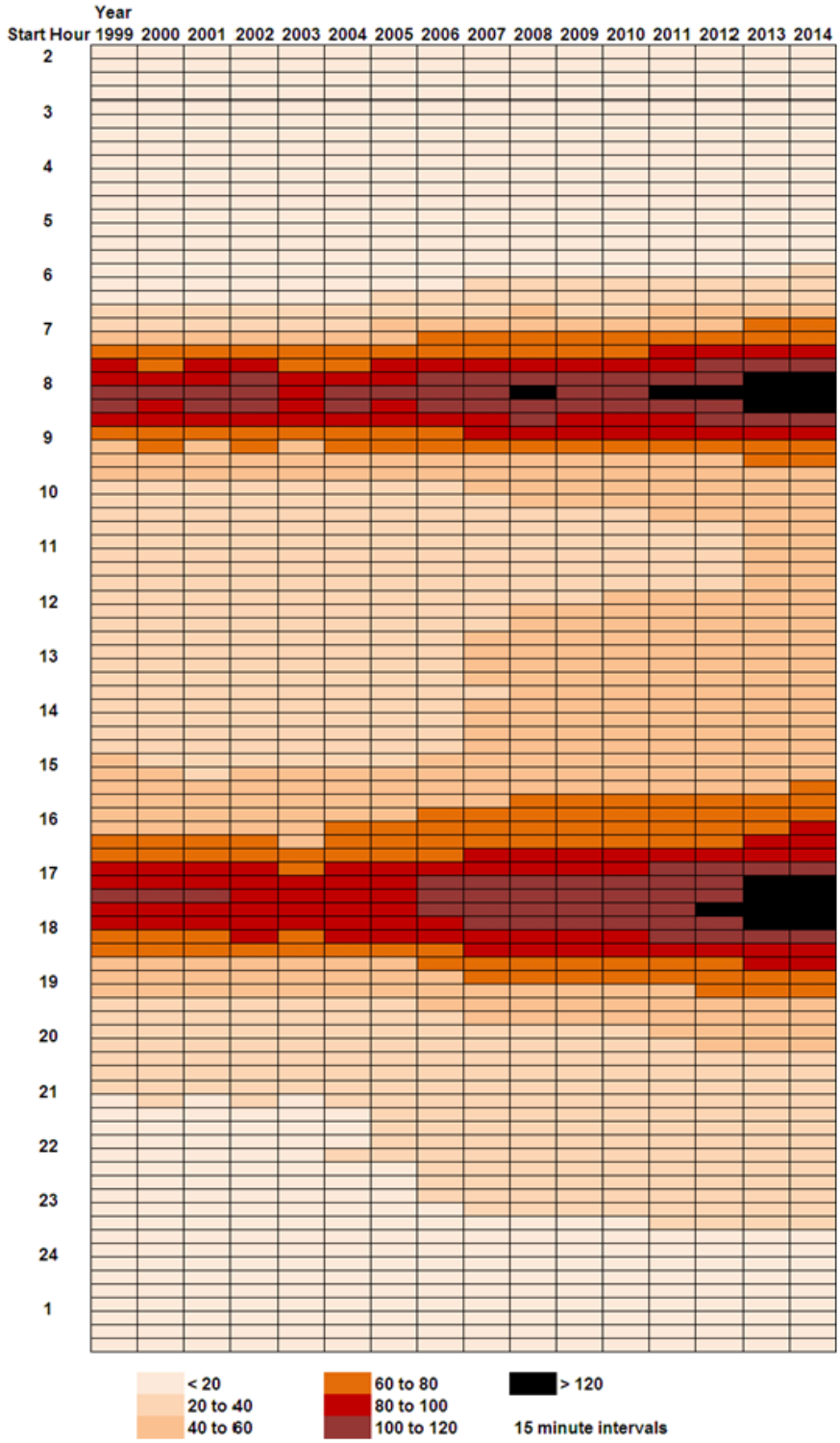
Despite the scale of its public transport system, London suffers from congestion across a range of modes of transport due to the sheer numbers of people who use it. Further, despite the scale of recent transport investment congestion is worsening and with the London population forecast to increase from 8.9 million in 2018 to 10.4 million by 2041 it is predicted to deteriorate further[42].

This section brings together evidence from TfL[43] for the Mayor of London's Transport Strategy (MTS)[44], the NIC[45], and DfT on congestion in London, and how it compares with the rest of the country.

[42] Population figures are for GLA 2018-based long-term trend projections at GLA Population and Household Projections – London Datastore, and evidence on congestion is in the Challenges and Opportunities report at Travel in London reports - Transport for London
[43] See Travel in London reports - Transport for London, and particularly the Challenges and Opportunities report
[44] See Mayor's Transport Strategy 2018 | London City Hall
[45] See Transport connectivity discussion paper - National Infrastructure Commission and Prospective: Transport connectivity report - National Infrastructure Commission

The evidence base for the MTS states that, "Since 2000, rail capacity into London has increased substantially. Nevertheless, demand for rail services has risen faster than the increase in space offered, and as a result more people than ever are travelling in crowded conditions. Crowding particularly affects London Underground services due to its role as both a local metro and onward distributor through the Central Activities Zone." Figure 3.2 illustrates the rising demand for London Underground services since 1999, showing how the peak is spreading out and intensifying.

Figure 3.2: London Underground station entry profile, 1999 to 2014



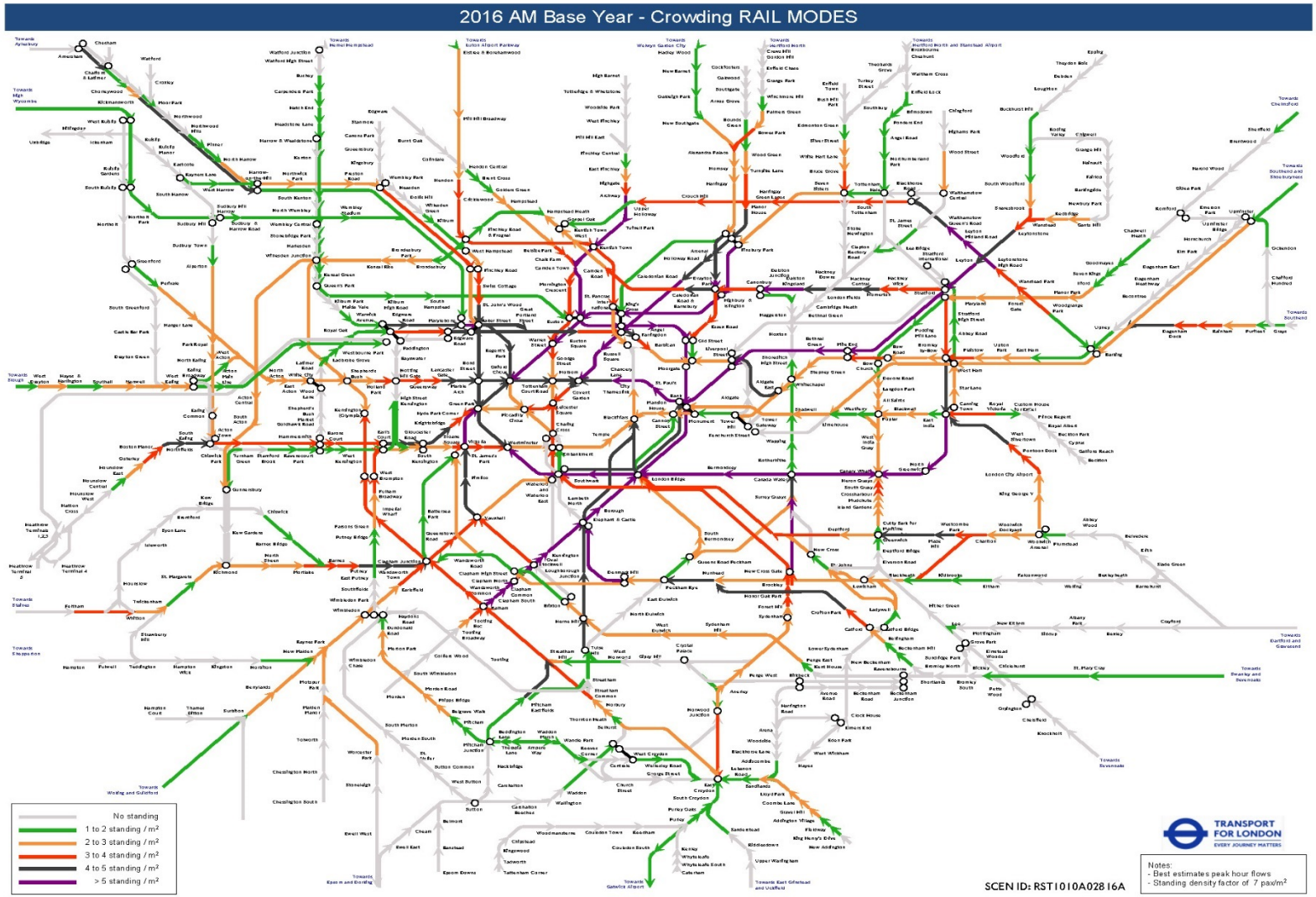
Source: TfL MTS Challenges and Opportunities

The evidence base continues, "Trains are considered crowded when there are more than two passengers standing per square metre, and severely crowded when there are more than four passengers standing per square metre. In the morning peak [7am to 10am], a significant proportion of passenger journeys are made in crowded conditions:

- 70 per cent of London Underground journeys;
- 41 per cent of National Rail journeys;
- 42 per cent of DLR journeys;
- 59 per cent of Tram journeys".

Map 3.3 "shows the current level of crowding on the rail network during the morning peak … The diagram uses coloured bands to represent increasing levels of standing per square metre, with yellow representing two passengers standing per square metre, rising through red and black with purple representing the most severe crowding. There is wide-spread crowding across the London Underground network, with most lines experiencing crowding within central London."

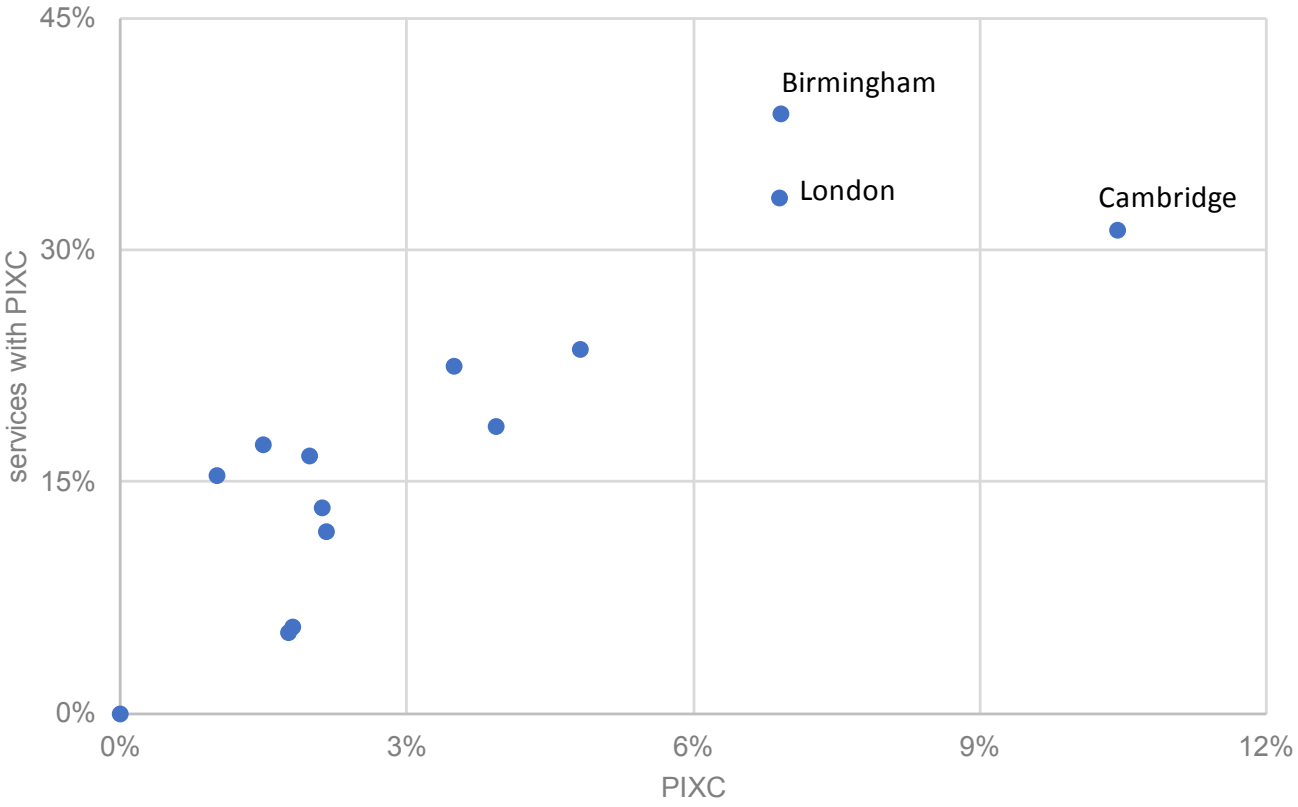
Map 3.3 Crowding on the London rail network, morning peak, 7am to 10am, 2016



Source: TfL

While crowding in London is worst on the Underground network, crowding on other rail services into London is as bad as elsewhere in England and Wales, and for some London mainline stations worse than all other cities. In proportionate terms, only Cambridge has more passengers in excess of capacity (PIXC) than London, and only Birmingham has more services with PIXC, (Figure 3.3). Liverpool Street, Moorgate and Paddington are the three London termini where crowding is worse than in all other English cities by both measures, while Fenchurch Street and King's Cross have a higher proportion of services with PIXC than any English city outside of London, (Figure 3.4)[46].

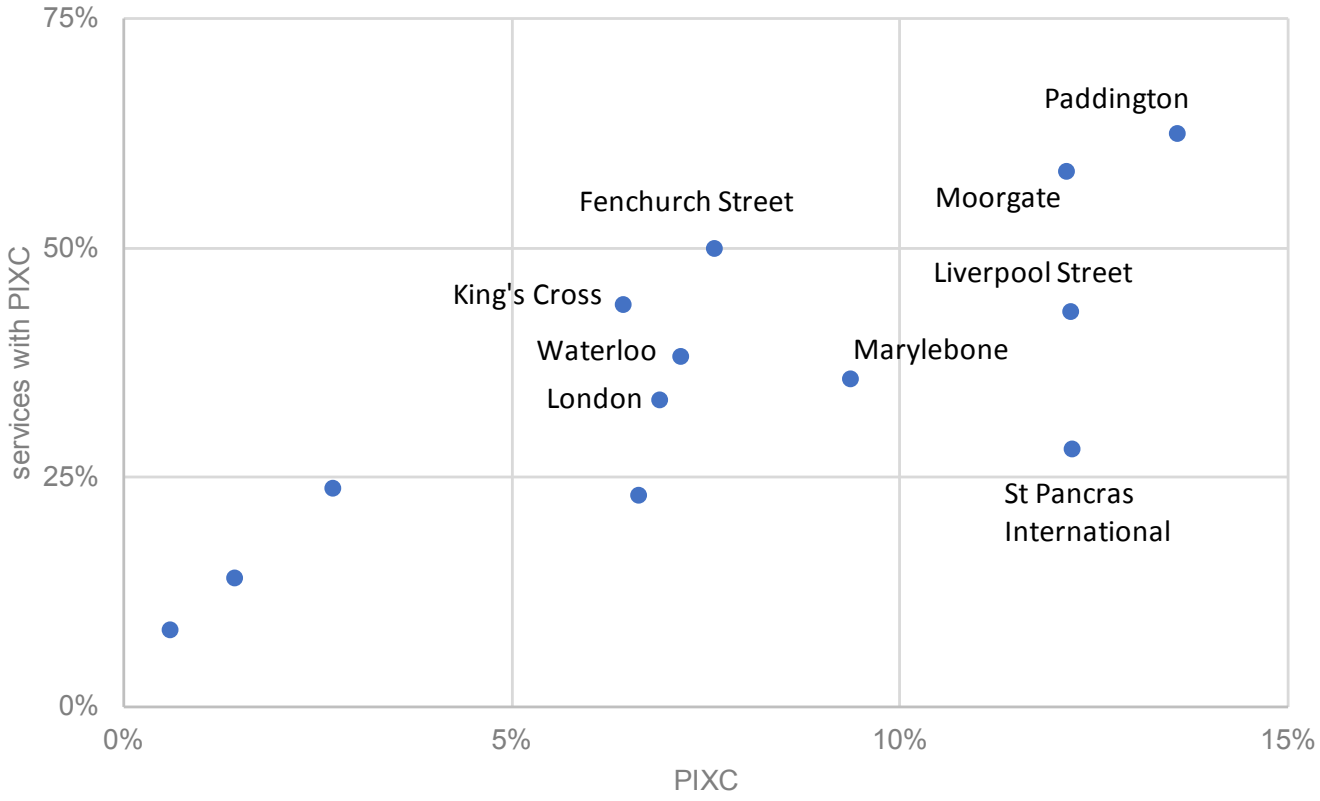
Figure 3.3: Passengers and services in excess of capacity, morning peak, 7am to 10am, major cities in England and Wales[47], 2018



Source: DfT, TfL, and Merseyrail, published in DfT rail statistics
Note: Capacity is standard class critical load

[46] The main finding of the extent of crowding on London services is similar using 2017 data, although the comparisons between cities and stations are slightly different.
[47] Cities are Birmingham, Brighton, Bristol, Cambridge, Cardiff, Leeds, Leicester, Liverpool, London, Manchester, Newcastle, Nottingham, Reading, and Sheffield

Figure 3.4: Passengers and services in excess of capacity, morning peak, 7am to 10am, principal London rail termini[48], 2018



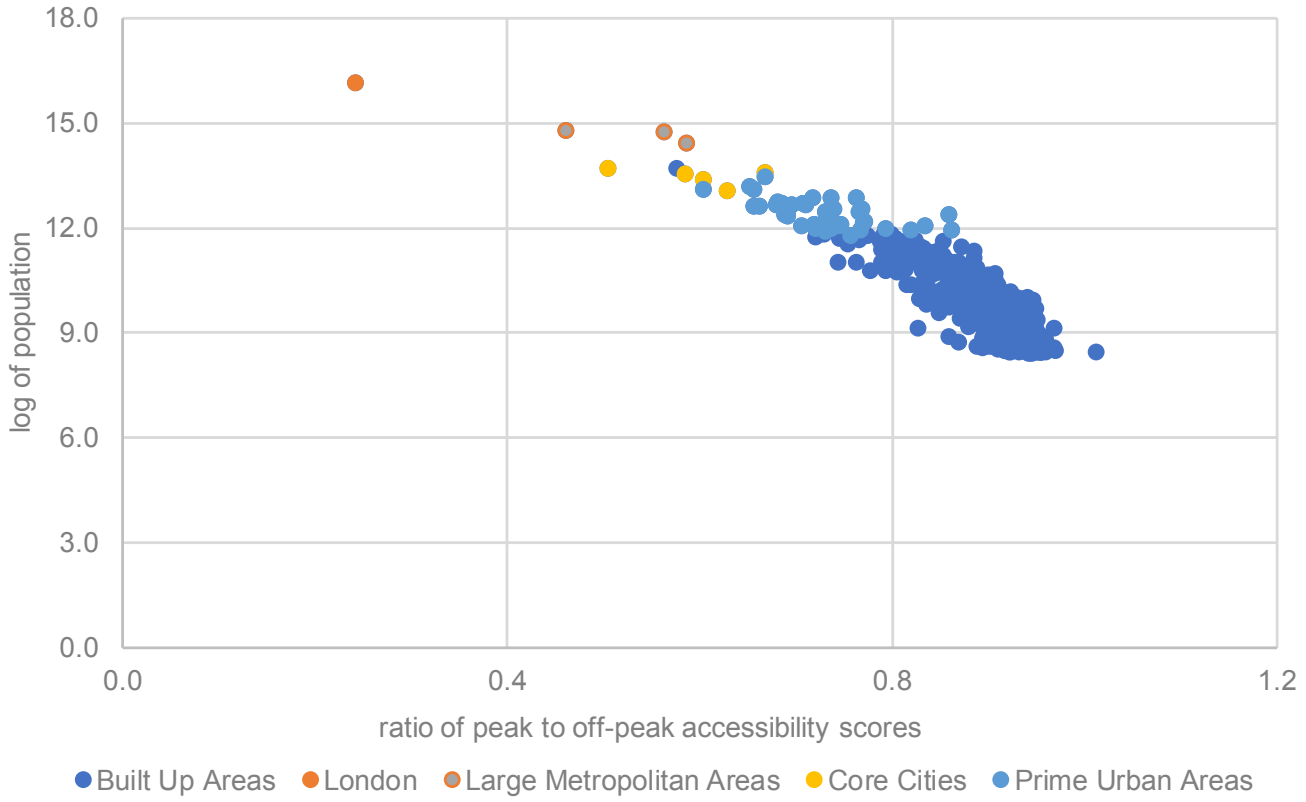
Source: TfL, published in DfT rail statistics
Note: Capacity is standard class critical load

Evidence also shows that London has some of the worst road congestion across England and Wales. The NIC[49] estimates road congestion at peak times for intra-urban and inter-urban travel by taking the ratio of car accessibility at peak and off-peak times. Figures 3.5 and 3.6 report this for the different categories of urban area defined in Chapter 2. Box 2.2 explains the methodology adopted – a lower accessibility score indicates less ease of travel.

Intra-urban car congestion is worse for larger cities, and is worst for London, (Figure 3.5). While there is not a similar relationship for inter-urban car journeys it remains the case that journeys to or from London suffer some of the worst congestion.

[48] Termini are Blackfriars (via Elephant and Castle), Euston, Fenchurch Street, King's Cross, Liverpool Street, London Bridge, Marylebone, Moorgate, Paddington, St Pancras International, Victoria, and Waterloo
[49] See Transport connectivity discussion paper - National Infrastructure Commission and Prospective: Transport connectivity report - National Infrastructure Commission

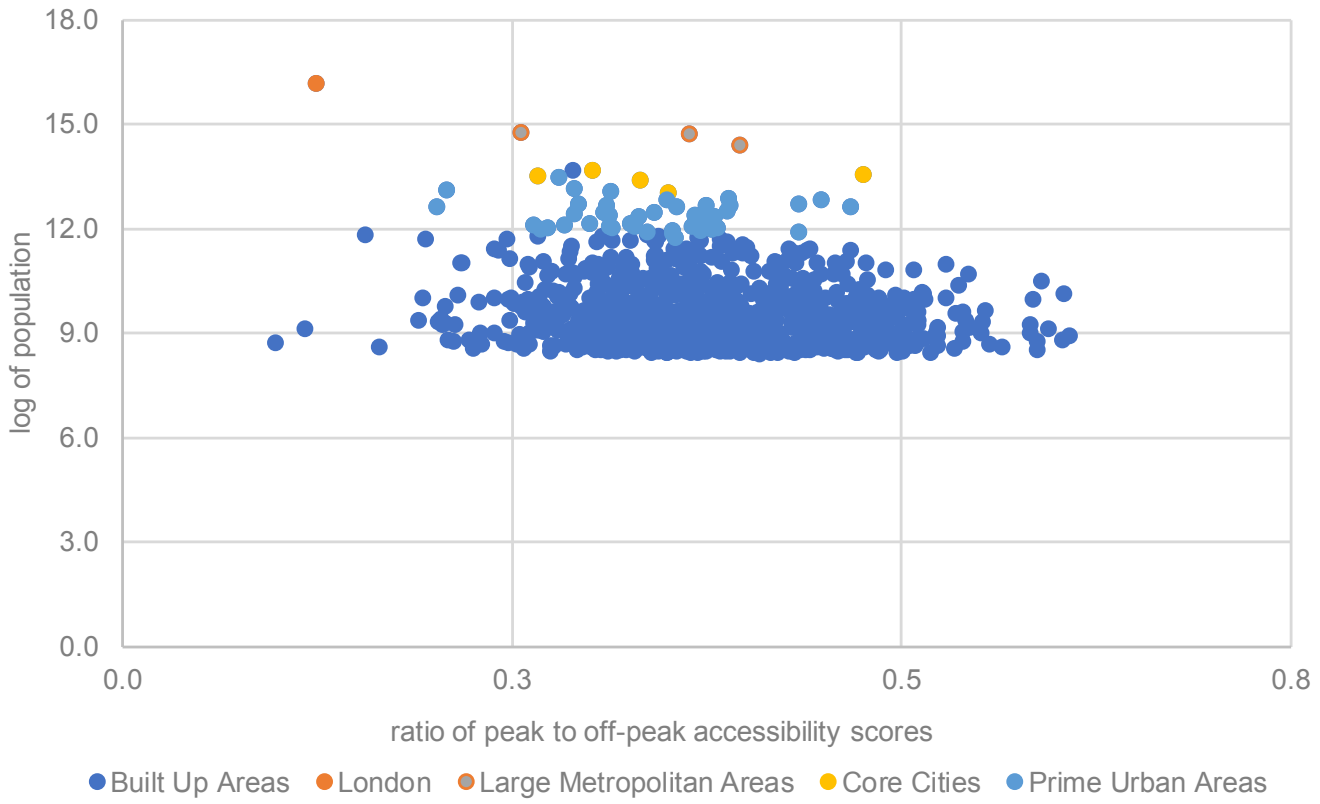
Figure 3.5: Relationship between population and road congestion at peak times for intra-urban car travel by category of Built Up Area[50] in England and Wales, 2016



Source: NIC

[50] The NIC classifies 53 of the BUAs in England and Wales as Prime Urban Areas (PUAs). This follows work for the Centre for Cities, by Newcastle University, Updating the definition of Primary Urban Areas. This uses workday population for a size criterion. It has its own separate geography, although the analysis of this paper uses the BUA definition. By this method Exeter is a PUA, while on the basis of resident population it would not be. Also, the PUAs of Leeds, Bradford, Huddersfield and Wakefield are part of the West Yorkshire BUA, Portsmouth and Southampton are part of the South Hampshire BUA, and Worthing is part of the Brighton and Hove BUA

Figure 3.6: Relationship between population and road congestion at peak times for inter-urban car travel by category of Built Up Area[51] in England and Wales, 2016



Source: NIC

This congestion impacts directly on the duration of bus journeys, and so indirectly on demand. Chapter 2 reported that there has been a decline in bus journeys, and TfL[52] finds that, "Central London observed the most significant decline in bus boardings […] Demand was expected to reduce as rail capacity came online, but this has occurred sooner than forecast." Instead, TfL concludes that, "The primary cause is considered to be the deterioration in bus speeds" associated with worsening road congestion.

In conclusion, the NIC has stated[53], "London's transport networks are already more congested and overcrowded than anywhere else in the country. Future growth will not be possible without substantial increases in capacity."

3.5 Transport interventions to unlock land

Transport interventions can unlock land for housing or commercial development by allowing new developments to meet planning conditions in term of public transport accessibility and/or by increasing the value of land and therefore by making developments commercially viable where this would not have been the case in the absence of investment. This is because - consistently with economic theory - the value of better connectivity for households and business will ultimately be reflected in the value of land.

An example of such a project is the extension of the Jubilee Line and associated enhancements to the Docklands Light Railway at the end of the 1990s. The NIC[54] notes that, "Conditions for this project were

[51] See previous footnote for explanation of PUAs
[52] See Travel in London reports - Transport for London, the Challenges and Opportunities report
[53] See, National Infrastructure Assessment 2018 - National Infrastructure Commission
[54] See, Economic growth and demand for infrastructure services - National Infrastructure Commission

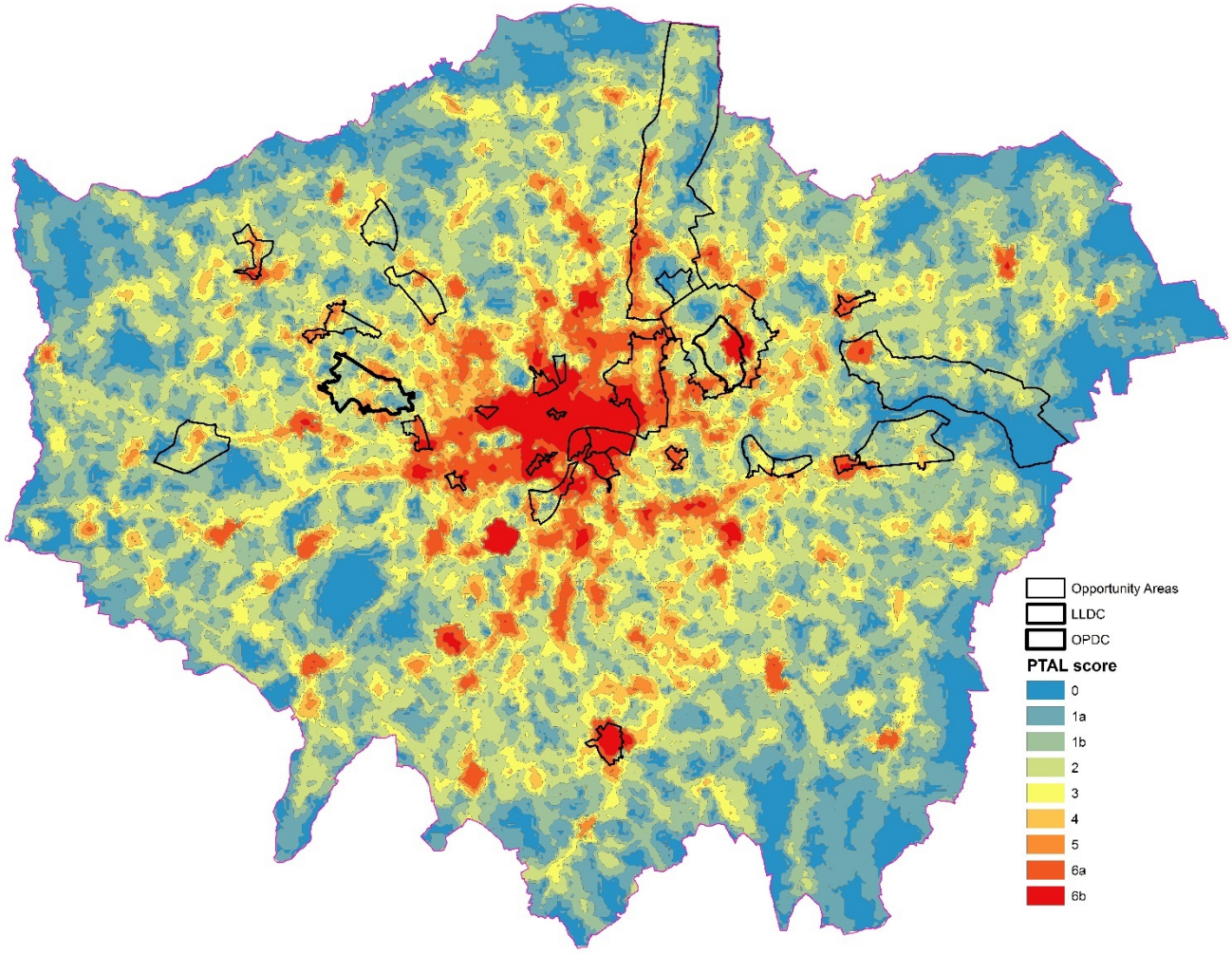
strongly supportive: London was already successful; the investments brought a substantial, but poorly linked, area of land close to the centre of the city into the main transport network; and Docklands benefited from governance reform (the development corporation), structural economic reform (the 'Big Bang') and structural shifts in the economy (the rise of knowledge intensive business services from the early 1990s)." Ex-post evaluation found that over the four-year period around the introduction of the service house prices rose by 9.3 percentage points more in places affected by these transport infrastructure changes, relative to places that were unaffected[55].

London's extensive transport network focuses on enabling people to reach the centre. Each small area can be given a Public Transport Accessibility Level (PTAL), which is a way to measure the density of the public transport network at any location within Greater London[56]. This can be compared with undeveloped areas which might be used for commerce or housing. Opportunity Areas, the London Legacy Development Corporation (LLDC) (around the Olympic Park), and the Old Oak and Park Royal Development Corporation (OPDC)[57] are London's major source of brownfield land with significant capacity for development. Transport infrastructure is typically key to unlock their potential[58].

In broad terms PTALs decline with distance from the centre of London, and development areas are more widely distributed across the city, (Map 3.4). That is, the provision of additional transport infrastructure to these areas might unlock both housing and jobs. Transport developments in the centre of London may benefit people who travel into London as well as Londoners.

[55] Gibbons S and Machin S (2005), "Valuing rail access using transport innovations", Journal of Urban Economics, vol 57, pp148-169
[56] For more information see Public Transport Accessibility Levels - London Datastore
[57] The Development Corporations have responsibility to plan, develop, and regenerate the areas for which they are responsible.
[58] See What are Opportunity Areas? | London City Hall

Map 3.4: Boundaries of Opportunity Areas, LLDC and OPDC, and 2015 PTALs, London



Source: GLA City Intelligence Unit modelling, incorporating TfL data
Note: These are adopted Opportunity Areas at July 2019[59]

[59] These are Canada Water; Charlton Riverside; City Fringe/Tech City; Colindale/Burnt Oak; Cricklewood/Brent Cross; Croydon; Deptford Creek/Greenwich Riverside; Earls Court & West Kensington; Elephant & Castle; Euston; Greenwich Peninsula; Harrow & Wealdstone; Ilford; Isle of Dogs; King's Cross-St Pancras; London Bridge, Borough & Bankside; London Riverside; Lower Lea Valley (including Stratford); Paddington; Park Royal; Old Oak Common; Southall; Thamesmead and Abbey Road; Tottenham Court Road; Upper Lea Valley; Vauxhall, Nine Elms, Battersea; Victoria; Waterloo; Wembley; White City; Woolwich. Other proposed OAs are: Bexley Riverside; Bromley; Heathrow; Kensal Canalside; Kingston Direction of Travel; Lewisham, Catford and New Cross; Old Kent Road; Royal Docks & Beckton Riverside

4 Investing in London's transport network

4.1 Introduction

While the previous chapter set out the arguments for investing in transport infrastructure, this chapter discusses the current levels of transport investment in London, what future plans are, how it is funded, and how the rest of the UK benefits. Part of the analysis is to consider some of the challenges in comparing across regions levels of transport expenditure, and it does this in the context of work by IPPR North.

4.2 Current levels of investment

4.2.1 Overview

The public sector spent around £810 billion during the 2018/19 financial year, and approximately £32.6 billion of that was on transport across the UK. That is according to the Public Expenditure Statistical Analyses (PESA) data collected by HM Treasury which are the most comprehensive datasets showing public sector investments and expenditure (see Box 4.1)[60]. Transport expenditure was around 3.8% of total government spending (also known as the total managed expenditure). To put that into perspective, the amount spent on transport was broadly comparable to that spent on public order and safety (£32.4 billion), yet a little over one-fifth of that for health (£152.9 billion) and slightly more than one-tenth of that for social protection (£274.7 billion).

Box 4.1: Public Expenditure Statistical Analyses (PESA) data

One of the main sources to identify trends in public sector spending is the PESA data compiled by HM Treasury. This includes information on central government departmental budgets, as well as the expenditure on services by the whole of the public sector using National Accounts definitions. The latter is used in this paper as it provides a more comprehensive view of public expenditure.

The PESA data can also be broken down by UK region as part of the Country and Regional Analysis (CRA)[61]. It can further be broken down into which levels of government were ultimately responsible for the spending – that is, whether it was by central government, local government (including bodies such as Transport for London (TfL) as well as local authorities) or public corporations, such as Network Rail. As will become apparent later in this chapter, this becomes an issue in that it does not consider how the spending was funded, or the value of the premium paid by train companies to the government.

As a separate breakdown PESA also includes information as to which spending area the expenditure was made. These spending areas are based on the UN Classification of the Functions of Government (COFOG) definitions and include:

- General public services;
- Defence;
- Public order and safety;
- Economic affairs;
- Environment protection;
- Housing and community amenities;
- Health;
- Recreation, culture and religion;

[60] HMT Public Expenditure Statistical Analyses (PESA) - GOV.UK

[61] Country and regional analysis - GOV.UK. Revisions to spending figures are often made between the publication of PESA and CRA, see Transport Expenditure Notes.

- Education;
- Social protection.

Within the economic affairs division, there is a specific group relating to transport which itself includes five sub-functions (see below). These definitions are used to identify transport investment in this paper:

- Local public transport;
- Local roads;
- National roads;
- Railways;
- Other transport.

A further breakdown is available by type of expenditure[62]:

- Capital expenditure includes expenditure on capital grants and spending on assets such as the acquisition of land, buildings, vehicles and machinery. For transport this includes the cost of building a road, or new rail lines and some maintenance work. Capital expenditure is broader than infrastructure spending, also discussed later in this chapter.
- Current expenditure covers recurring spending on items such as pay, benefits and the purchase of goods and services. For transport this includes services such as concessionary fares and revenue support to public transport. Expenditure is net of income from parking services, such as enforcement, and the congestion charge[63], and in consequence current expenditure for local roads for some years for London is negative.

Funding method can determine how, and to what extent, public sector expenditure is attributed to capital or current expenditure. The bus and train companies are mostly privately owned, so their capital spending will not be attributed to the public sector. Revenue support to the operators is part of public sector current expenditure, and may make a contribution to capital expenditure, as may fare revenue. There is no comparable issue for London Underground which is publicly owned, and whose expenditure will be reflected fully in the statistics as part of expenditure on railways.

Due to changes in methodology the series is not consistent over time. Notably, this is the reason for an increase in transport spending in 2015/16 of a quarter, and rail spending of over 50%. The change occurred because ONS began to record Network Rail spending as public sector expenditure with its reclassification as a public body in the National Accounts. Previous figures reflected only the Network Grant paid by government to Network Rail[64]. While year-on-year changes may reflect a number of factors the recorded regional increase in public expenditure on the railways was only lower than the UK average for London, Northern Ireland, Scotland and Wales, (Table 4.1).

[62] See Transport Expenditure Notes
[63] See Local authority revenue expenditure and financing - GOV.UK
[64] See Transport Expenditure Notes

Table 4.1: Public expenditure on railways, 2014/15 and 2015/16, and % change, by region, £ million, 2017/18 prices

	2014-15	2015-16	% change
North East	£192	£322	67%
North West	£905	£1,567	73%
Yorkshire and the Humber	£502	£926	84%
East Midlands	£213	£464	118%
West Midlands	£573	£973	70%
East	£572	£1,072	87%
London	£4,277	£6,107	43%
South East	£724	£1,428	97%
South West	£227	£510	125%
Scotland	£897	£1,097	22%
Wales	£437	£641	47%
Northern Ireland	£67	£88	32%
Total	£9,587	£15,193	58%

Source: HM Treasury, PESA, and ONS GDP deflators

Finally, while the intention is to allocate regional expenditure on a 'who benefits' basis the complexity of transport networks and limited data sources mean that it is not always possible or appropriate to allocate transport spending on this basis. For HS2 the allocation is where the benefits lie once each phase of the project is complete. Where this is not possible, expenditure has been apportioned based on actual regional spend (at the point of leaving the public sector) rather than where the benefit lies[65]. This is important to London as rail infrastructure can be of benefit to commuters from outside London, as discussed in Chapter 2, while much of the cost may be incurred in London. Further, some London residents may be receiving no benefit from the investment as they would not use the service it supports.

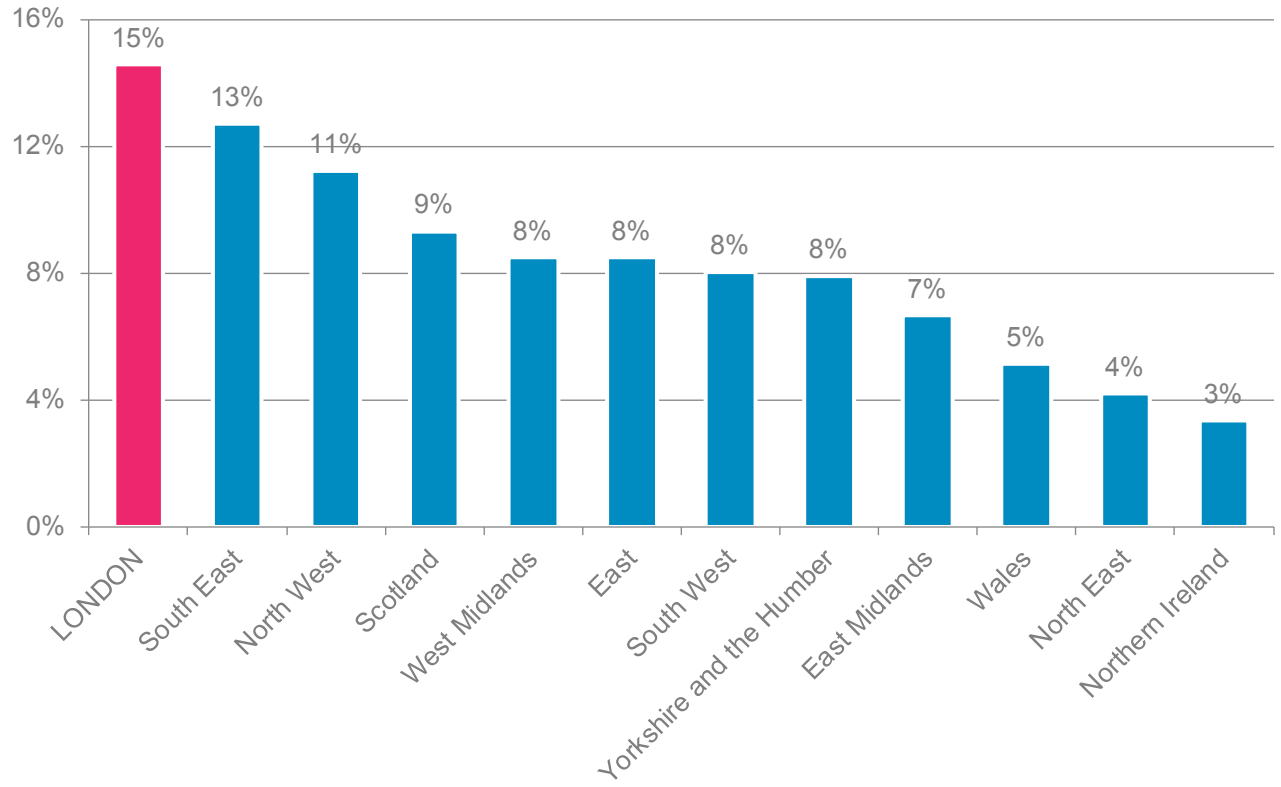
It is possible to attribute transport expenditure to specific regions of the UK. However, while some expenditure might occur outside of the UK or cannot be attributed to a specific region (i.e. UK wide projects, or for the benefit of the UK), these have been allocated at a regional level on a per capita basis in this publication. That said, it should be noted that this 'non-attributable' expenditure has historically represented less than 2% of all transport spending in the UK.

The analysis of public sector transport expenditure in this chapter is only for 2017/18[66], as the coverage of the public sector is not consistent over time, see Box 4.1, and so year-on-year expenditure comparisons would not be on a like-for-like basis. Much of this analysis updates the analysis in the 2017 GLA Economics transport paper[67] and the high-level conclusions with regard to London remain unchanged. It should be noted that there are shifts in expenditure across regions year-on-year and over time.

In London in 2017/18 public sector expenditure was £115.8 billion, and £9.1 billion of this was on transport. Across the regions of the UK, London's share of both categories of expenditure was highest, (Figures 4.1 and 4.2). It received 15% of all expenditure, and 28% of transport expenditure. For other regions the shares of both categories of expenditure were more similar.

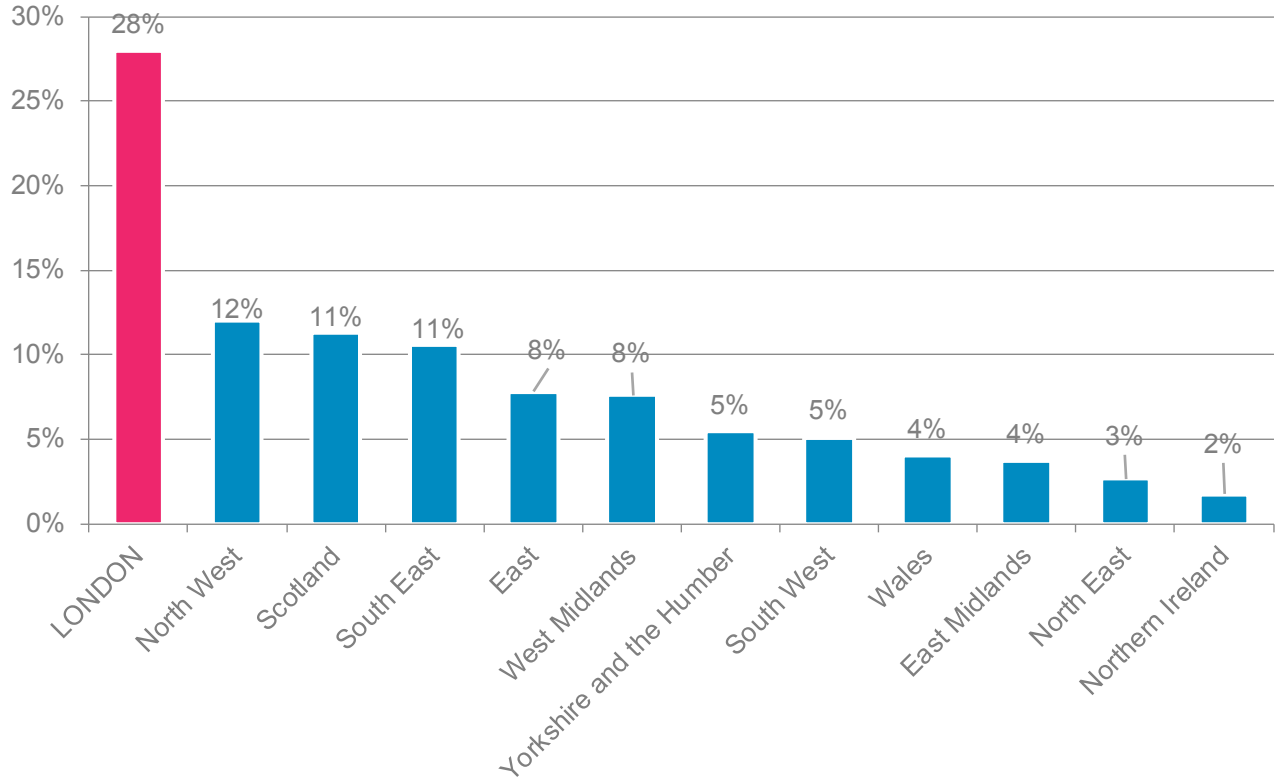
[65] See Transport Expenditure Notes
[66] This is the latest year for which regional estimates are available
[67] See Transport expenditure in London | London City Hall

Figure 4.1: Regional shares of public sector expenditure, 2017/18



Source: HM Treasury, PESA

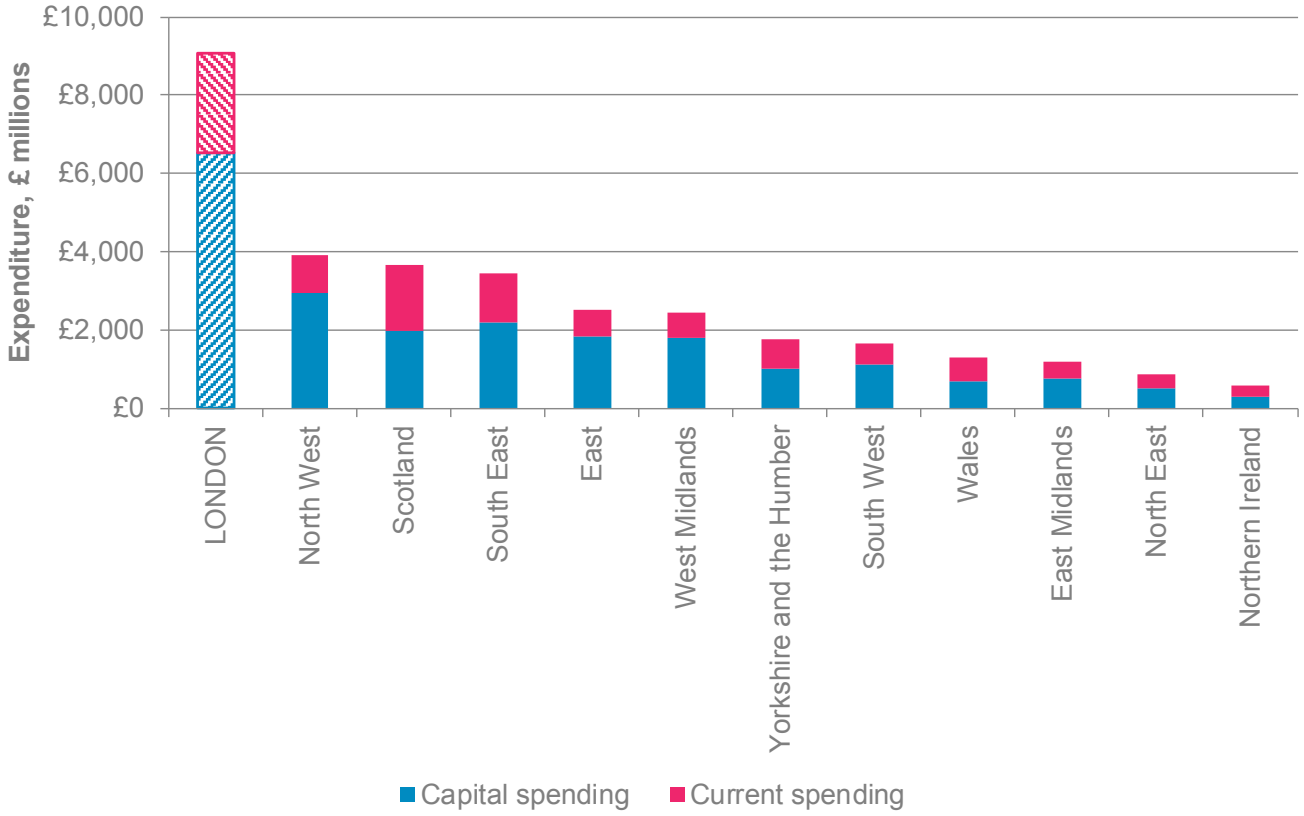
Figure 4.2: Regional shares of public sector transport expenditure, 2017/18



Source: HM Treasury, PESA

Over two-thirds (72%, or £6.5 billion in 2017/18) of transport expenditure in London was on capital projects, with the remainder on current spending such as operating costs. London spends proportionally more on capital than other UK regions, with around 67% of transport spending across the UK being capex, amounting to £21.7 billion in 2017/18. Consequently, while 30% of all the UK capital expenditure on transport was in London, it was lower at 24% for current expenditure (operational expenditure or opex), (Figure 4.3).

Figure 4.3: Public sector capital and current expenditure on transport by UK region in 2017/18, £ million

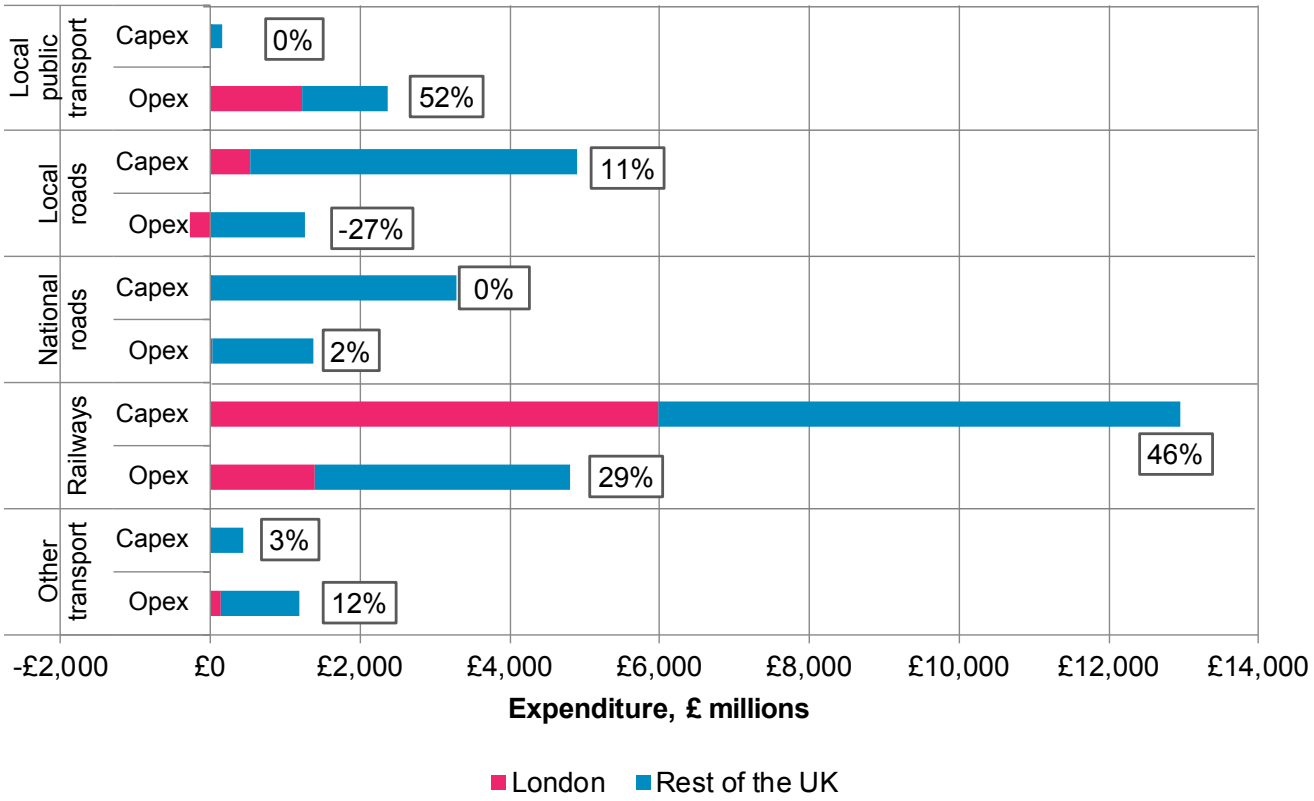


Source: HM Treasury, PESA
Note: The share of capital expenditure is shown next to the bars.

Transport expenditure can be analysed at a more detailed level, (Figure 4.4). Acknowledging this, around four-fifths (81%) of transport spending in London was on railways, which includes London Underground, in 2017/18, of which around four-fifths (also 81%) was capex. A further 14% was spent on local public transport (which was almost entirely opex), while 3% and 0.3% was spent on local and national roads respectively. The remaining amount (2%) was spent on 'other' transport.

As a percentage of total expenditure for the UK, approximately a half of all UK spending on local public transport (49%) and railways (42%) was in London in 2017/18. In contrast, relatively little is spent on local roads, national roads, and other transport in London, with spending in each category being less than 10% of the corresponding spending in the UK.

Figure 4.4: Public sector expenditure on transport in London and the rest of the UK by sub-function in 2017/18, £ million



Source: HM Treasury, PESA
Note: London's share of the UK total is shown next to the bars.

4.2.2 Regional comparisons of expenditure

The initial inspection of transport expenditure data presented above suggests that proportionally more is spent on transport in London than elsewhere and that this is driven predominantly by capital expenditure on railways and (to a lesser extent) expenditure on local public transport.

Having said that, comparisons that simply look at the total amount of expenditure do not consider need or demand for transport. Traditionally, this is often assessed by looking at measures of spend per resident, though a better measure is spend per daytime population which takes into account commuters and tourists who do not necessarily live in that specific area (Box 2.1). An even better approach to illustrate actual demand is to look at the actual number of transport users, such as the number of rail passenger journeys.

Moreover, given that transport infrastructure is essential in supporting an economy (see Chapter 3); a more 'rational' way of looking at transport investment is in terms of the region's economic contribution. For example, in terms of the amount of tax the region generates and the amount of economic output the infrastructure supports.

These different benchmarks for comparing transport expenditure are looked at in turn below.

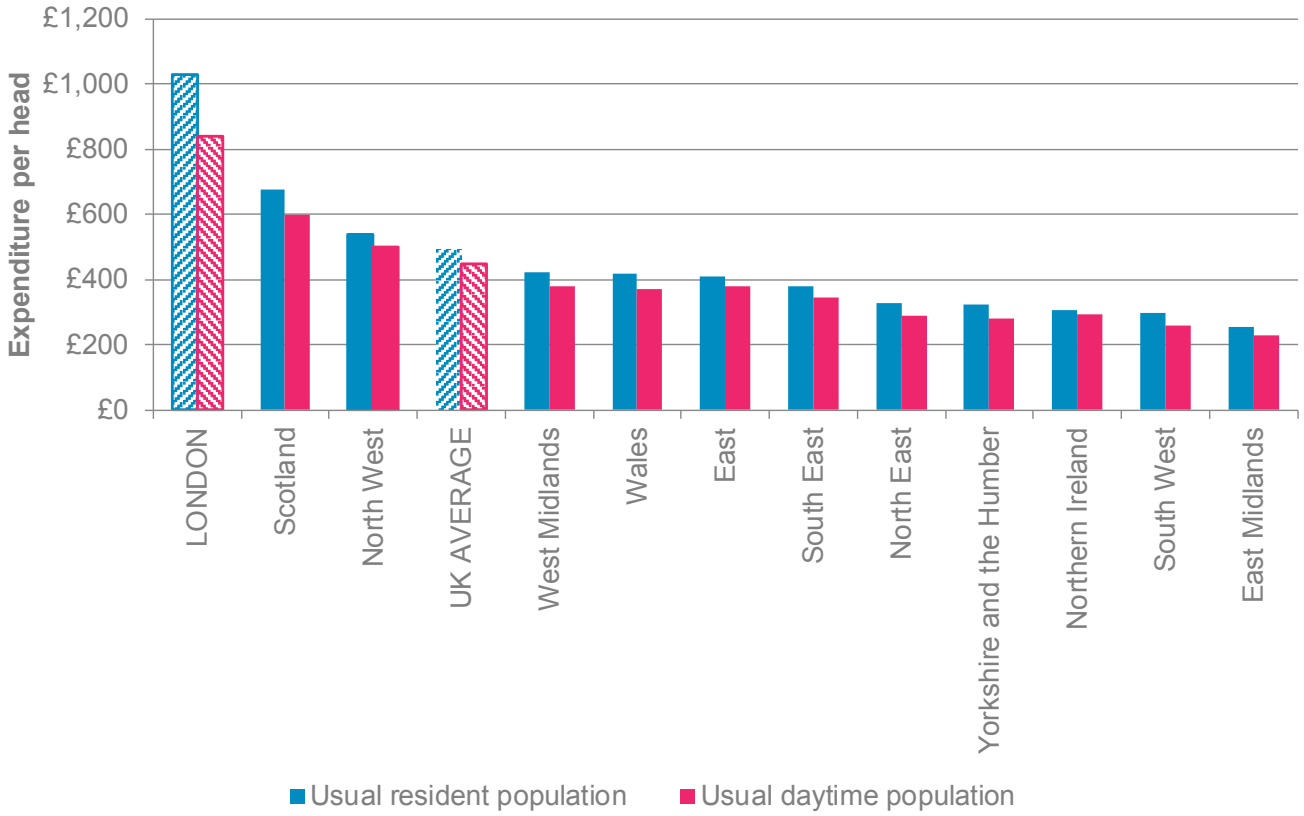
4.2.2.1 Expenditure per head

This section looks at the amount of transport expenditure per person for each UK region. Initially, there are two measures of people that can be used in this analysis. The first relates to the resident population – that is, the number of people actually living within that region. The second is the usual daytime population which

consists of residents, commuters and tourists. While commuters and tourists are not formally part of population estimates, they do 'use' transport infrastructure and so it could be more accurate to include them in expenditure per head calculations. Both measures are looked at in this section.

Using the estimates of the usual resident population, the amount of transport expenditure per person living in London was £1,028 in 2017/18. That was more than double the UK average of £492 and the highest for any UK region, (Figure 4.5). When looking at the usual daytime population, transport spending per person in London was lower at £840, still above the UK average of £449 but much less so than the estimate based on usual resident population.

Figure 4.5: Public sector expenditure on transport per head for the usual resident and daytime populations by UK region in 2017/18



Source: HM Treasury PESA, ONS Population Estimates, GLA Economics calculations

Box 4.2: Transport expenditure in the Wider South East

Chapter 2 highlights the large flows of commuters into the capital, principally from the WSE. In fact, London accounted for over 40% of an area's total employment in some parts of the WSE. As such, transport expenditure in London is not only beneficial to the capital itself, but also to the surrounding areas through these commuting flows. Consequently, transport spending may be better considered as part of the wider functional urban region, i.e. the WSE. Looking at expenditure for the wider WSE region would also make it more comparable with other UK regions. That is, London on its own is predominantly an urban area (in contrast with other regions that typically have a mix of urban and rural areas) which, as a result, means that transport is likely to constitute a larger proportion of spending[68]. The WSE is more 'balanced' in this aspect enabling better comparisons – see Appendix A.

[68] A similar argument was made in Travers, T et al (2010). Public spending priorities in London, May 2010.

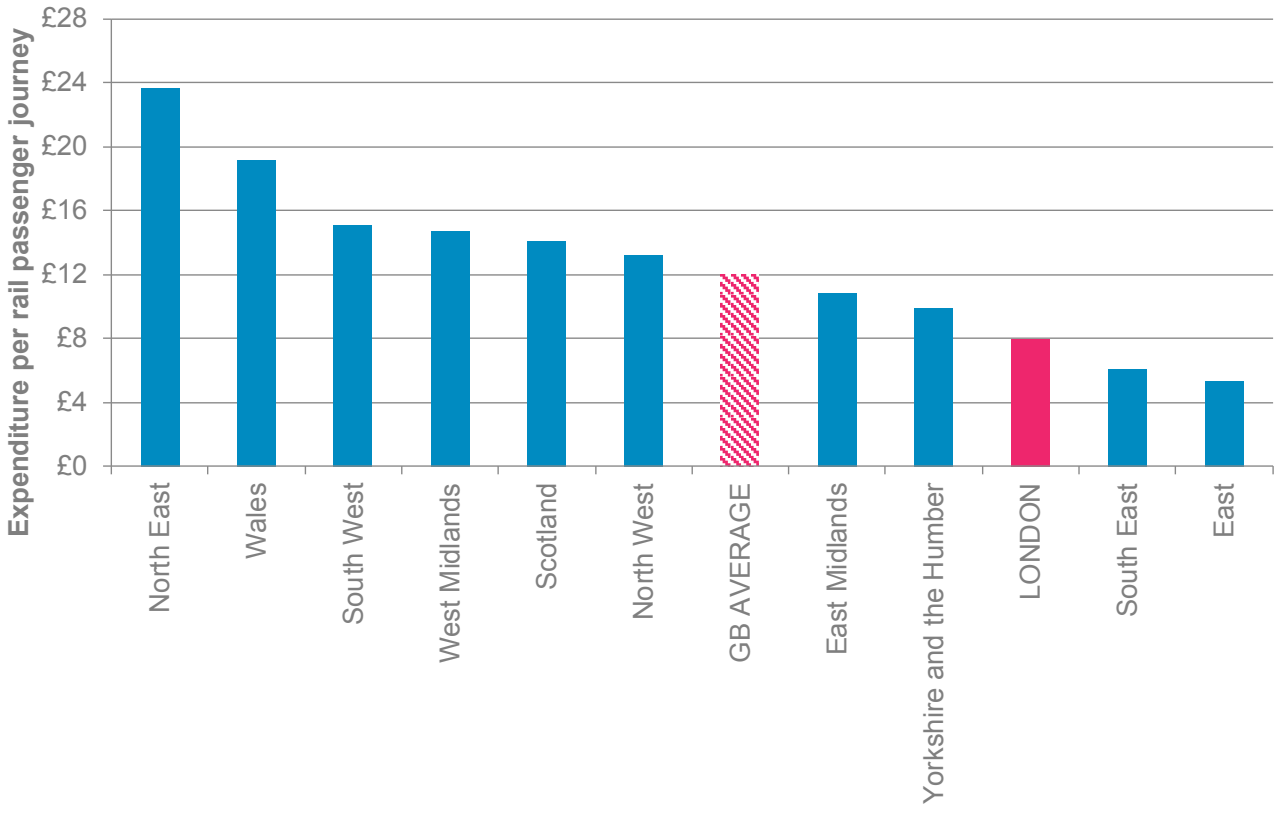
Given the above, the total amount spent on transport by the public sector in the WSE was £15.0 billion in 2017/18. That was the equivalent of 46% of the UK total. On a per head basis using the resident population, approximately £625 was spent on transport per person in the WSE. While that was above the UK average of £492, it was around three fifths (61%) that for London on its own (£1,028)[69].

4.2.2.2 Expenditure per user

Another way to describe the level of transport expenditure in London is in terms of the number of 'users'. This illustrates the actual demand for transport in the region. For instance, this can include the number of passengers using the railway or local public transport system or the number of vehicles using the road network. However, any analysis based on the number of users will be limited to areas where there is comparable data for all UK regions.

The Office for Rail and Road publishes data on the number of railway journeys by region for Great Britain which could be an indication as to the number of 'users'[70]. These showed that there were approximately 1.5 billion journeys across Great Britain in 2017/18, of which almost two-thirds (63% or 927 million journeys) had at least a part in London. Comparing these estimates with public sector expenditure on railways, the amount spent per passenger journey in London was approximately £7.96 in 2017/18. That was below the GB average of £11.97 and was only higher than the other regions of the WSE, (Figure 4.6).

Figure 4.6: Public sector expenditure on railways per passenger journey by GB region, 2017/18

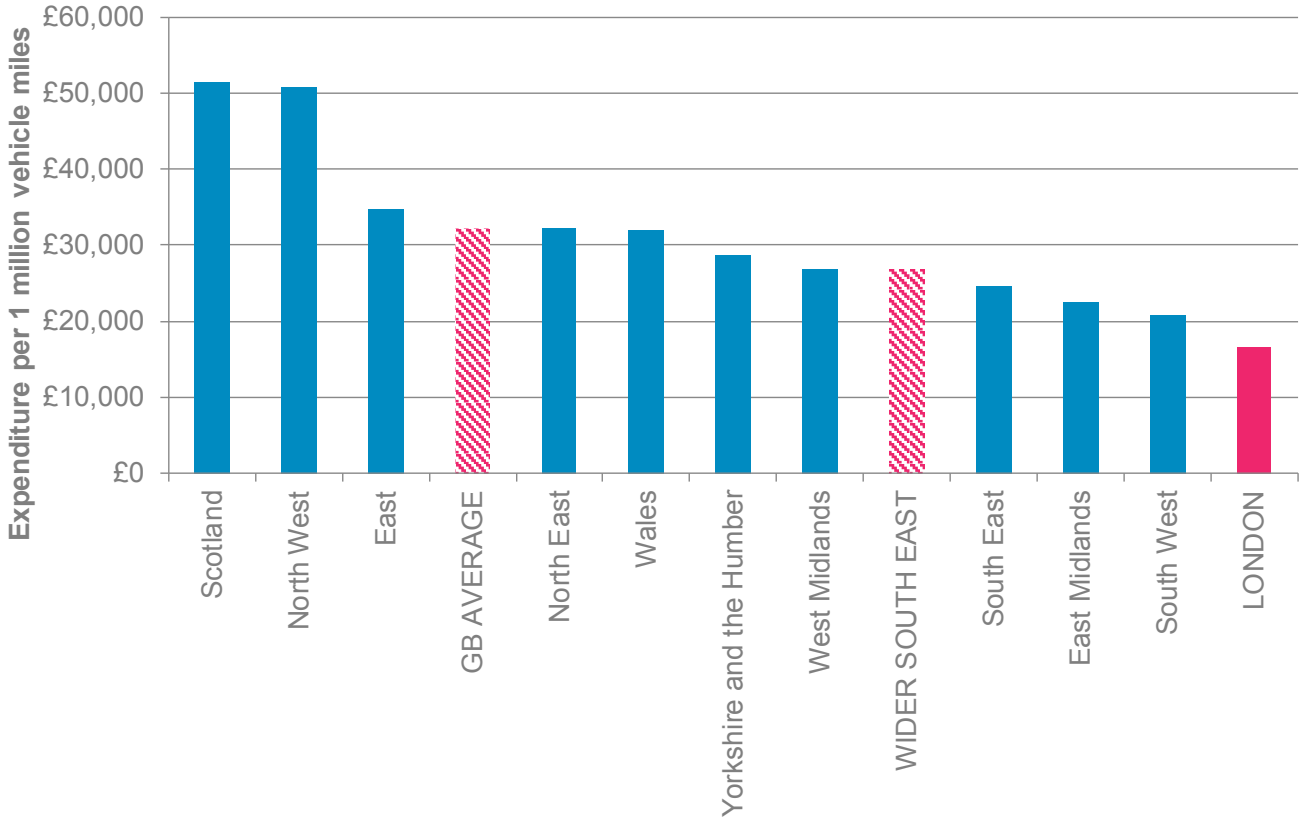


Source: HM Treasury PESA, Office for Rail and Road Regional Statistics

[69] It is not possible with daytime population data for individual regions to estimate the corresponding figure for the WSE due to double counting of people who spend part of a day in more than one region.
[70] Office for Rail and Road Regional rail usage statistics

Similar estimates can be calculated for road use with the Department for Transport regularly publishing information on road traffic[71]. As part of this, they provide estimates of the number of vehicle miles or traffic volumes for most UK regions except Northern Ireland. The latest estimates suggest that there were 328.1 billion vehicle miles across Great Britain in 2018, of which 18.4 billion (or 6%) were made in London. Overall, these estimates of vehicle miles could be a proxy of the road network's 'use'. The amount of public sector expenditure spent on roads in London was approximately £16,400 per 1 million of vehicle miles in 2017/18. That was the lowest among the GB regions (thus below the GB average of £32,200), (Figure 4.7).

Figure 4.7: Public sector expenditure on roads per 1 million vehicle miles by GB region, 2017/18



Source: HM Treasury PESA, Department for Transport Road Traffic Statistics
Note: Expenditure on roads combines the PESA sub-category functions for national and local roads

4.2.2.3 Expenditure as a share of economic activity

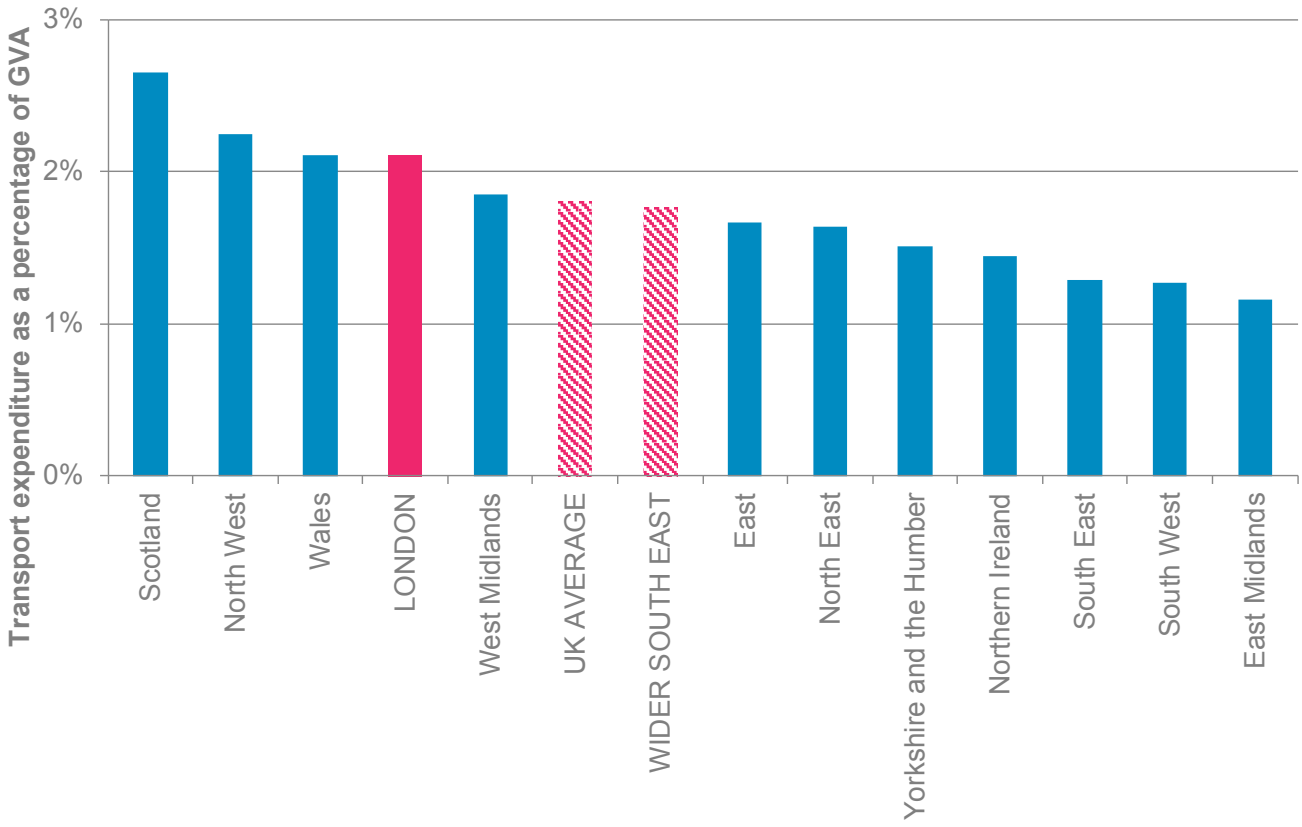
Given that a good transport system is essential in supporting the economy, a more 'rational' way of looking at transport expenditure is in terms of economic activity supported rather than on a per head basis. Chapter 3 outlined how good infrastructure can give rise to agglomeration benefits by reducing transport costs. This in turn enables a more efficient allocation of resources and boosts productivity, thus supporting the local economy. Or to put it another way, an economy needs good transport to function and grow. This is particularly true for London where a lot of the economic activity, especially in the centre, is dependent on this infrastructure. Therefore, it makes sense to compare transport infrastructure with economic activity to illustrate the need for such expenditure. This would also then make it more in line with how such economic indicators are usually referenced. For example, national debt and R&D investment is usually referred to in terms of the size of an economy rather than on a per head basis.

[71] Department for Transport Road network and traffic statistics

A measure of economic activity is gross value added (GVA). This shows the value of goods and services produced in an area and defined as output minus the cost of inputs associated with that production (i.e. intermediate production). London's GVA was valued at £431.2 billion in 2017, according to data published by the ONS[72]. London's share of total economic output for the UK was nearly a quarter (24%), and that of the WSE was nearly a half (47%). The contribution of the next largest region was the South East at 15% of UK GVA.

Combining these GVA estimates with the public sector's transport expenditure suggests the amount spent on transport in London was 2.1% of its economic output in 2017/18, (Figure 4.8). While that was higher than the UK average of 1.8%, it was less than the North West, Wales and Scotland. In addition, if looking at the wider functional area of the WSE which arguably enables more like-for-like regional comparisons (see Box 4.2); then transport expenditure was the equivalent of 1.8% of its economic output.

Figure 4.8: Public sector expenditure on transport as a percentage of GVA by region, 2017/18

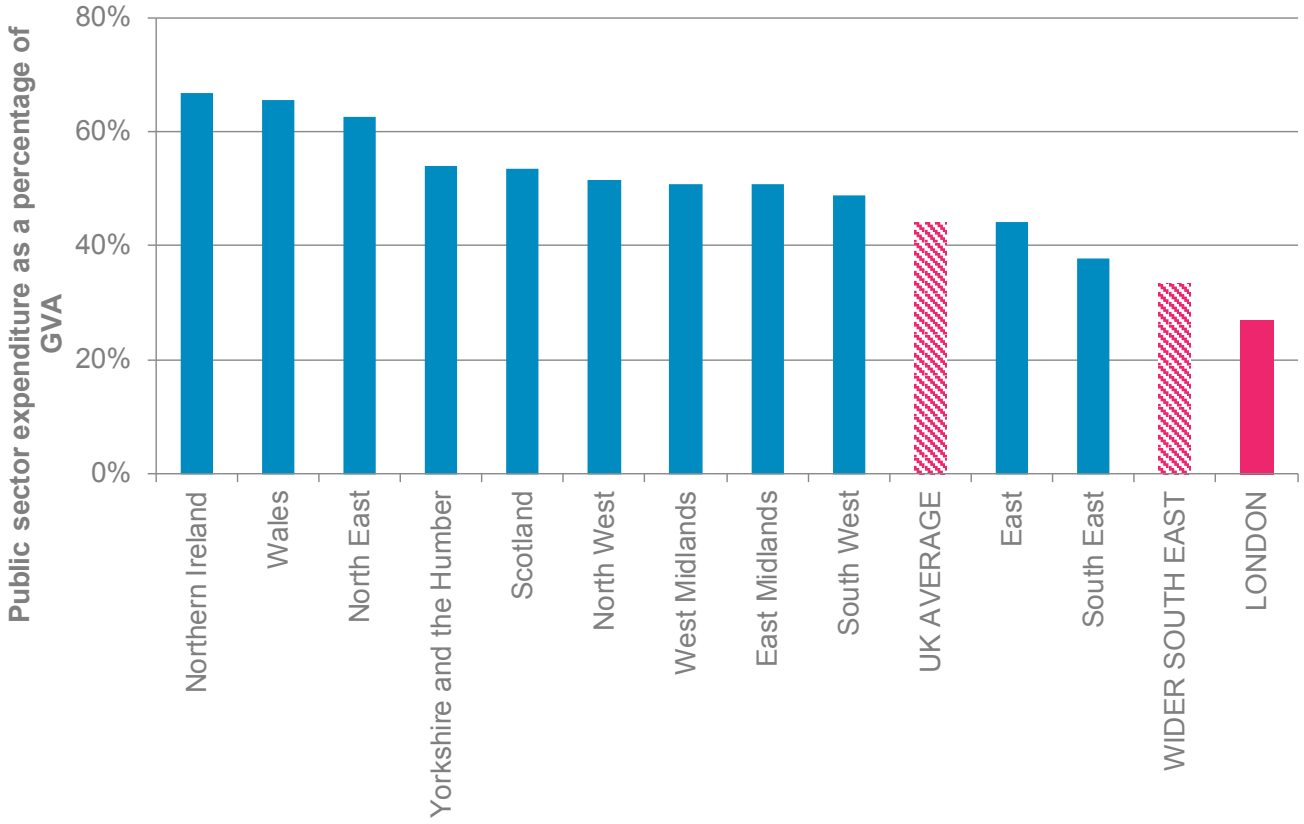


Source: HM Treasury PESA, ONS Regional GVA

As noted earlier transport spending is a comparatively important component of public sector spending. Total public spending as a share of GVA was lowest in London of all regions in 2017/18 at 27%, and second lowest across the WSE at 33%. This compares to a UK average of 44%, (Figure 4.9).

[72] ONS Regional gross value added (income approach)

Figure 4.9: Public sector expenditure as a percentage of GVA by region, 2017/18



Source: HM Treasury PESA, ONS Regional GVA

4.2.2.4 Expenditure as a share of tax revenue

Public sector expenditure made in London can also be considered in terms of the tax contributions the capital makes as these provide much of the funds available for spending. The ONS has produced experimental statistics showing public sector revenue and expenditure by UK region which can be used for this purpose[73]. This suggested that London generated £150 billion in taxes in 2017/18[74]. That was one-fifth of the UK total making it the largest tax contribution for any UK region, and more than public spending in London of around £116 billion[75].

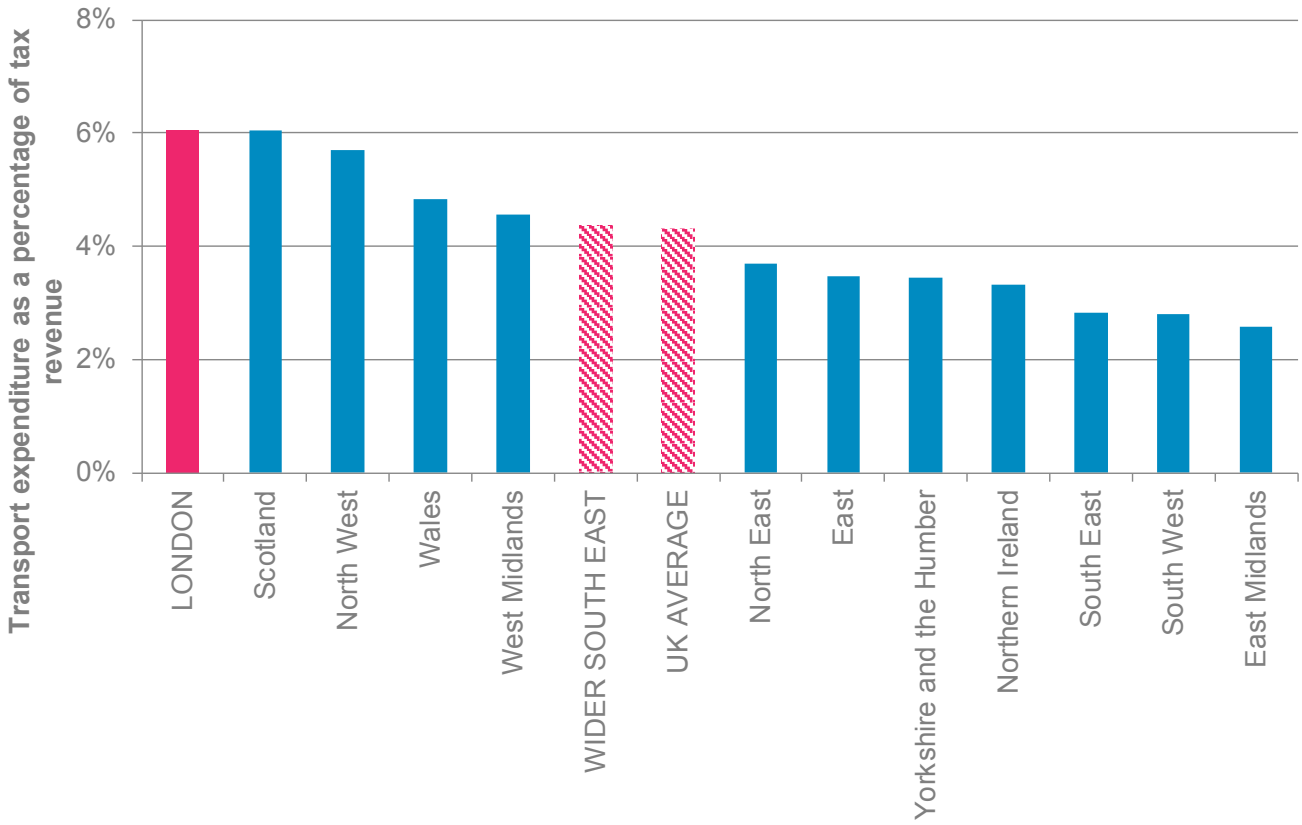
The amount of public sector expenditure spent on transport can be compared with a region's tax contribution. On this basis, transport spending by the public sector in London was the equivalent of 6% of its tax revenue in 2017/18, the highest rate across the regions of the UK. However, the WSE (see Box 4.2) received around 4.4% of its tax contributions in transport expenditure. That was broadly in line with the UK average of 4.3% as can be seen in Figure 4.10.

[73] Country and regional public sector finances - Office for National Statistics

[74] This does not mean the tax revenue raised in London is retained in the capital and spent on transport. Due to the way that government finance operates, for most taxes, the revenue is pooled centrally and then either spent directly by central government or redistributed back to the regions and spent locally.

[75] This is the PESA figure. Due to slightly different methodologies, this does not necessarily equal the ONS estimate.

Figure 4.10: Public sector expenditure on transport as a percentage of tax revenue by region, 2017/18



Source: HM Treasury PESA, ONS Country and Regional Public Finances

4.3 Future infrastructure investment

There are two ways to consider future investment at a national level. The Government publishes annually the National Infrastructure and Construction Pipeline (NICP)[76], the last being in November 2018, and is a ten-year projection. While the independent NIC publishes a five-yearly NIA[77], the last being in July 2018, which covers the period to 2050. The Government has yet to publish a formal response to the NIA, so while some projects are in existing plans, not all of them have been adopted.

TfL develops its infrastructure plans, through its business plan[78] (currently for 2019/20 to 2023/24) and the Mayor's Transport Strategy[79] (which runs to 2041). The central aim is for 80% of all trips in London to be made on foot, by cycle or using public transport by 2041. This is to support the health and wellbeing of Londoners, and the city as a whole by reducing congestion and enabling the most efficient use of valuable street space. TfL estimates that this requires, on average, £3.3 billion of new capital investment per year, with an additional £0.7 billion for renewals. This figure, in 2017 prices, is more than double TfL's current level of investment.

4.3.1 National Infrastructure and Construction Pipeline

The NICP sets out the planned investment in infrastructure, see Box 4.3. Unlike the PESA data used above, the NICP covers all transport infrastructure projects, both those which are publicly funded, and those which

[76] See National Infrastructure and Construction Pipeline 2018 - GOV.UK
[77] See National Infrastructure Assessment 2018 - National Infrastructure Commission
[78] See Budget and Business Plan - Transport for London
[79] See Mayor's Transport Strategy 2018 | London City Hall

are funded by the private sector, notably those for airports and ports. At the same time the NICP is not a complete source of all planned infrastructure projects (as it predominantly includes projects costing in excess of £50 million) and it is not limited to firm and funded projects, so there is a risk that some of the investments will not go ahead. There is a total of £615.4 billion of investment in the pipeline across the UK. Of this, a third (32%) at £198.6 billion is specifically related to transport infrastructure. £286.5 billion of the total investment would be publicly funded, of which three fifths (58%) at £167.6 billion would be for transport infrastructure.

Box 4.3: The National Infrastructure and Construction Pipeline

Building on the National Infrastructure Delivery Plan, the Infrastructure and Projects Authority (IPA) – a government centre that supports the successful delivery of all types of infrastructure and major projects – collated information about planned infrastructure across the UK. This was published for the first time in December 2016 and has been updated annually thereafter as part of the NICP.

The NICP covers both public and private sector investment in infrastructure. It predominantly includes large capital projects with a value of more than £50 million, though some smaller projects are also included. While completed projects are removed from the NICP, new projects are added once they have been announced. However, it does not necessarily mean that these projects will go ahead.

The information within the NICP can be broken down by sector. In total, there are 15 sectors including housing, transport, energy, digital communication, education and justice among others. In addition, it can be broken down by the type of finance used to fund the infrastructure project (i.e. public or private sector funding or a mix of both).

It can also be split by region for which the spending relates. However, while the pipeline refers to planned infrastructure across the UK, it mostly relates to spending in England. That is because most of the infrastructure spending in Scotland, Wales and Northern Ireland is the responsibility of each devolved administration and, therefore, not included in the NICP. The known London-based projects could also be over a longer time period than other regions. This is because there are structures to support it such as the Mayor's Transport Strategy[80], and the TfL business plan[81], and which don't exist elsewhere. Indeed, the pipeline does not include local authority investment, which falls to TfL in London. This means that regional comparisons may not be on a like-for-like basis. Notably, projects for areas outside London may be captured in the NICP later than similar projects for London.

Allocation of expenditure to regions is on the basis of asset location where this is known. On this basis around 40% of the pipeline is allocated to a specific region. Other projects are national, cross region or are broader investment programmes[82]. In this paper these investments have been allocated to English regions on a per capita basis (as with the earlier analysis of PESA data).

Allocating cross-regional and broader spend to regions by head of population, the total amount of planned spending included in the NICP was approximately £551.9 billion across England, and £273.7 billion for publicly funded projects. London's share is around a fifth, (Table 4.2). London's share of all transport projects is a third (33%), falling to 28% for publicly funded projects (which as it happens is in line with London's share of England's GVA). London's share of transport projects, though, remains markedly higher

[80] See Mayor's Transport Strategy 2018 | London City Hall
[81] See Budget and Business Plan - Transport for London
[82] This includes offshore, overseas and international projects

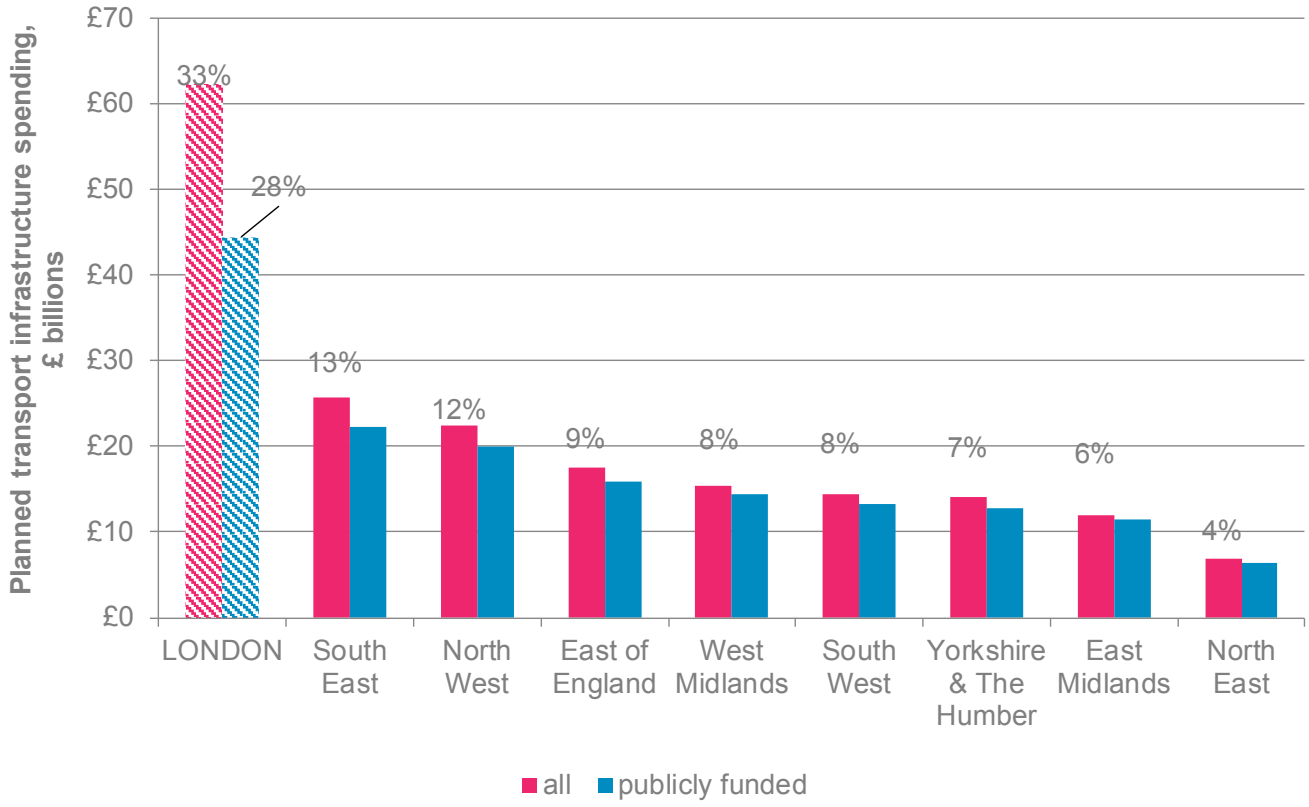
than that of all other English regions, (Figure 4.11). Around a third (35%) of all projects in England are transport projects, and this figure rises to around three fifths (59%) for publicly funded projects.

Table 4.2: NICP planned infrastructure and transport spending, all spending and publicly funded spending, 2017/18 to 2027/28, London and England, 2017/18 constant prices

	London	England	London's share
all projects	£117.0bn	£551.8bn	21%
all publicly funded	£61.2bn	£273.7bn	22%
all transport projects	£62.3bn	£190.5bn	33%
all publicly funded transport projects	£44.4bn	£160.8bn	28%

Source: GLA Economics calculations of NICP November 2018, and ONS Population Estimates

Figure 4.11: NICP planned transport infrastructure spending, all spending and publicly funded spending, 2017/18 to 2027/28, English regions, 2017/18 constant prices



Source: GLA Economics calculations of NICP November 2018, and ONS Population Estimates
Note: Each region's share of the UK total for all spending is shown next to the bars, as is publicly funded spending for London. There is little difference in shares of publicly funded spending for other regions.

The IPA has attributed £43.8 billion of all transport infrastructure spending to London, and £26.8 billion of publicly funded spending, (Table 4.3). The remainder is either cross-regional, or for other regions. Railways are the most important mode of spending in London, accounting for more than half of all spending, (Figure 4.12), and a little less than half for publicly funded spending, (Figure 4.13) – this includes Crossrail and development costs for Crossrail 2. The corresponding figure for other regions is more like 10%. Nearly all of cross-regional spending is on railways, including HS2.

Table 4.3: NICP planned transport spending, all and publicly funded, by regional category, 2017/18 to 2027/28, 2017/18 constant prices

	all	publicly funded
London	£43.8bn	£26.8bn
Other regions	£30.8bn	£23.2bn
Cross-regional	£124.0bn	£117.5bn
Total	£198.6bn	£167.6bn

Source: GLA Economics calculations of NICP November 2018

Figure 4.12: Distribution of all NICP planned transport spending by transport mode, by regional category, 2017/18 to 2027/28, 2017/18 constant prices

Source: GLA Economics calculations of NICP November 2018

Figure 4.13: Distribution of publicly funded NICP planned transport spending by transport mode, by regional category, 2017/18 to 2027/28, 2017/18 constant prices

Source: GLA Economics calculations of NICP November 2018

4.3.2 National Infrastructure Assessment

The NIA sets out the infrastructure requirements, see Box 4.4. Like the NICP, and unlike the PESA data used above, the NIA covers both infrastructure projects funded by the public sector as well as projects funded the private sector, notably those for airports and ports. It is also not a complete source of all planned infrastructure projects as it is a set of recommendations to government and so some of these projects may not go ahead. There is a total of £615.4 billion of investment in the pipeline across the UK. Of this, a third (32%) at £198.6 billion is specifically related to transport infrastructure. £286.5 billion of the total investment would be publicly funded, of which three fifths (58%) at £167.6 billion would be for transport infrastructure.

Box 4.4: The National Infrastructure Assessment

The NIC came into being in April 2017 to carry out an overall assessment of the UK's infrastructure requirements once every 5 years – like the NIDP it does not include spending by the devolved administrations. The NIC covers transport, energy, water and waste water, flood resilience, digital connectivity, and solid waste over a thirty-year period to 2050. The Commission's remit also includes the potential interactions between its infrastructure recommendations and housing, but not housing supply in general. The NIA is guided by the Commission's objectives to support sustainable economic growth across all regions of the UK, improve competitiveness and improve quality of life. The first NIA came out in July 2018[83]. The recommendations meet the fiscal remit of gross public investment in economic infrastructure of between 1.0% and 1.2% of GDP in each year between 2020 and 2050[84]. The Government has not yet responded to the NIA.

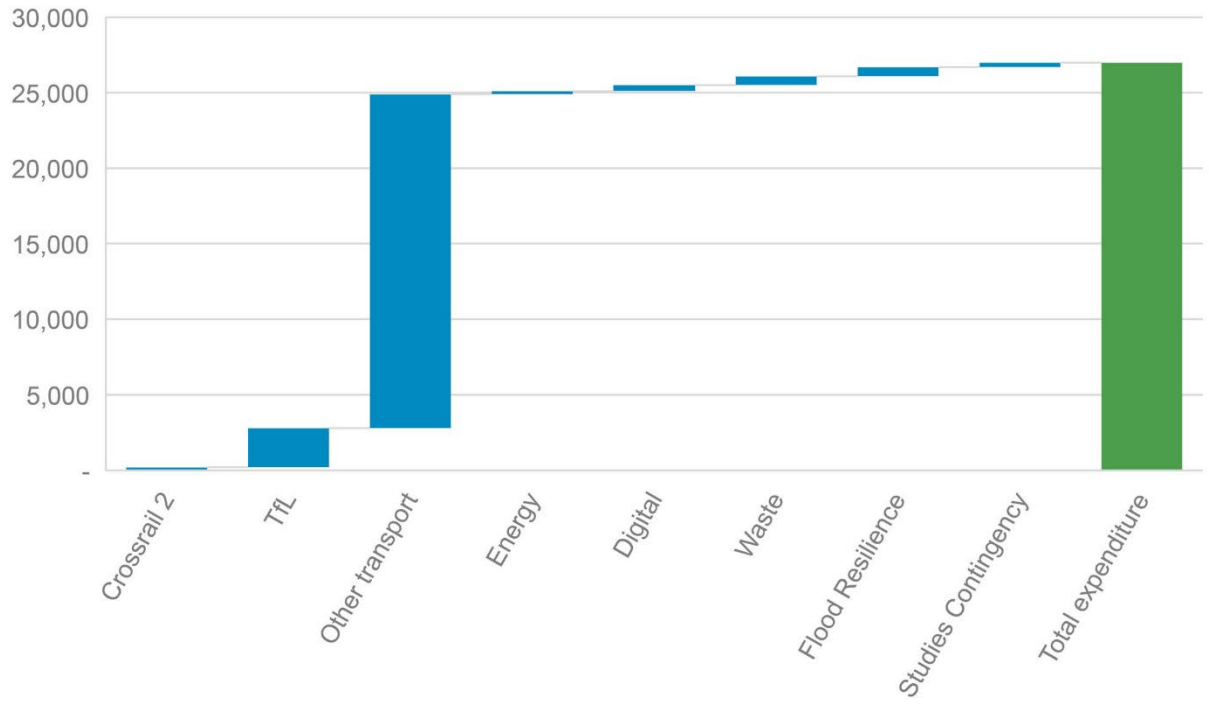
The Commission's remit is in line with UK government competence, respecting devolved responsibilities for infrastructure. As such, the fiscal remit does not include spending where infrastructure investment decisions rest with the devolved administrations in Scotland, Wales and Northern Ireland. There are devolved responsibilities for all the areas the NIC covers except digital connectivity, and energy, aside from energy efficiency.

NIC costings differ from the NIDP in two respects. The NIC does not include directly the cost of private investment. Instead, where the NIA recommends private projects, and the costs will ultimately be met by consumers, the NIC has provided an assessment of the overall impact on bills – this is done separately to the assessment of investment needs. Second, the NIC does not only include new projects. It has to accommodate existing commitments and ongoing investment in maintenance and renewals.

The priorities of the NIC are congestion, capacity, and carbon, and flowing from this transport projects are the principal source of infrastructure investment it recommends. The NIA notes that intercity transport is getting the investment it needs, and that cities are the priority for future transport investment. The NIC recommends that over 90% of infrastructure investment should be on transport, whether this is for the five-year period from 2020 to 2025, or over the thirty years to 2050. A little over 10% of transport funding would be for TfL (including Crossrail 2) for both time periods, (Figures 4.14 and 4.15). That is, within the constraint of the fiscal remit, it is possible both to meet London's investment needs while also investing significantly in the rest of the country.

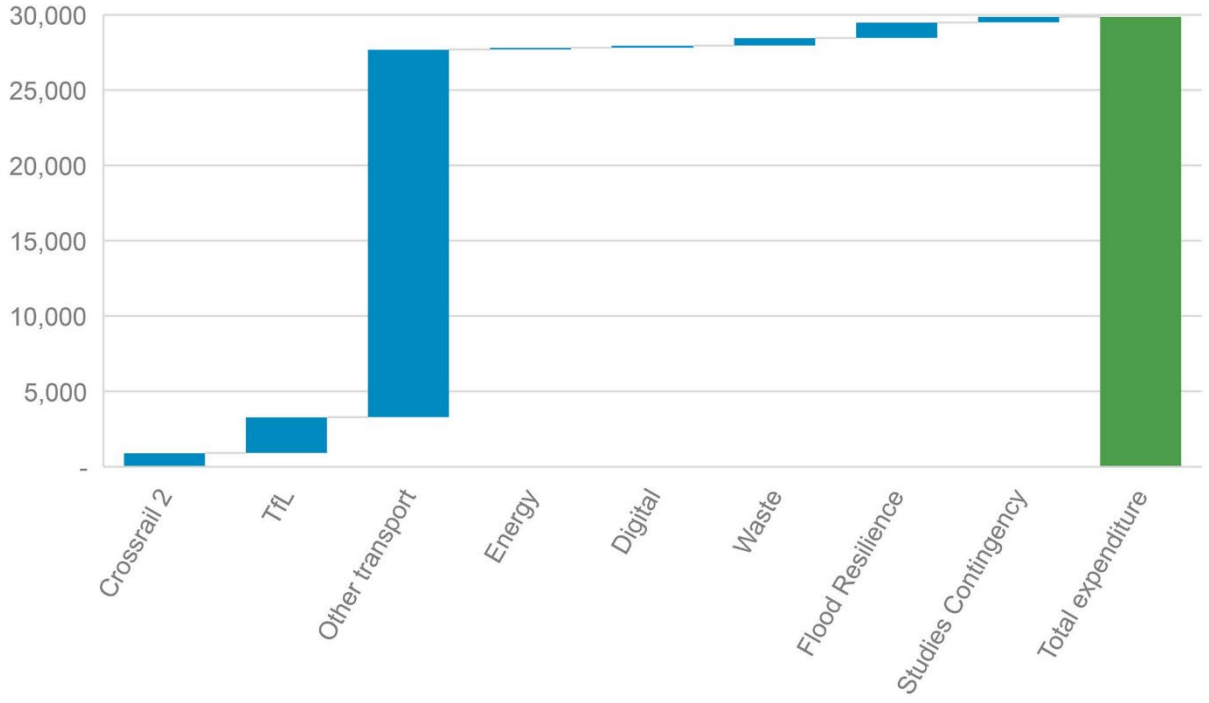
[83] See National Infrastructure Assessment 2018 - National Infrastructure Commission
[84] See Remit letter to the National Infrastructure Commission - GOV.UK

Figure 4.14: NIC Fiscal Remit 2020-2025, Average annual expenditure by priority area, 2018/19 prices



Source: NIC, Updated fiscal remit table 7.1

Figure 4.15: NIC Fiscal Remit 2020-2050, Average annual expenditure by priority area, 2018/19 prices



Source: NIC, Updated fiscal remit table 7.1

4.4 Funding of transport projects

Transport projects are either publicly or privately funded. Historically, TfL and its predecessors have used a range of methods to fund transport infrastructure[85]. The construction of the M25, Croydon Tramlink and the East London Line extension (now a part of London Overground) were at least initially funded by Private Finance Initiatives (PFIs). This usually involved the private sector funding the infrastructure project initially and then being repaid by the public sector or 'users' over a set time period. Other projects including the DLR and Jubilee Line extension were alternatively funded by government grant, while the Heathrow Express was entirely funded by the private sector operators of Heathrow Airport. London relies more on private funding than other parts of the country, as the earlier analysis of the NICP pipeline indicates.

Ultimately, households and individuals will also pay for publicly funded transport projects either through fares or taxes. There are a number of options for taxes. For individuals, as well as income tax, and VAT, there is the place-based council tax. Business taxes are passed on through the prices for goods and services, but can also be levied at the location of a business. Increasingly, though, users of transport services in London are being asked to meet the costs either through fares or taxes. While they are the immediate beneficiaries of the services, there will also be tax flowbacks to the Exchequer where there is higher output or productivity – this justifies a continued Exchequer contribution to projects.

The next three sub-sections provide examples of the funding of recent and ongoing transport infrastructure projects in London. The final sub-section considers the infrastructure funding gap of unfunded projects in the Mayor's Transport Strategy.

4.4.1 TfL projects

TfL is moving to a position where it will receive no central Government support. The 2015 Spending Review settlement was to end the grant for operational costs by 2017/18[86], although there would continue to be an investment grant. In the 2016 Budget the Chancellor announced, as part of the Government's devolution strategy, that it would no longer pay investment grant from April 2017. Instead, the GLA would receive an equivalent amount through retention of a larger proportion of income from London's business rates[87]. Business rates retention (BRR) is one of the funding streams for Crossrail, and the Northern Line Extension (NLE). Funding to TfL from central government has fallen by £1 billion a year from 2016/17, (Table 4.4), and is £3.3 billion lower than it was in 2010/11 in cash terms, (Figure 4.16).

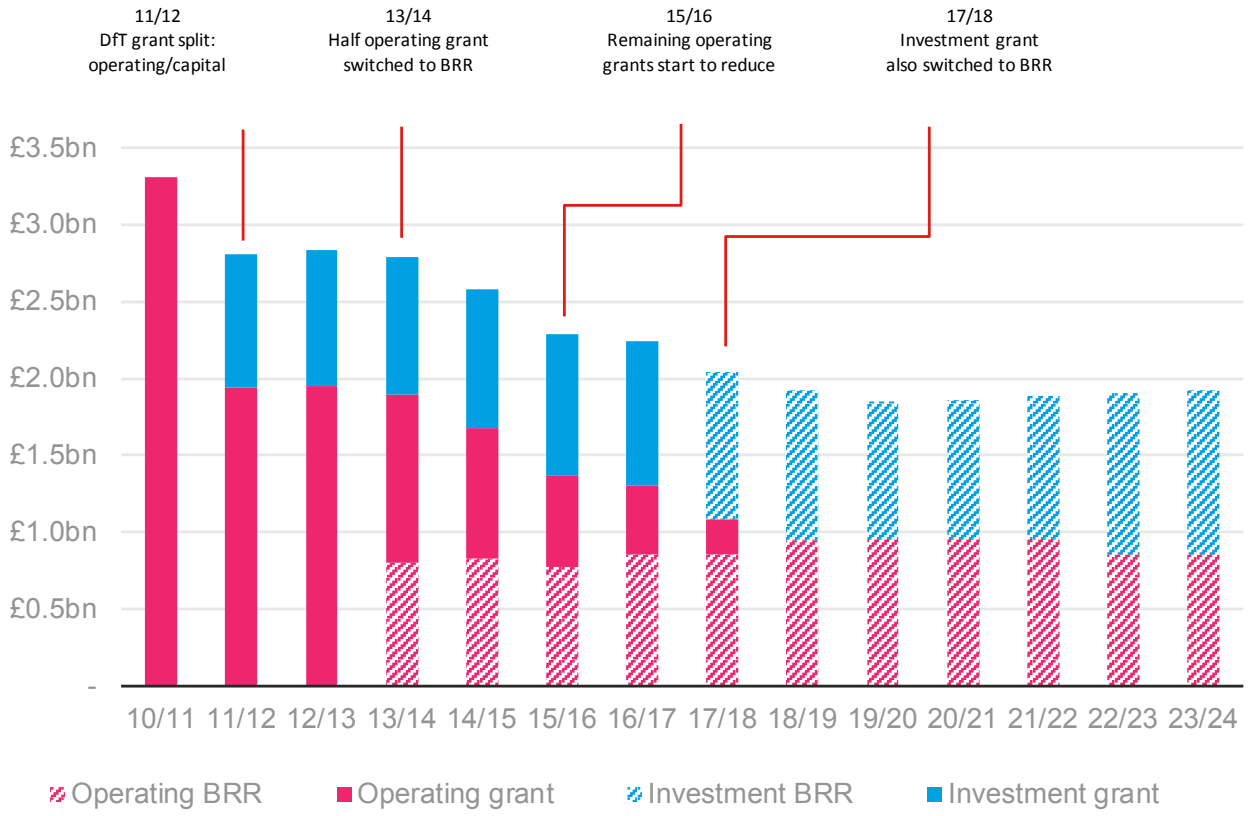
Table 4.4: HM Government funding intentions for TfL, Spending Review 2015, and Budget 2016, £m

	2016/17	2017/18	2018/19	2019/20	2020/21
Spending Review 2015					
Investment grant	944	960	976	993	1010
General grant	447	228	0	0	0
Budget 2016					
Investment grant		0	0	0	0
General grant		228	0	0	0

Source: DfT funding agreement letters to TfL of 2 March 2016 and 27 March 2017

[85] Travers, T (2009). Transport infrastructure in London, *Oxford Review of Economic Policy*, 25, 3, pg.451-468.
[86] Letter from the Secretary of State for Transport to the Mayor of London, 2 March 2016, see Funding letters - Transport for London
[87] Letter from the Secretary of State for Transport to the Mayor of London, 27 March 2017, see Funding letters - Transport for London. London Overground would continue to receive £27 million a year until 2019/20, and nothing thereafter

Figure 4.16: Change in TfL funding 2010/11 to 2023/24



Source: TfL
Note: Excludes one off or exceptional payments, such as funding for Crossrail, London Overground

The NLE will extend the Northern Line to Battersea, and is being funded by a tax incremental financing (TIF) deal between the GLA, TfL and the London boroughs of Wandsworth and Lambeth[88]. The TIF operates by the GLA taking a £1 billion loan to cover the cost of the NLE – with central government acting as the guarantor – which will be repaid back mostly through future growth in business rate income. As such, this required the creation of a new enterprise zone – the Nine Elms enterprise zone – whereby the incremental business rates generated will be retained to pay back the loan. Developer contributions such as Section 106 and the Community Infrastructure Levy will also be used to repay the loan. Consequently, the future beneficiaries of the NLE (i.e. the businesses and developers that choose to locate there) are in essence also 'paying' for the infrastructure instead of it coming from the public purse.

The Silvertown Tunnel, in East London that will link the Greenwich Peninsula and Silvertown, will be privately financed using a public private partnership (PPP) arrangement[89]. The private sector is responsible for paying for the construction and ongoing maintenance of the tunnel. In return, TfL will pay the private sector for using the tunnel over a 25-year period. TfL itself will make these payments by setting and collecting a toll charge. Therefore, it is envisioned that the future users of the tunnel will in effect 'pay' for it rather than the Exchequer.

TfL and London local authorities have been awarded grants by the Government's Housing Infrastructure Fund (HIF)[90]. This will unlock new homes by helping to fund much needed infrastructure such as roads,

[88] Transport for London (2013). Northern line extension – factsheet 1: funding and finance.
[89] Transport for London (2016). Silvertown tunnel: 4.2 funding statement, TR010021, April 2016.
[90] See Housing Infrastructure Fund - GOV.UK

community facilities and utilities in areas of greatest housing need. Funding is being provided from 2018/19 to 2023/24. TfL has been awarded four grants worth £778 million to:

- Increase the growth capacity of the DLR;
- Develop Old Oak North;
- Develop Meridian Water infrastructure;
- Increase the growth capacity of the East London line.

This is 29% of the £2.7 billion of awarded grants. London local authorities have been awarded another £71 million, although not all of this money may be for transport projects.

4.4.2 Crossrail

Crossrail is a new railway, including a 26 mile tunnelled section beneath central London, and will be known as the Elizabeth Line once in operation. New rail services will operate on the line between Abbey Wood and Shenfield to the East of London, and Heathrow and Reading in the West. Total cost in July 2019 was £17.8 billion[91].

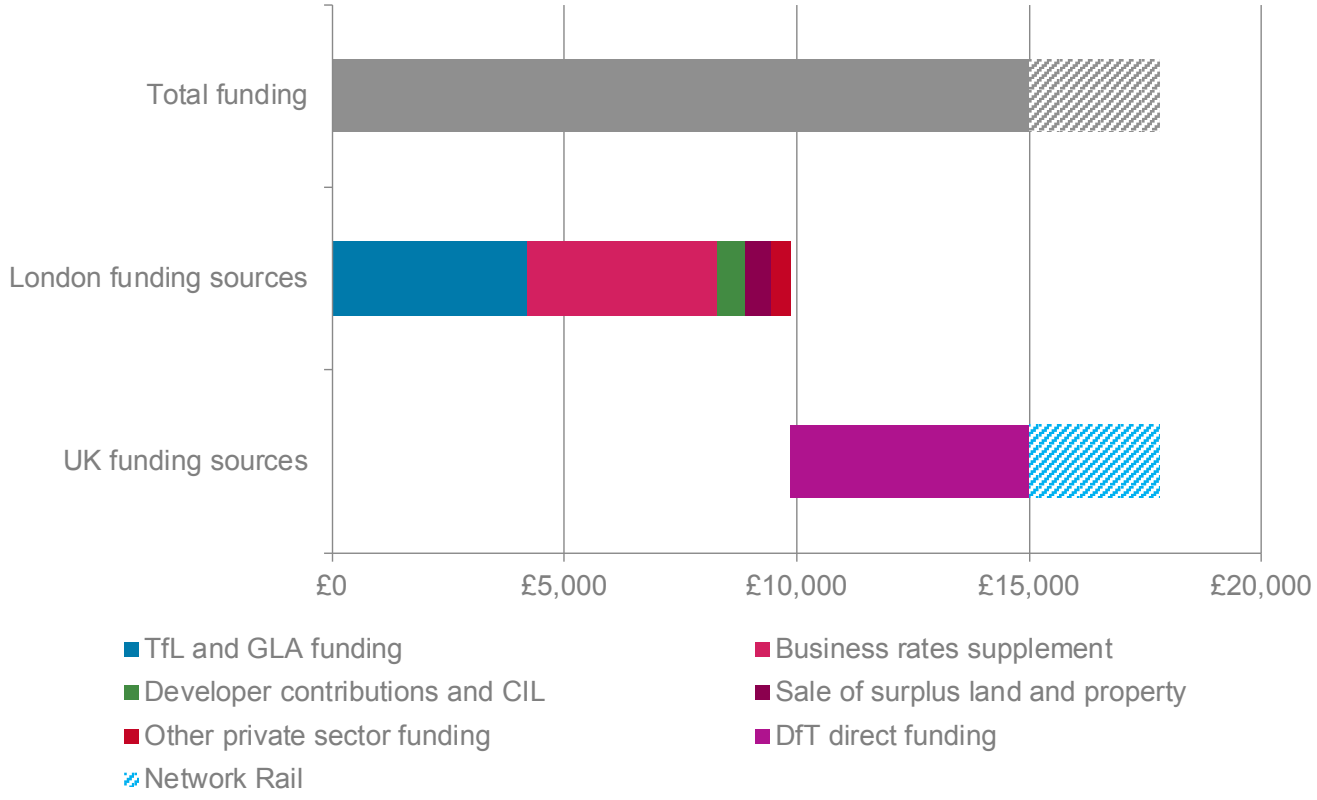
Chapter 3 discusses how rail developments can benefit individuals, companies, and land developers. Indeed 55% (£9.9 billion) of the cost of Crossrail will be funded by London funding sources, (Figure 4.17):

- TfL and GLA funding comes to 24% (£4.2 billion), which in turn will be met by fare income, a council tax precept on London local authorities, and income from London business rates;
- Business rates direct funding represent 23% (£4.1 billion) of the total;
- Another 3% (£0.60 billion) is property-related coming from developer contributions or the Community Infrastructure Levy;
- Sale of surplus land and property is 3% (£0.55 billion);
- Other private sector funding is 2% (£0.42 billion), and comprises:
    - £0.1 billion voluntary contribution from London businesses;
    - £0.25 billion City of London Corporation committed funding;
    - £0.07 billion from Heathrow Airport Limited.

As Crossrail extends beyond London not all the benefits will be captured by London residents and companies. Further, there will be tax flowbacks to the rest of the UK from the additional economic activity generated. Direct funding by DfT is 29% (£5.1 billion) of the total funding of Crossrail, while 16% (£2.8 billion) goes to Network Rail predominantly to undertake work on existing surface tracks.

[91] Source Funding - Crossrail. By November 2019 it was concluded the cost could reach £18.25 billion, although there was no decision on where the additional funding might be found, see Crossrail Delay: Line will not open until 2021 as costs increase - BBC News

Figure 4.17: Sources of Crossrail funding, £ million



Source: Crossrail
Note: TfL and GLA funding includes loans from DfT

4.4.3 Network Rail

In contrast to TfL, there continues to be government support to train services provided on Network Rail. There has been significant public investment in services to and through London both through the Thameslink Programme to re-develop Blackfriars, Farringdon, and London Bridge stations (a £5.5 billion infrastructure investment)[92], and the London Waterloo upgrade (an £800 million investment), which have both increased capacity significantly. This is to the benefit of Londoners and people who travel to London. Only a part of this investment is paid for by train users as 70% of Network Rail income comes from grants from the DfT, leaving 25% in track charges paid by train operating companies.[93] These companies also receive some subsidy from the Exchequer, although it is not possible to attribute this to regions as the franchises in England radiate from London in slices[94].

4.4.4 Infrastructure funding gap

The GLA commissioned consultants Arup in 2018 to model the level of investment needed in London's infrastructure over the London Plan period to 2041[95]. In the transport sector, the total required investment over the period was estimated to be approximately £445bn - £150bn in capital expenditure and £295bn in operating expenditure (in 2018 prices). This estimate includes: Transport for London's expenditure requirements to deliver the Mayor's Transport Strategy (including major projects like Crossrail 2)[96];

[92] See Update on the Thameslink Programme - National Audit Office (NAO) Report
[93] See How we're funded - Network Rail. The remaining 5% is from property income.
[94] See UK rail industry financial information 2017-18 | Office of Rail and Road
[95] See The London Plan | London City Hall
[96] There is an assumption that 50% of the funding for this project will come from central government.

investment by Network Rail and the Train Operating companies in the rail network; investment in high speed rail; and investment to maintain the road network. The consultants compared these costs with projected levels of funding to estimate a public sector funding gap of £32bn over the period[97].

The clear conclusion of this analysis was that current funding mechanisms are insufficient to pay for London's long-term transport infrastructure needs. Closing the gap (and delivering the level of investment in London infrastructure that the NIC recommended) will require a range of measures including better use of existing assets, deriving greater commercial income from the infrastructure asset base, and cost savings in future projects.

However, even with these efficiency measures, new funding mechanisms will need to be considered. The Mayor has argued that additional funding should be delivered through fiscal devolution to the capital as set out in the report of the London Finance Commission 'Devolution: a capital idea'[98].

4.5 Wider beneficiaries from transport projects

While there is a trend to the direct beneficiaries of transport provision and use paying for them there are also other beneficiaries. The higher income through higher productivity that transport projects in London enable flows back across the UK through tax receipts. Secondly, London and the rest of the UK grow together. The rest of the UK is London's most important trading partner, and imports to London from the rest of the UK make an important contribution to London's exports to the rest of the world.

4.5.1 The Exchequer

Chapter 3 noted that transport projects which heighten agglomeration economies can increase output and productivity, which raises taxes which can be dispersed across the country, and for a range of public services. This benefit is more likely to be realised in London than elsewhere because productivity levels in London are higher than elsewhere even though productivity growth in London is similar to the national trend.

The productivity level of London is markedly higher than that of England and Wales, with GVA per worker of £84,000 compared with £59,000 nationally. As there is within London there is a wide dispersion in productivity levels across areas. The productivity level of all of the CAs is below the national average, (Table 4.5). Productivity growth in London has been near the national average in the period since 2004, as indicated by the dotted line in Figure 4.18 – other evidence indicates that the rates of London and UK productivity growth have been similar in the period since 1971[99]. Productivity growth in London has been higher than for some CAs, and lower than for some others. While some CAs may be reducing the gap in productivity level with London it is happening slowly.

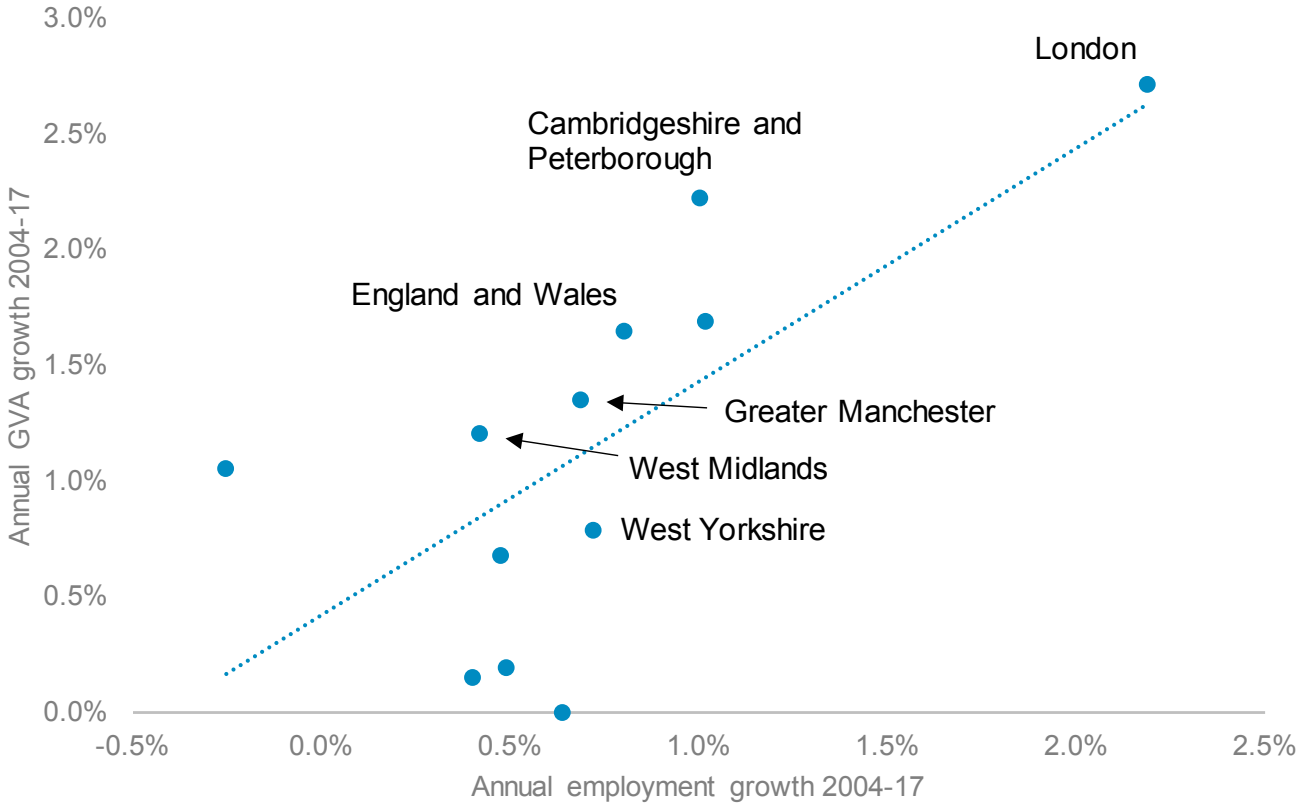
[97] See Funding London's infrastructure requirements | London City Hall
[98] See London Finance Commission | London City Hall
[99] See London labour market projections 2017 | London City Hall

Table 4.5: GVA per worker by devolved authority and for England and Wales, 2017

Devolved Authority	GVA per worker
London	£84,000
West of England	£55,000
Cambridgeshire and Peterborough	£54,000
West Midlands	£51,000
Greater Manchester	£51,000
Liverpool City Region	£50,000
Tees Valley	£48,000
West Yorkshire	£47,000
North of Tyne	£47,000
North East	£46,000
Sheffield City Region	£38,000
England and Wales	£59,000

Source: ONS, and GLA Economics calculations of GVA and workplace employment statistics [2018 GVA, 5 September]

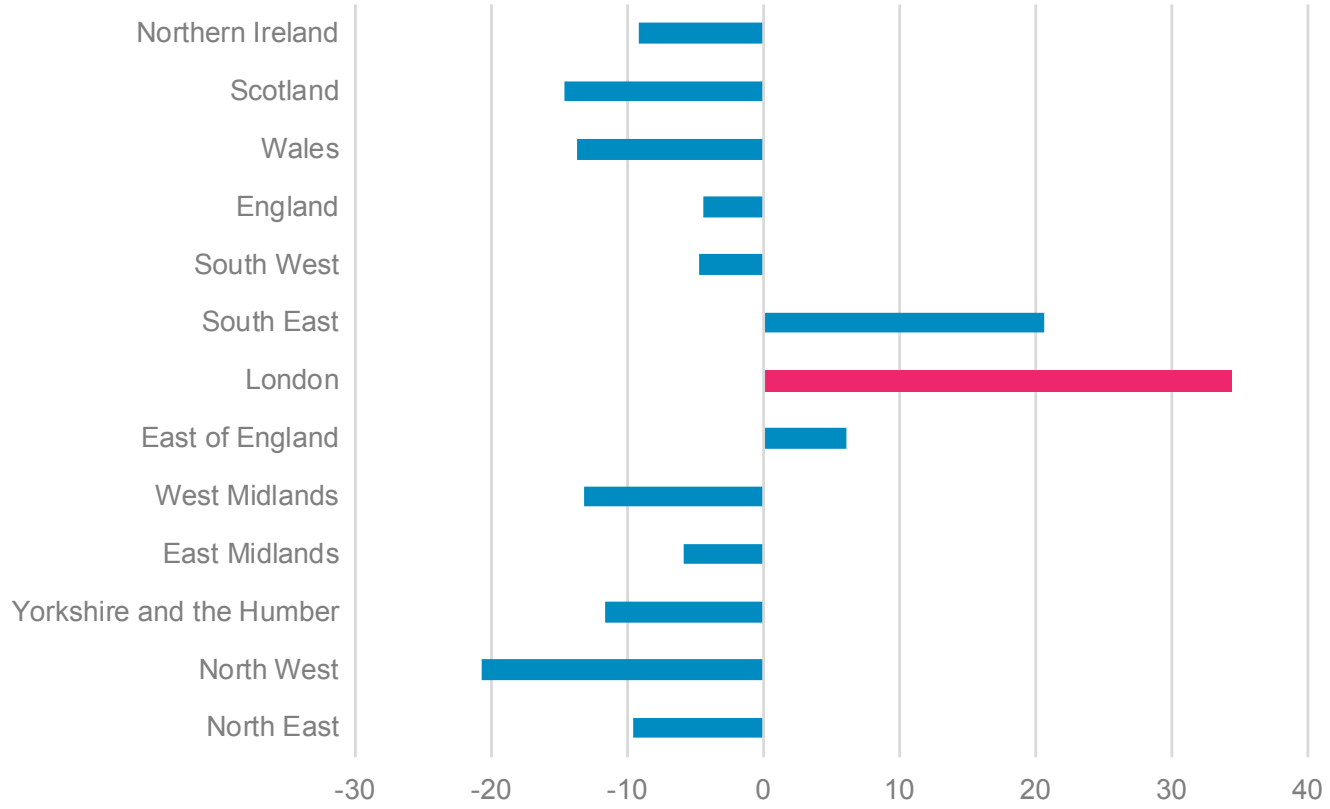
Figure 4.18: GVA growth and employment growth by devolved authority and for England and Wales, 2004-2017



Source: ONS, and GLA Economics calculations of GVA and workplace employment statistics [2018 GVA, 5 September]

It is perhaps not surprising that London makes the largest net contribution to public finances, after spending, of all regions at £35 billion. Only the other regions of the WSE also made a positive contribution, which came to £27 billion, Figure 4.19.

Figure 4.19: Regional net contribution to public finances, 2017/18



Source: ONS, Country and regional public sector finances
Note: North Sea oil and gas revenues included by population share

4.5.2 The rest of the UK

It is also the case that London, the WSE, and the UK grow together, (Figure 4.20). While London's economy has grown faster, the economic cycles of the areas have been in step. When London grows the other areas have also grown, and when London's economy has shrunk so has that of other areas.

Figure 4.20: GVA growth rates, UK, Wider South East, and the UK, 1998-2017, three year rolling averages

Source: ONS

Part of the reason for this is that the rest of the UK is London's most important trading partner. While the total value of London's exports is £284 billion, £158 billion are with the rest of the UK, and £126 billion is with the rest of the world. London also imports more from the rest of the UK at £160 billion than from the rest of the world at £66 billion. As a result, London is broadly in trade balance with the rest of the UK (a trade deficit of £2 billion) but runs a trade surplus with the rest of the world of £60 billion, (Table 4.6).

Table 4.6: Trade flows for London, the rest of the UK, and the UK, £bn, 2013

		London	Rest of the UK	UK
Rest of the UK	Exports	£158bn	£160bn	
	Imports	£160bn	£158bn	
	Net exports	-£2bn	£2bn	
Rest of the World	Exports	£126bn	£392bn	£518bn
	Imports	£66bn	£491bn	£557bn
	Net exports	£60bn	-£99bn	-£39bn
Total	Exports	£284bn	£552bn	
	Imports	£226bn	£649bn	
	Net exports	£58bn	-£97bn	

Source: GLA Economics calculations[100]

[100] See The London input-output tables | London City Hall

While the principal use of imports to London from the rest of the UK is for use within London. This is either for household or government consumption (£61 billion) or investment (£20 billion). (These figures include imports which have been used in the production of goods and services in London as well as imports used directly.) Over a quarter of imports (£44 billion) are for exports to the rest of the UK, and the remaining fifth (£34 billion) is for exports to the rest of the world, (Table 4.7).

Table 4.7: Use of imports to London, £bn, 2013

	household and government consumption	investment	exports to the rest of the UK	exports to the rest of the world	Total
imports from the rest of the UK	£61bn	£20bn	£44bn	£34bn	£160bn
imports from the rest of the world	£24bn	£7bn	£20bn	£15bn	£66bn
all imports	*£85bn*	*£28bn*	*£64bn*	*£49bn*	*£226bn*

Source: GLA Economics calculations[101]

4.6 Challenges in comparing levels of transport expenditure across regions

There is no single, or perfect, way to compare transport expenditure, or investment, across regions. This section brings together the analysis elsewhere in this paper to consider some of the choices and their implications. While London has received a larger share of public and private investment than other regions these choices can distort the differences and fail to recognise other factors such as need or demand.

Box 4.5: Analytical choices to compare transport expenditure across regions

IPPR North[102] has concluded that planned transport investment in London is 2.9 times higher per capita than in the North. This box sets out the dimensions of analytical choices, and how they have been applied to examine the regional distribution of transport expenditure:

- **Choice of regions** – London is an entirely urban area, whereas other UK regions include a mix of urban and rural areas. London is more reliant on public transport than other cities and relies on workers commuting from outside the city more than other large metropolitan areas. A more rational comparison would be to look at transport expenditure for the WSE, which is more 'balanced' in terms of land use. IPPR North considers London in isolation.
- **Choice of weighting factor** (to normalise for different sizes of region) – transport may be used for leisure or work. Weighting expenditure per capita may be a reasonable proxy for leisure use for some areas but does not take into account the large numbers of commuters, tourists and visitors in London. Nor does it reflect that transport infrastructure facilitates commuting, which, in turn, enables agglomeration economies which increases productivity and output. In this regard, GVA would be a more appropriate weighting factor. IPPR North uses transport expenditure per capita.
- **Definitions of funding** - total infrastructure investment in an area includes both public and private investment and provides an aggregate picture. It will include investment in airports, and ports, which tends not to be publicly funded[103]. Public sector investment looks at the allocation of public funds and provides some insight on public sector decision making. This is incomplete as it does not consider who pays in the end for projects. For London, and more so than for other regions, this is often Londoners and London businesses. The options for which London receives the highest share of national investment is total investment, and this is what IPPR North uses.

[101] See The London input-output tables | London City Hall
[102] See Transport investment in the Northern Powerhouse: 2019 update | IPPR
[103] See National Infrastructure and Construction Pipeline 2018 - GOV.UK

- **Infrastructure pipelines** – the NICP[104] includes announced government projects or spending commitments. It does not necessarily mean that all the named projects will go ahead, and there may be other unidentified projects that do go ahead. The 2018 pipeline attributes £127 million for the development of Crossrail 2, but does not include the Northern Powerhouse rail or phase 2 of HS2 in the North of England. By intention it does not include the projects identified in the NIA which advocates projects across the country recognising the claims of both London and the North of England. Inevitably, there is a degree of uncertainty in terms of individual projects and their costs around any pipeline.
- **HS2 cost apportionment** – In the 2018 NICP there is a cost approach apportioning spending to the full length of the route included in each region, and there is a published regional breakdown to 2020/21. By contrast IPPR North uses the 2017 NICP which allocates expenditure to regions in proportion of expected transport user benefits (in part because this includes full project costs)[105]. While there may be a rationale for this, IPPR North themselves note that it is not consistent with the methodology adopted for other investments in the NICP. The likely consequence is that it allocates a higher proportion of expenditure to London.
- **Contributions to national income** – London makes a net contribution to public finances, which is then distributed to other regions. Investment in transport infrastructure supports higher output and productivity, from which higher taxes accrue. The UK benefits from these investments, and not just London. IPPR North does not take this into account.

The IPPR North choices systematically overstate London's share of national public transport investment.

There are also reasons to be wary about producing time series of transport expenditure data from HMT PESA, (see Box 4.1), as IPPR North does.

[104] See National Infrastructure and Construction Pipeline 2018 - GOV.UK
[105] These are modelled for the HS2 network by HS2 Ltd - see Appendix 5 of HS2 Phase Two economic case advice for the Department for Transport - GOV.UK

Appendix A Geographies and travel patterns

A.1 Overview

The demand for transport provision depends on where people live, and where they go. This appendix compares London to other regions and devolved authorities in terms of various administrative and statistical geographies to assess latent demand.

A.2 Geographical classification of areas

A.2.1 Administrative geographies

The analysis of this paper compares London with the other regions in England and Wales, and with the CAs. While there has been a steady process of devolution over the last ten years which has taken a number of forms[106], in terms of function, CAs are the devolved authorities that bear most similarity to London. They bring together local authorities to support economic development in the wider area for some of the most populated areas of the country[107]. Map A.1 shows where the 11 CAs are across the regions of England and Wales.

[106] See, for example, the House of Commons briefing papers Devolution to local government in England and Local growth deals
[107] For more information see the House of Commons briefing paper Combined Authorities

Map A.1: Spatial geography of London, the other regions in England and Wales, and the Combined Authorities

Source: GLA

A.2.2 Statistical geographies

Travel patterns do not always naturally fit with administrative geographies, and so this analysis makes use of other geographies. The ONS has developed three geographies based on residence and commuting patterns:

- Output Areas (OAs);
- Built-Up Areas (BUAs);
- Travel-to-Work-Areas (TTWAs).

The first two are classifications of residence, and the latter of commuting patterns.

The OECD has also produced a classification of Functional Urban Areas (FUAs)[108], which seeks to capture both areas of residence, and commuting patterns. This provides a sense check of the other definitions, which tend to be based on one of the criteria.

The Output Area Classification of residence uses 2011 Census data to summarise the varying characteristics of the population and built areas into similar groupings at the highest level of granularity[109]. OAs are of varying size, and each has a marker whether or not it is an urban area[110]. OAs are part of a nested series of geographies for the UK[111] up to local authorities, CAs, and regions. Table A.1 enumerates the numbers of areas by geography for London, and England and Wales.

Table A.1: Numbers of areas for nested classification from OAs to regions, for London and England and Wales

	London	England and Wales
Output Areas	25,053	181,408
Lower Super Output Areas	4,835	34,753
Middle Super Output Areas	983	7,201
Local Authorities	33	292
Combined Authorities	1	10
Regions	1	10

Source: Office for National Statistics

This classification is consistent with the administrative boundaries for London and the CAs as they are combinations of local authorities.

Almost all of the OAs in London are in urban areas, while the proportion of urban OAs in the next highest region, the North West, is 89%. Only the West Midlands, Yorkshire and the Humber, and the North East also have a proportion of urban OAs that is higher than the average for England and Wales of 81%, (Figure A.1 and Map A.2). The WSE, combining London, the East and the South East of England, is more balanced in its land use, and provides a more like-for-like comparison with other regions in terms of urban development. It is also the case that urban OAs tend to be smaller in area, and so for regions other than

[108] The definition has three steps. First, an urban core of 1km2, and at least 1,500 inhabitants per km2. Second, two urban cores are considered integrated if more than 15% of the residence population of any of the cores commutes to work in the other core. The third step is to identify the worker catchment area, which is all municipalities with at least 15% of their employed residents working in a certain urban core. See, OECD Definition of Functional Urban Areas. The areas have been updated in 2019, and this is what has been used in this analysis, see Functional urban areas by country - OECD

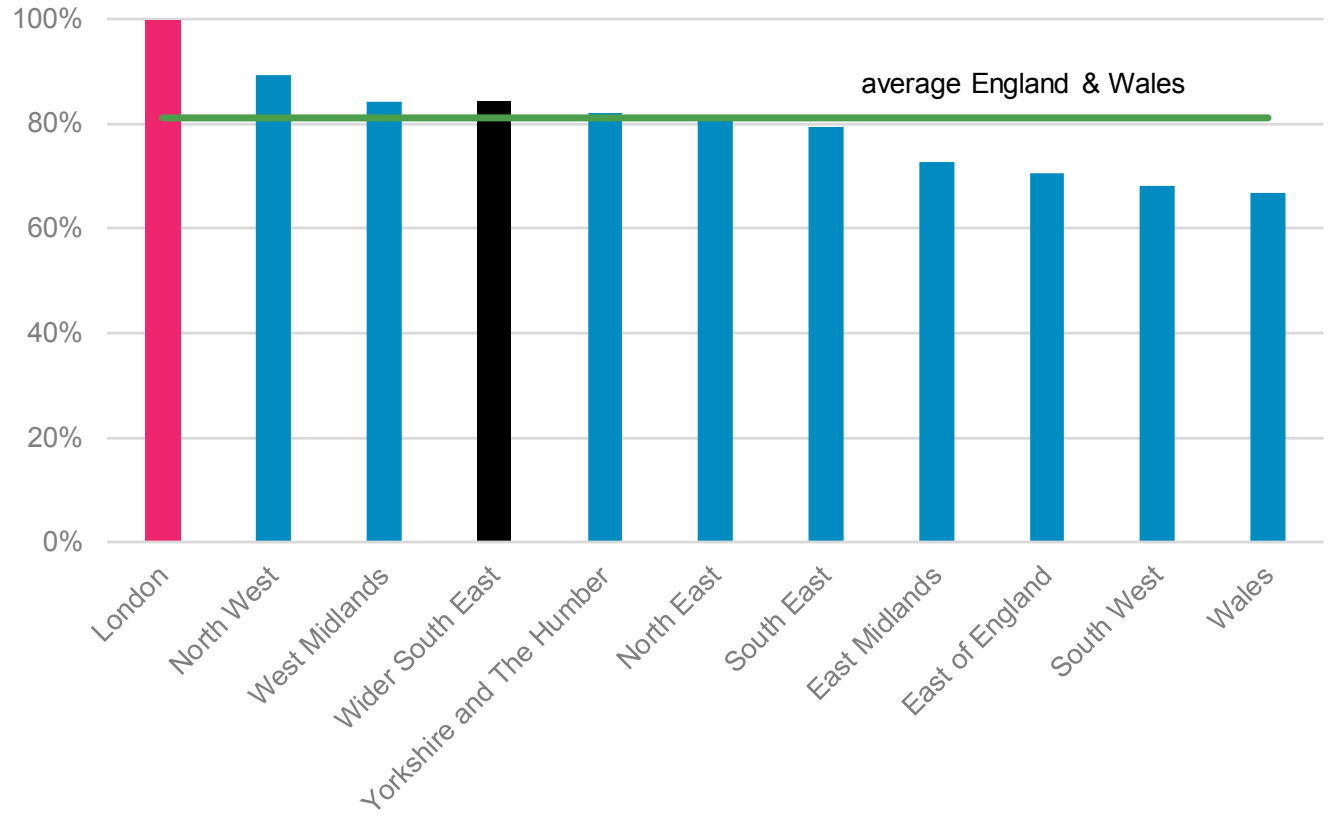
[109] See Creating the 2011 area classification for output areas (2011 OAC), Gale et al (2016), Journal of Spatial Information Science, number 12, pp1-27

[110] The full classification includes various types of urban and rural areas

[111] The text uses the language for England and Wales

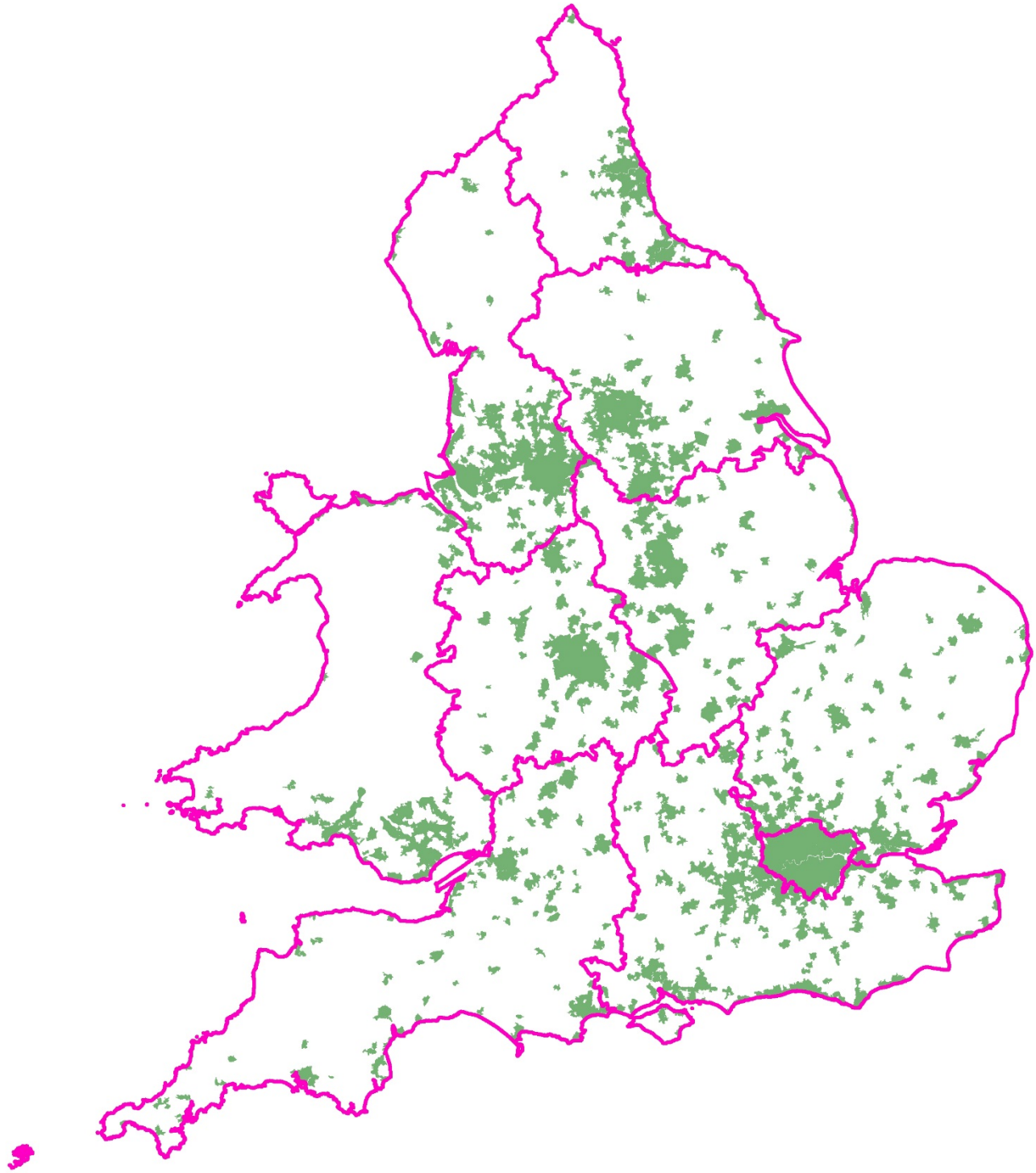
London the proportion of their overall land mass which is classified as urban is lower than the proportion of urban OAs as is clear from the map.

Figure A.1: Proportion of OAs in regions in England and Wales which are urban areas



Source: GLA Economics calculations of ONS data

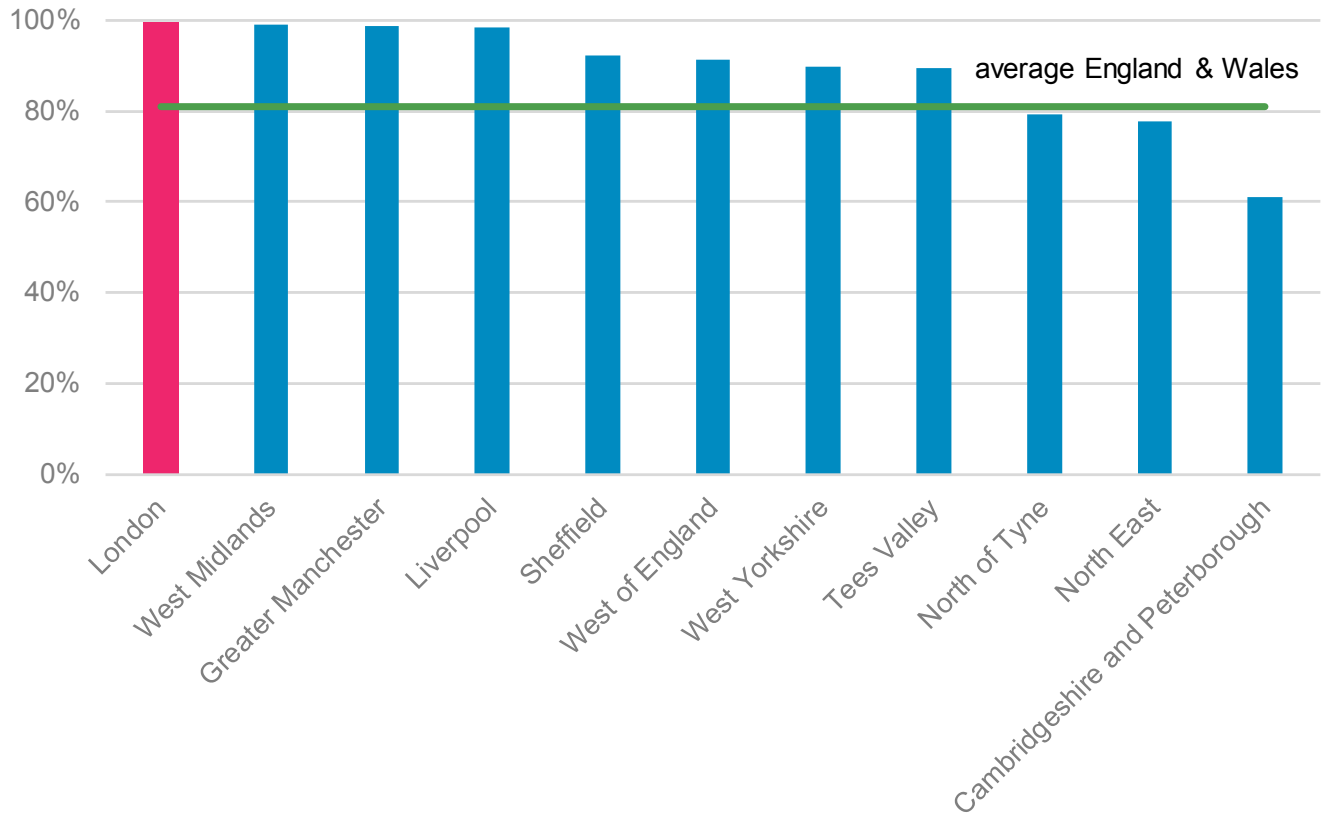
Map A.2: Distribution of urban areas across regions in England and Wales



Source: GLA Economics calculations of ONS data

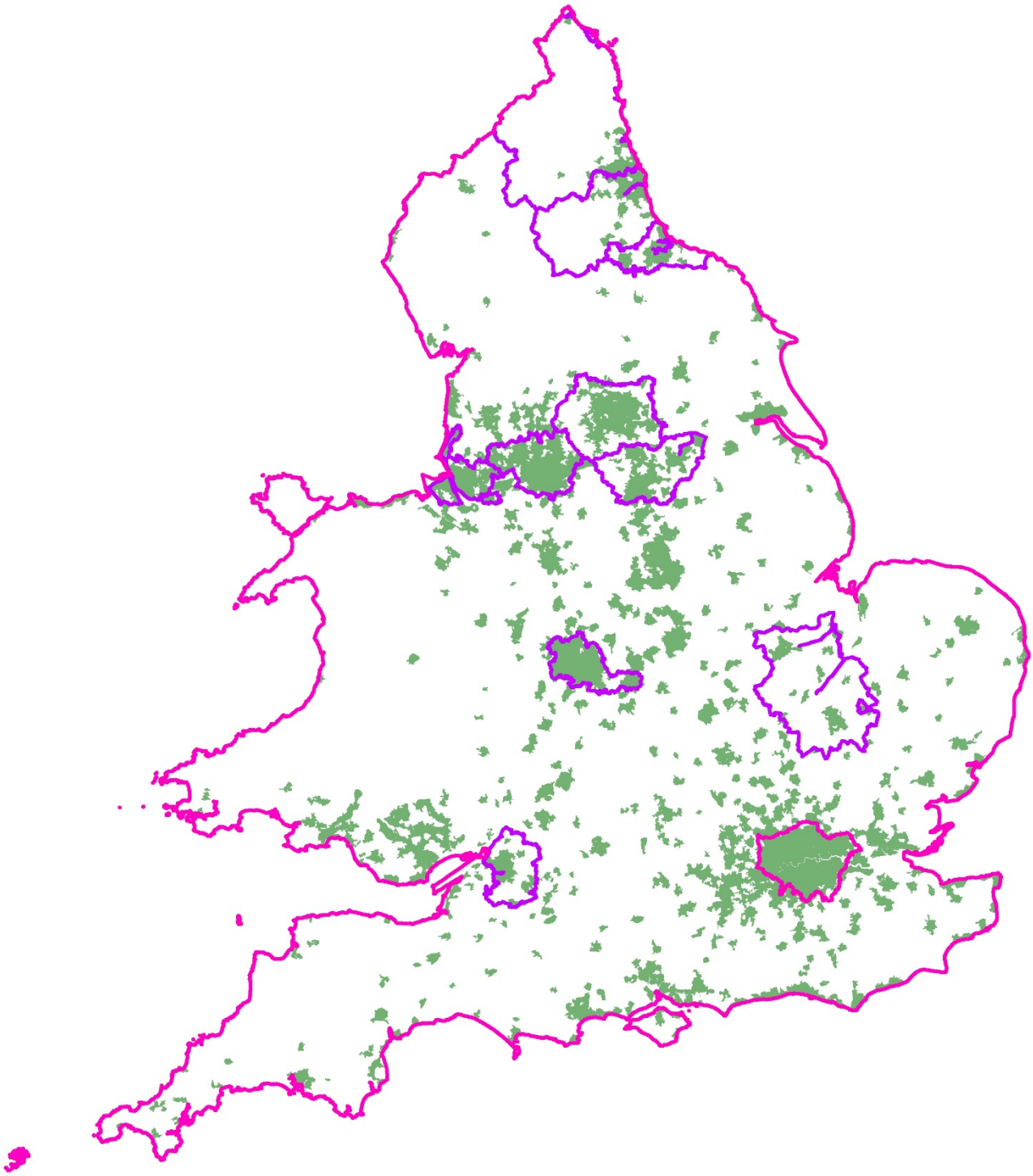
Some CAs are similar to London in terms of prevalence of urban OAs within their boundaries. Nearly all of the West Midlands, Greater Manchester, and Liverpool are made of urban OAs. While only Cambridgeshire and Peterborough has a proportion of urban OAs which is markedly below the England and Wales average, (Figure A.2 and Map A.3). Again, for devolved authorities other than London the overall proportion of their land mass which is classified as urban is lower than the proportion of OAs.

Figure A.2: Proportion of OAs in London and the Combined Authorities in England and Wales which are urban areas



Source: GLA Economics calculations of ONS data

Map A.3: Distribution of urban areas across London and the Combined Authorities in England and Wales

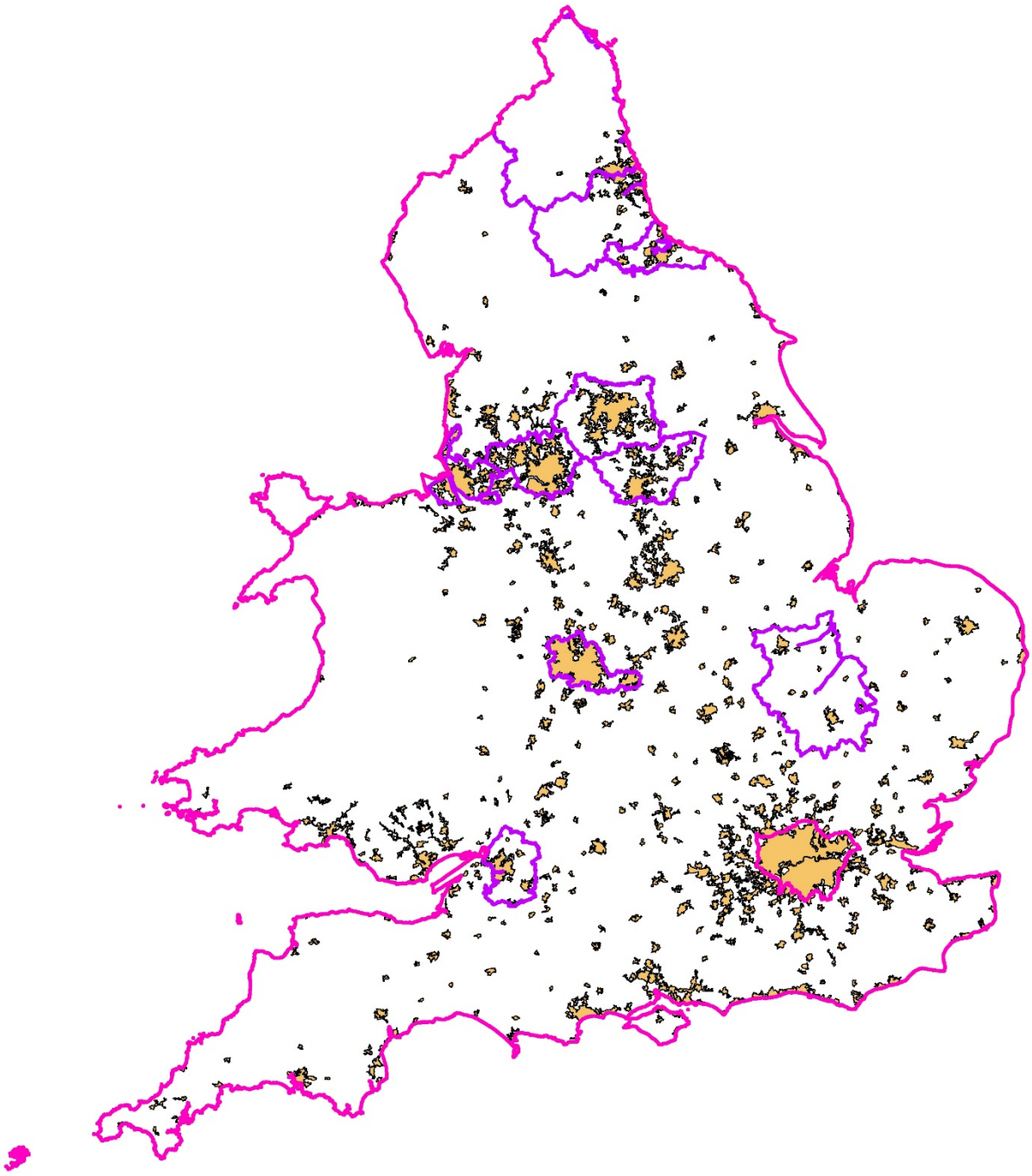


Source: GLA Economics calculations of ONS data

The ONS has developed BUAs as a way of defining urban areas, by aggregating OAs, and using the urban-rural classification for each OA. A BUA is land with a minimum area of 200,000 square metres, while

settlements within 200 metres of each other are linked and included within the same BUA[112]. There are 5,493 BUAs in England and Wales with some residents[113], the lowest being 100, (Map A.4). While several CAs are almost entirely urban only London is fully built up.

Map A.4: Built Up Areas and Combined Authorities in England and Wales, 2011

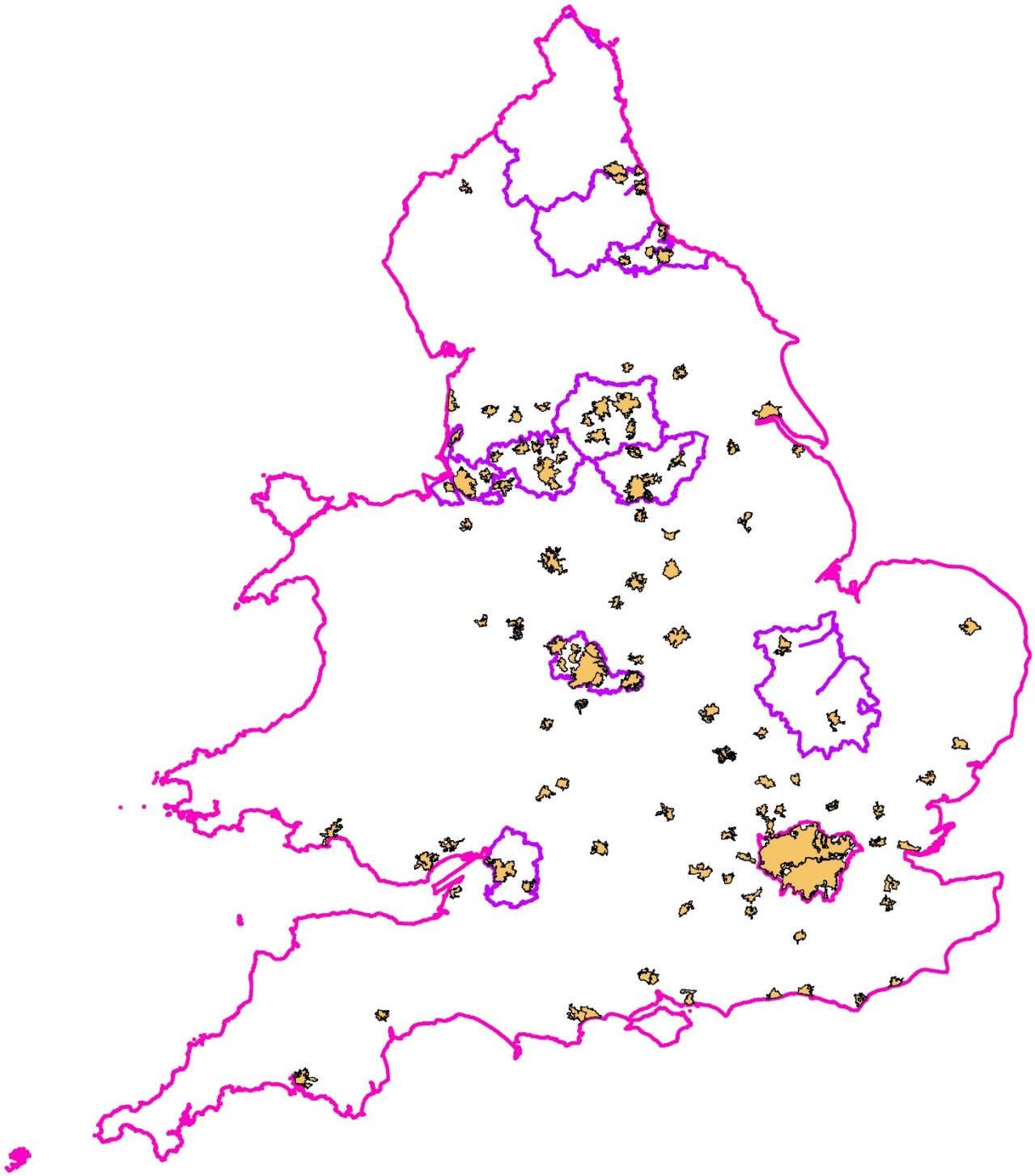


Source: GLA Economics calculations of ONS Census data

[112] See 2011 Built-Up Areas - Methodology and Guidance for an explanation of how they have been derived
[113] See Census geography - Office for National Statistics. There is another 337 BUAs where population has not been allocated. In most cases the area has commercial use, such as for an industrial estate, airport, or theme park, and does not have any residential buildings.

The ONS has reduced BUAs to 112 Major Towns and Cities in England and Wales. These are those BUAs with a threshold of at least 75,000 usual residents or workday population[114]. Most CAs have a number of towns or cities, but it is only the area of London which in its entirety is a city, (Map A.5).

Map A.5: Major Towns and Cities and Combined Authorities in England and Wales, 2011



Source: GLA Economics calculations of ONS Census data

[114] See Major Towns and Cities - Methodological Note and User Guidance

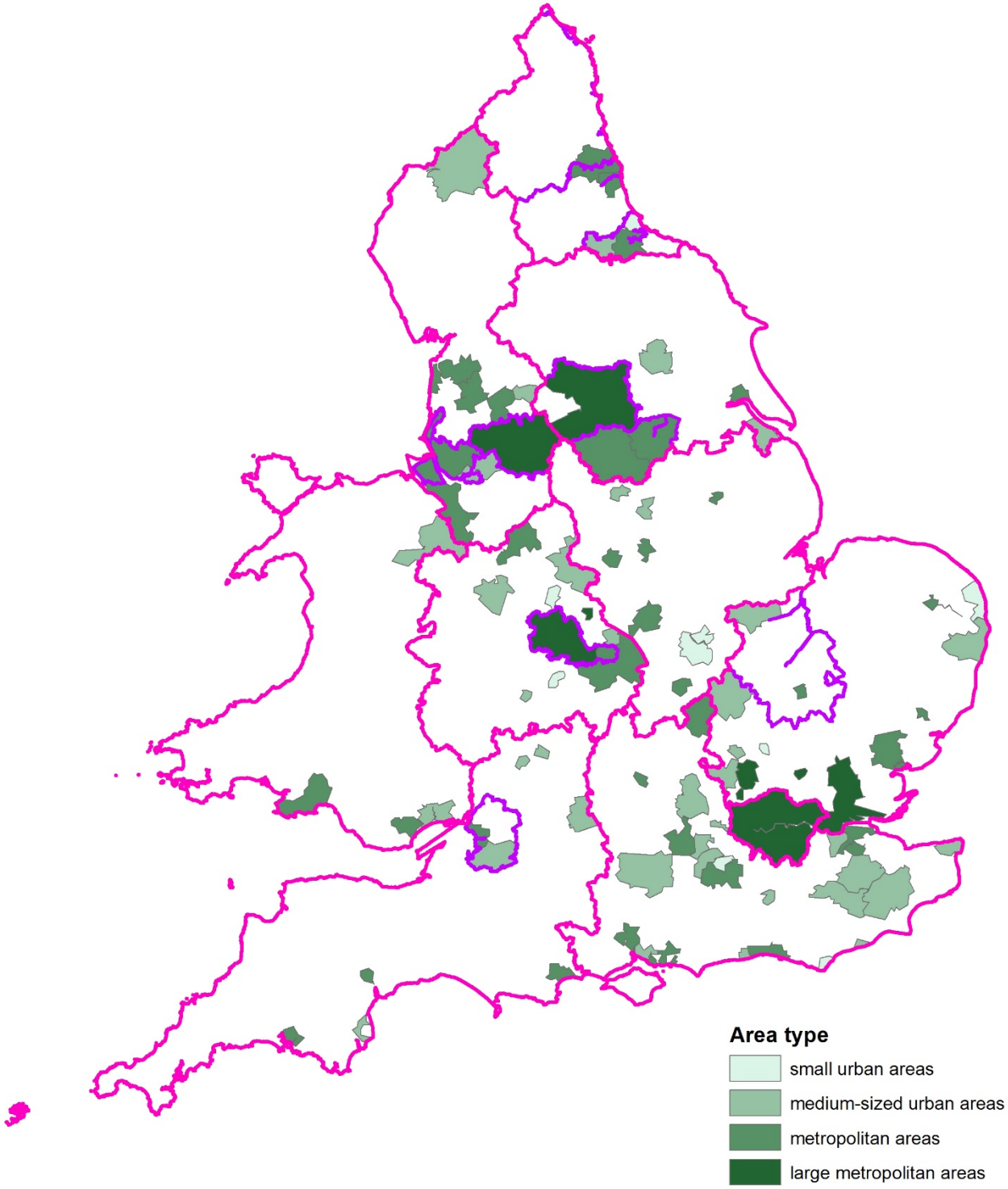
The OECD uses its classification of FUAs to categorise them by size, (Map A.6):

- Large metropolitan areas have a population of 1.5 million or more;
- Metropolitan areas have a population between 500,000 and 1.5 million;
- Medium-sized urban areas have a population between 200,000 and 500,000;
- Small urban areas have a population below 200,000.

There are four large metropolitan areas in England and Wales:

- London, which extends beyond its administrative boundary;
- Manchester, which maps onto its administrative boundary;
- West Midlands, which has a second urban area within its administrative boundary;
- West Yorkshire, for which the FUA is within the administrative boundary.

Map A.6: Distribution of Functional Urban Areas across London and the Combined Authorities in England and Wales



Source: OECD data

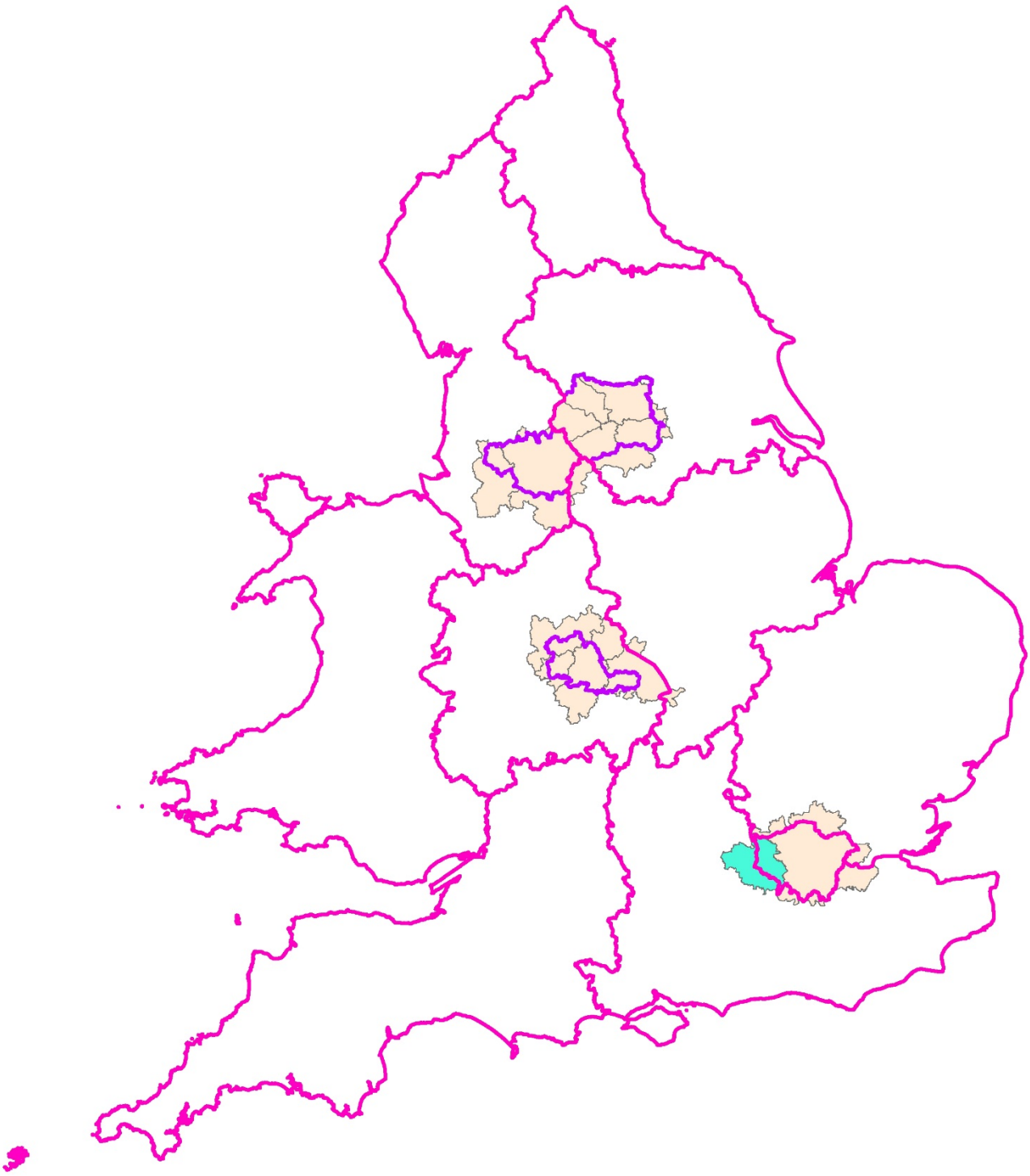
As a way of capturing commuter patterns, the ONS has developed TTWAs as a way of defining commuter areas, which in concept are self-contained labour markets where people both live and work[115]. The 2011 classification comes from Census data, and the criteria are that at least 75% of the area's workforce work in the area, and at least 75% of the people who work in the area also live in the area. In England there are 149, and in Wales 18[116]. Each of these TTWAs is a combination of LSOAs.

As with some FUAs, and Major Towns and Cities, there is more than one TTWA for each of the large metropolitan areas, (Map A.7). For London, the London TTWA has an employment centre in the Central Activities Zone (CAZ), and its second TTWA has a centre of Heathrow airport. Unlike with the FUAs of large metropolitan areas (other than London) the TTWAs spread beyond administrative boundaries.

[115] See Travel to work area analysis in Great Britain - Office for National Statistics

[116] For some TTWAs self-containment rates are as low as 66.7% as a part of a trade-off between workforce size and level of self-containment.

Map A.7: Distribution of Travel to Work Areas across large metropolitan areas in England and Wales



Source: GLA Economics calculations of ONS data

A.3 Conclusion

This appendix has compared London and other areas in terms of administrative and statistical geographies. London is distinguished from other regions in that it is the only region which is almost entirely urban. The WSE is more balanced in its land use, and so provides a more like-for-like comparison with other regions in terms of urban development. The CAs of the West Midlands, Greater Manchester, and Liverpool are as built up as London, but it is only London which in its entirety is a city.

Appendix B Further analysis of National Infrastructure Commission connectivity dataset

This appendix provides more detail on the formulas behind the connectivity measures explained in Box 2.2, and some results for the attractiveness measure. Chapter 2 provides the corresponding results for the accessibility measure.

Definitions of these measures are[117]:

- Accessibility provides an assessment of ease of travel movements – this compares observed travel times to a city centre with crow-fly travel times
- Attractiveness rates the appeal of journey to a city centre relative to other city centres nearby – this compares observed travel times to a city centre relative to those for other city centres nearby

B.1 Formulas behind connectivity calculations

Connectivity is calculated using the average of travel times between each point in the place and its centre, weighted by demand (population or employment) in each point. The measure is calibrated so that places that are further away from the centre are given less weight, to reflect the impact of travel time/distance on willingness to travel. Centres are defined as the OAs with the highest employment density in each place. In almost all BUAs the centre is defined as a single OA, or a set of adjacent areas. For London, there are two distinct centres: the West End and the City of London.

Average travel time is calculated in a way similar to running millions of journey planner queries.

Accessibility and attractiveness measures can be calculated for each city centre i and place j. It can be done for each of employment or population, public transport or car travel, and for intra-urban or inter-urban travel. There are separate measures for each mode of travel. These measures are normalised to allow comparisons across cities. On the basis of the raw measures London has the highest values simply because of its size.

The accessibility measure is:

$$U_i = \sum_j \omega_j \, \mathrm{x} \exp(-\beta \, \mathrm{x} \, t_{ij})$$

β is set to the weighted average journey travel time across all transport modes and city centre to place combinations. This is 50km/hr.

ω is demand for which the proxy measure would be employment or population.

The equation can be normalised by the as-the-crow-flies equivalent metric:

$$\acute{\mathrm{U}}_i = \sum_j \omega_j \, \mathrm{x} \exp(-\beta \, \mathrm{x} \, d_{ij})$$

[117] These are not the only ways to consider connectivity, but they are the concepts for which there is associated published data for London and the rest of Great Britain at Prospective: Transport connectivity report - National Infrastructure Commission

d is the as-the-crow-flies distance between i and j.

The normalised accessibility indicator W_i represents the effectiveness of the chosen transport mode in facilitating access to city centre i:

$$W_i = U_i/\acute{U}_i$$

The attractiveness measure is:

$$X_i = \sum_j \omega_j \text{ x } \frac{\omega_i \text{ x } \exp(-\beta \text{ x } t_{ij})}{\sum_i \omega_i \text{ x } \exp(-\beta \text{ x } t_{ij})}$$

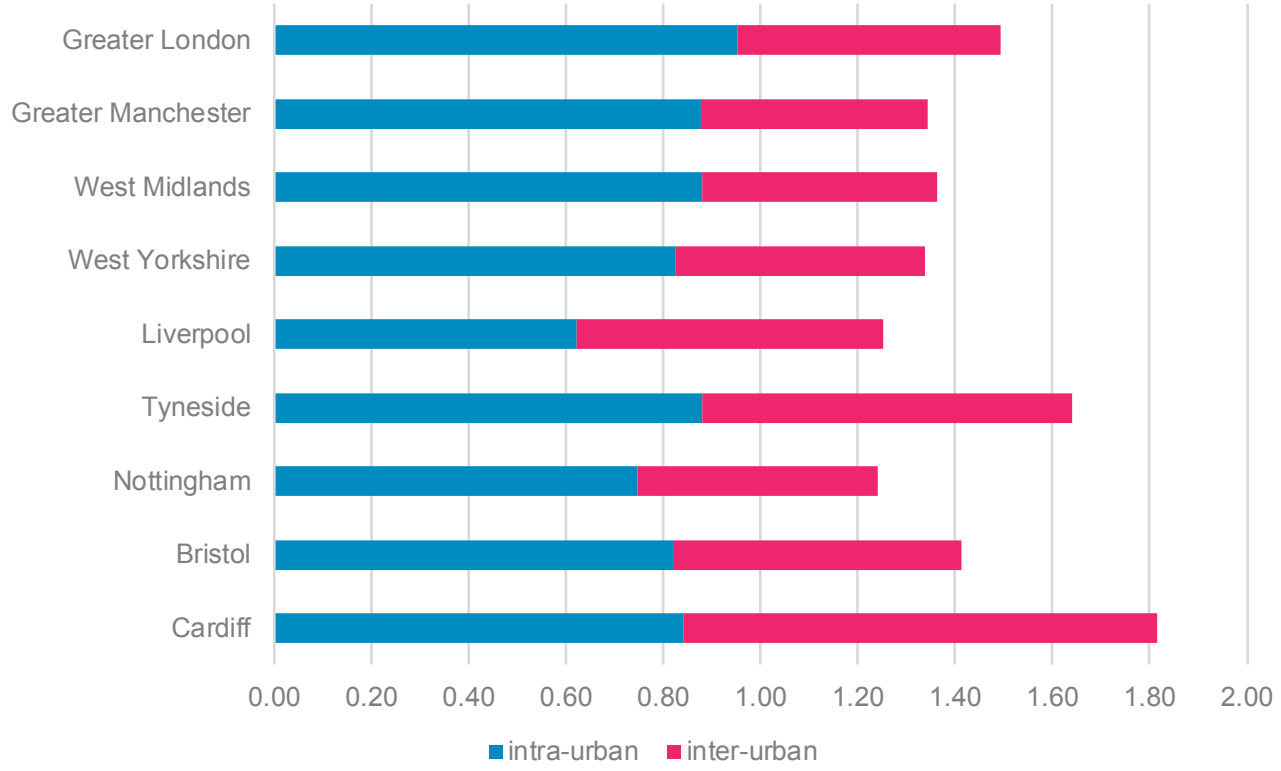
This measure is weighted by employment or population depending on the form of analysis. Employment is a proxy for intermediate demand in production, and population is a proxy for final demand.

In consequence, because of the weighting procedure, attractiveness measures for intra and inter-urban transport are additive, while this is not the case for the corresponding accessibility measures.

B.2 Results for the attractiveness measure

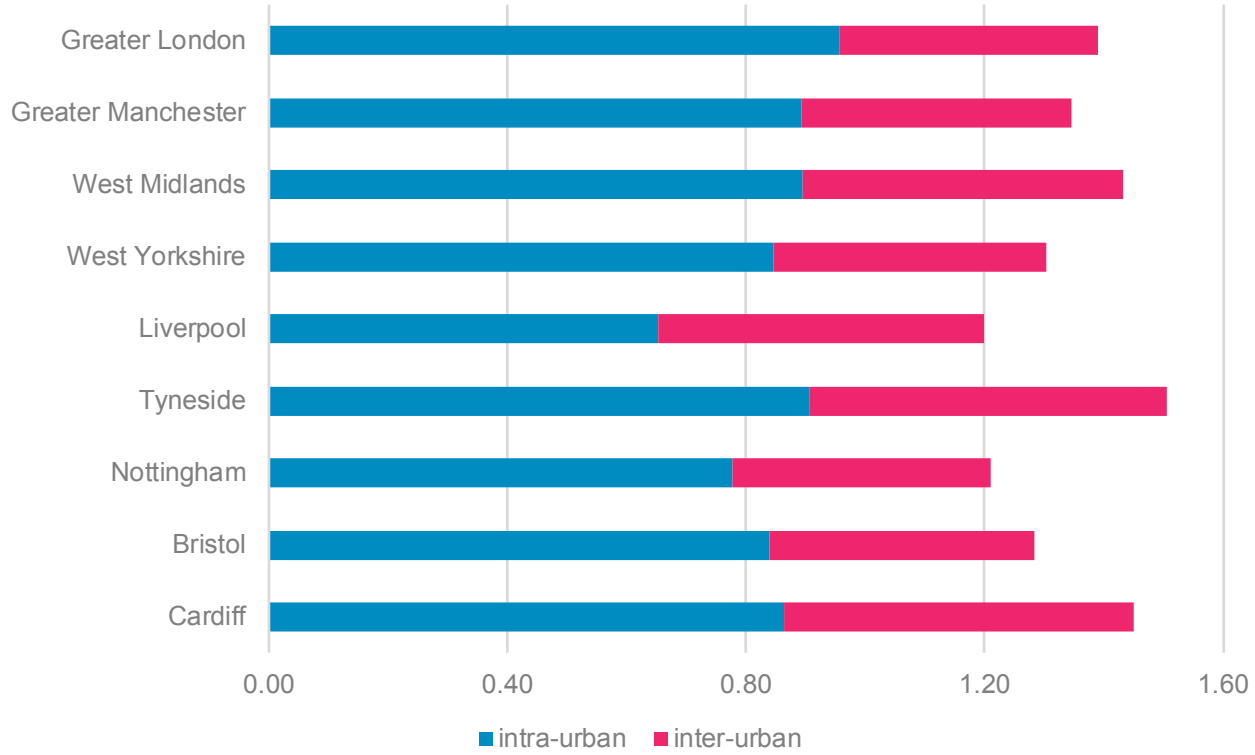
Intra-urban normalised population and employment attractiveness of London by public transport is comparable across Core Cities, Figures B.1 and B.2. There have been improvements in absolute employment and population attractiveness of all Core Cities by public transport between 2011 and 2016, Figure B.3.

Figure B.1: Normalised population attractiveness to Core Cities by public transport, 2016



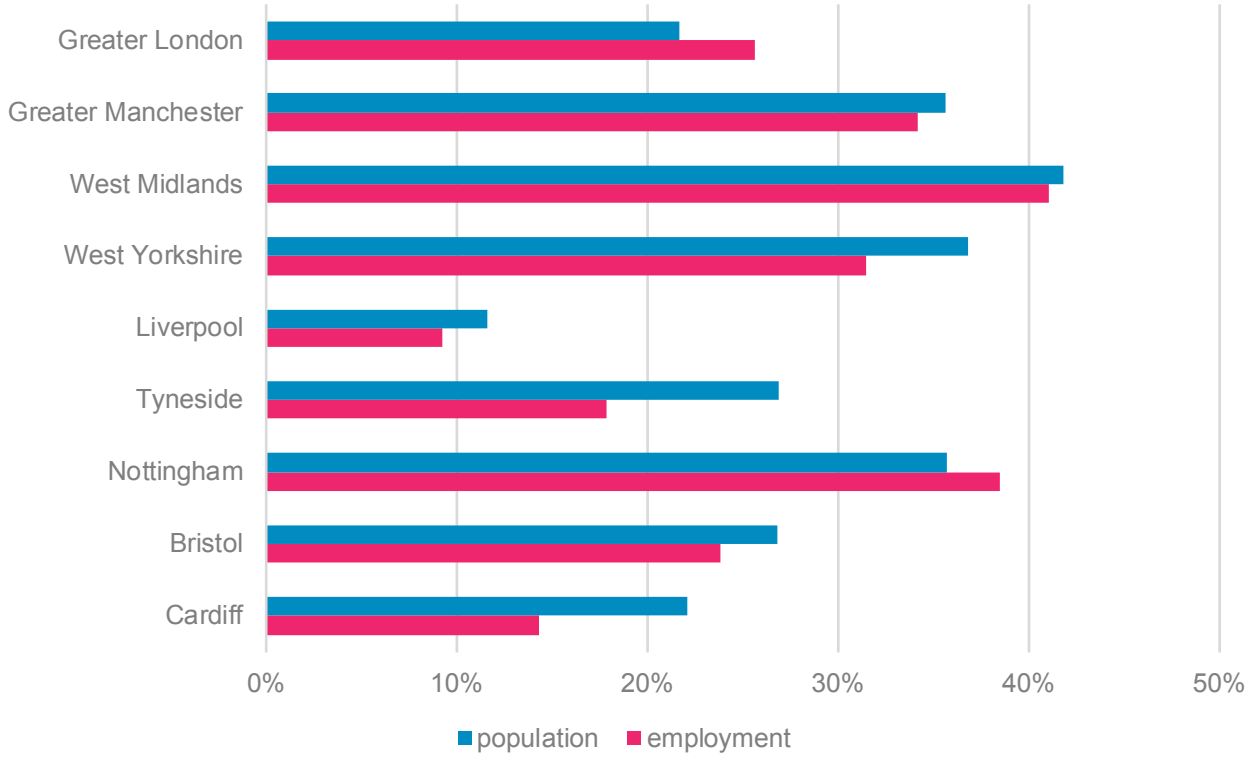
Source: GLA Economics calculations of NIC connectivity dataset

Figure B.2: Normalised employment attractiveness to Core Cities by public transport, 2016



Source: GLA Economics calculations of NIC connectivity dataset

Figure B.3: Change in absolute population and employment attractiveness to Core Cities by public transport between 2011 and 2016



Source: GLA Economics calculations of NIC connectivity dataset

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