2 The spatial characteristics of London

2.1 Main Findings

- A number of different geographies can be used to examine London depending on what issue is of interest such as London's administrative geography, its Functional Urban area, its connected built up area etc.

- Agglomeration has led to a large clustering of economic activity in London, particularly in the area of the Central Activities Zone and the northern part of the Isle of Dogs.

- It is calculated that the output of the Central Activities Zone, northern part of the Isle of Dogs and a 1km fringe around them stood at just over £179 billion in 2012, accounting for nearly 55 per cent of London's output and just over 12 per cent of UK output.

- Significant concentrations of employment can also be seen in central London which has grown over time, but with other areas such as Heathrow also being important areas of employment in London.

- London represents a significant share of employment in the Greater South East and is a destination of employment for a large number of commuters.

- Distinct clustering of sectors by employment was also discovered in London with the Central Activities Zone being important for most but with other areas such as Hillingdon around Heathrow showing clustering in Accommodation and food service activities employment.

- London has seen a large growth in public transport usage but this has led to challenges such as overcrowding at a number of heavily used rail stations. Further, London dominates rail travel in Great Britain with it being found that in 2012/13, 62 per cent of all rail journeys in Great Britain started or finished in London.

- There is a risk that the high demand for residential land may crowd out commercial uses of land. The emerging evidence suggests that this is starting to have a negative impact on the supply of office floorspace.

- The supply of housing has not kept up with demand, in part, driven by London's strong population growth over the past 15 to 20 years. There have been strong rises in London house prices which are far higher than the rest of the country.

- In the centre of London, population density is quite low relative to other major cities around the world, despite it being smaller in terms of its geographical size.

2.2 Introduction

Urbanisation and the trade of goods and services often go hand in hand. Cities benefit from agglomeration economies, external benefits that arise when economic activity takes place in a concentrated space. The spatial nature of London's economy is the product of more than a century of trade and agglomeration at work. Central London is, and will likely remain, the most significant employment centre in the Greater South East region, with over two million jobs in the Central Activities Zone, Northern Isle of Dogs and their fringes alone. London's specialised, globally competitive activities tend to locate here, and in fact some locate almost exclusively in Central London because they benefit so greatly from agglomeration economies. Meanwhile, those in London's outer boroughs provide a support function to other businesses in the region as part of a complex network of businesses, while also fulfilling the needs of London's many residents. This chapter considers aspects of the spatial nature of London's economy, including its relationship with surrounding regions.

2.3 London: its evolution and relationship to its neighbours

This section examines the evolution of London up to the 20th century, to give a background to its changing geography. It then looks at different definitions of London itself such as the boundaries of Greater London, travel to work areas etc. and shows that more than the official administrative boundaries of Greater London may be necessary when thinking about the geography of the capital.

London has long had a large and often growing population as shown by Table 2.1 and has meant that setting a geographic definition of London has always been more difficult than it may first appear. Thus in bygone times would London be defined as just the City of London or should it also include neighbouring populations in Southwark and Westminster? Where the exact boundary of London lies remains a question to this day. In order to best understand the capital, different definitions of where London starts and ends can be appropriate, so that they best reflect the issue that is being considered.

Table 2.1: World's largest cities, 1500-1900 (inhabitants, millions)

	1500		1600		1800		1900		2010	
1	Beijing	0.7	Beijing	0.7	Beijing	1.1	**London**	**6.5**	Shanghai	13.3
2	Istanbul	0.7	Istanbul	0.6	**London**	**1.1**	New York	4.2	Mumbai	12.6
3	Vijayanagar (India)	0.5	Agra	0.5	Guangzhou	0.8	Paris	3.3	Buenos Aires	11.9
4	Cairo	0.4	Osaka	0.4	Tokyo	0.7	Berlin	2.7	Moscow	11.3
5	Tabriz (Iran)	0.3	Kyoto	0.3	Istanbul	0.6	Chicago	1.7	Karachi	10.9
	London	**0.1**	**London**	**0.2**					**London**	**8.1**

Source: Tertius Chandler, (1987), Four Thousands Years of Urban Growth via London 2036: an agenda for jobs and growth[1] *(1500-1900); The WorldAtlas List of Geography Facts and London Datastore (2010)*

A number of definitions of London's boundaries exist with a few of these summarised below. It should be noted that each definition of London has their advantages and disadvantages, with some providing ease of international comparison and others providing insights into London's true economic spread etc. Thus which boundaries are used in analysis will be partly dependent on the type of question the researcher is interested in, however in this analysis, given the GLA's statutory responsibilities, the definition of London mostly used in this report will be that of Greater London.

The boundary of the Greater London area and its constituent local authorities (surrounding the nucleus of the City) is shown in Map 2.1 and highlights the geography for which the GLA is responsible for. Map 2.2 shows another couple of ways of mapping Greater London's geographic area; first in terms of its connected built-up or metropolitan areas which extend beyond the defined Greater London area, demonstrating that development has extended beyond the city's defined boundary. Map 2.2 also shows another definition of London this time as set out by the London's Functional Urban Area[2], which is a definition that allows international comparisons between cities, by covering the wider area over which London's economic impact is thought to extend.

Another way of defining London may be by its travel to work area (TTWAs). This is as noted by the ONS in its current definition of TTWAs defined generally by "at least 75 per cent of an area's resident workforce work in the area and at least 75 per cent of the people who work in the area also live in the area. The area must also have a working population of at least 3,500. However, for areas with a working population in excess of 25,000, self-containment rates as low as 66.7 per cent are accepted. TTWA boundaries are non-overlapping, are contiguous and cover the whole of the UK. TTWAs do cross national boundaries, although no account is taken of commuting between Northern Ireland and the Republic of Ireland"[3].

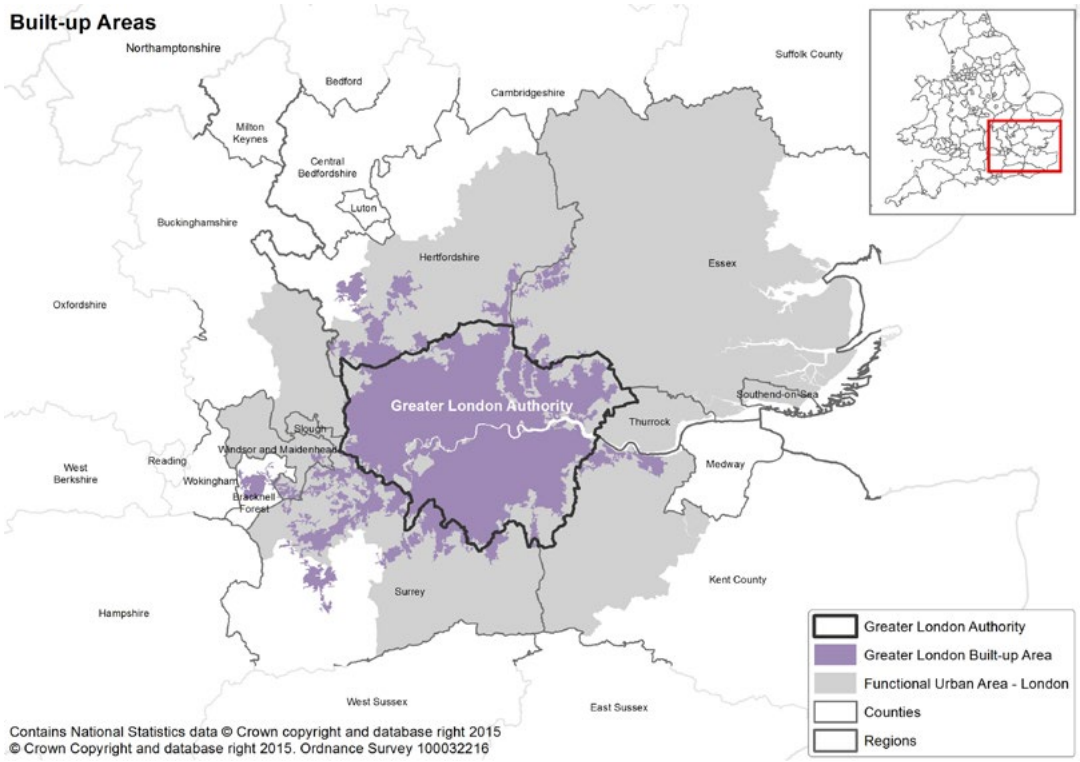
Maps 2.3 a to c show the UK's, parts of the Greater South East's and London's TTWAs. Interestingly, a significant part of West London including Heathrow is not a part of the London TTWA, but has its own TTWA called Heathrow and Slough. Whilst not in the London TTWA, arguably Heathrow and Slough TTWA should be considered as part of London given much of it lies within the city's boundaries.

Finally, Maps 2.38 to 2.43 later in this chapter show the commuter flows into London from areas outside of Greater London and thus highlight how large areas of the Greater South East are influenced by London.

Map 2.1: Greater London and its constituent local authorities

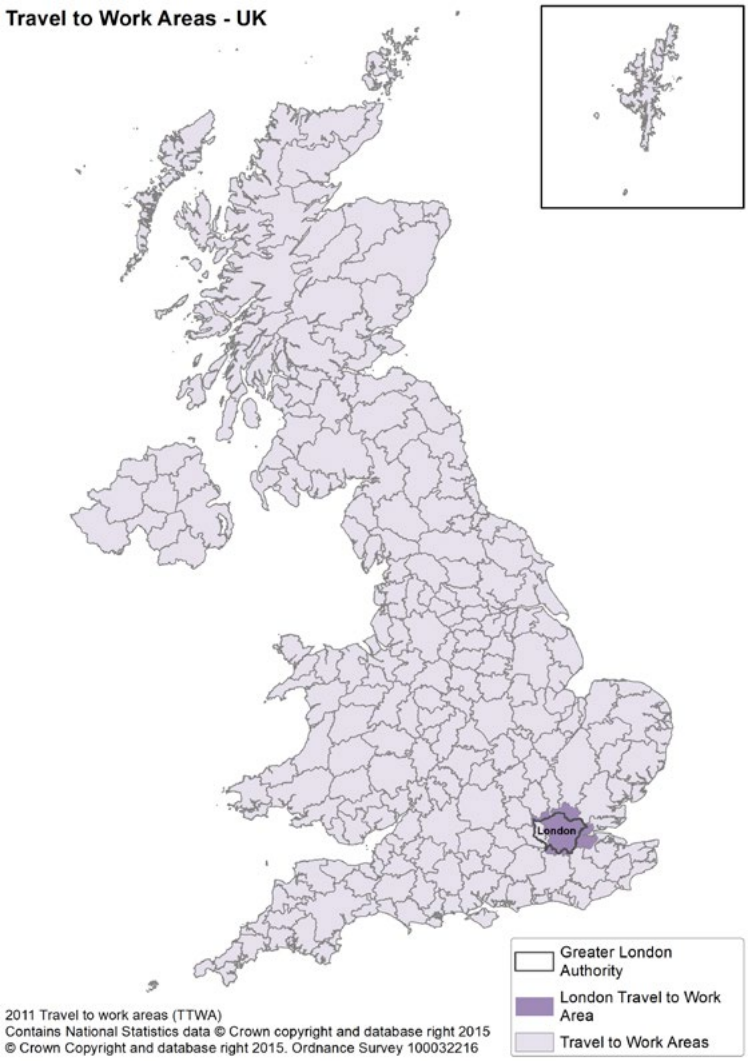
Source: GLA Intelligence Unit

Map 2.2: Greater London's connected built-up area and functional urban area



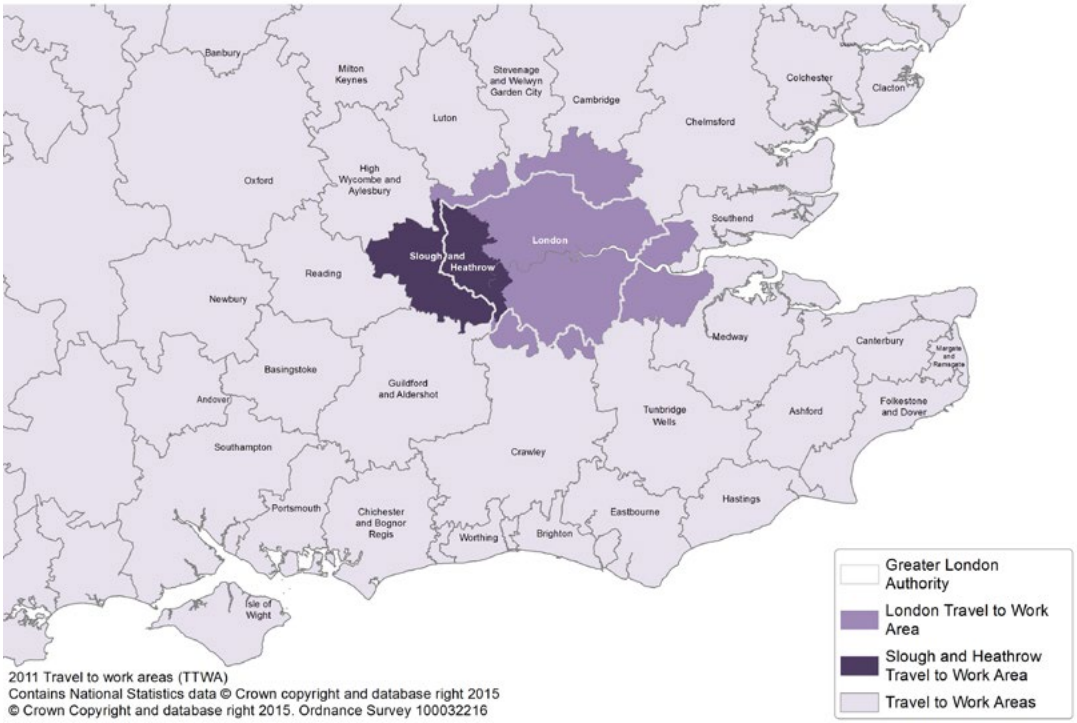
Source: GLA Intelligence Unit

Map 2.3a: United Kingdom 2011 Travel to Work areas



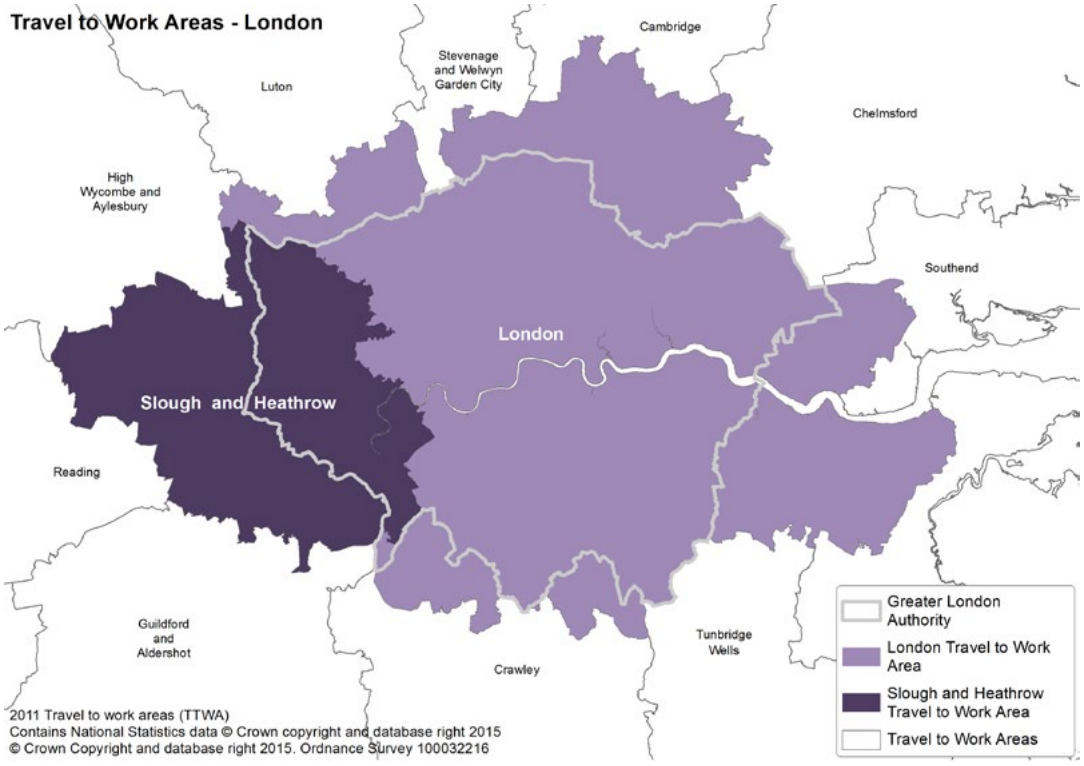
Source: ONS & GLA Intelligence Unit

Map 2.3b: Travel to Work areas in 2011 with a focus on part of the Greater South East



Source: ONS & GLA Intelligence Unit

Map 2.3c: London's 2011 Travel to Work area



Source: ONS & GLA Intelligence Unit

Still, having observed that London's reach or spatial impact can be defined in many ways it should be noted that particular (and many) functions of London's economy have tended to locate in certain areas of London – particularly central London. Central London offers a range of factors that are not found in combination in many other places. As shown by a number of surveys[4] on a range of factors, businesses see London as the best place in Europe to locate – with the top one of these being availability of qualified staff. A large number of firms therefore locate themselves within central London with 40 per cent of the world's largest

250 companies basing their European headquarters in London. London's nearest European rival is Paris with 8 per cent[5]. This concentration of businesses at the centre of London brings benefits to the economy over and above those that accrue to the individual firms themselves: so-called agglomeration benefits. These agglomeration benefits are the positive externalities which arise when specialised economic activity takes place in a spatial concentration – such as in Central London. The four key elements of agglomeration are: labour, specialised inputs, knowledge, and the market.

Such agglomeration benefits support the development of economic activity by providing firms with access to a deep and highly-skilled labour force, a range of complementary input and output markets and the benefits of spill over effects such as the rapid transfer of innovation and knowledge. These agglomeration benefits are also greater in certain industries such as finance, insurance and business services[6], as outlined in Chapter 1.

The economies of agglomeration have a degree of circular causality – existing spatial concentration results in forces that encourage further spatial concentration. The productivity benefits of high employment density, within industries, across geography and over time, are found in cities across the world. The development of London's radial public transport network has enabled the growth of central London by reducing the cost of accessibility to a significant proportion of the region's population; the implementation of Crossrail and High Speed 2 (HS2) will advance this accessibility further. Finally, it should also be noted that although beneficial to the city's economy agglomeration economies also lead to costs within London in terms of increased congestion and competition for space, between businesses seeking to maximise the benefits of agglomeration, and increased demand for housing from people working in these areas.

2.4 The Central Activities Zone, Northern Isle of Dogs and their fringes

Thus it can be seen that a geography of particular importance to not only London or the UK as a whole but arguably the wider EU is London's Central Activities Zone (CAZ). As noted the CAZ contains a unique cluster of vitally important activities including central government offices, headquarters and embassies, and a large concentration of business activity, with many businesses clustering by industry sector. This clustering also occurs in the northern part of the Isle of Dogs[7] (NIOD) and may further bleed into a fringe surrounding the CAZ and the NIOD. This section sets out to examine the economy of this dynamic area in detail[8].

2.4.1 The output of the CAZ

Given the economic activity that is easily observable and concentrated in the CAZ, the NIOD and their fringes it is likely that these areas are responsible for a large proportion of London's output. However, official measures of output for the CAZ, its fringe, the NIOD and its fringe are not available from the ONS. At the time of writing, these data is also not available at the borough level with the lowest published official estimate of output (as measured by GVA) being at the NUTS3[9] level geography that existed before January 2015[10]. Estimates of GVA at the NUTS3 level for the new post-January 2015 geography will be published by the ONS in December 2015, but will still not include estimates for the size of output for the CAZ, NIOD and their fringes. However GLA Economics has published estimates of output in the CAZ the results of this analysis are given in Table 2.2; although it should be emphasised that these numbers are estimates based on GLA Economics' calculations and are not official ONS statistics.

Table 2.2: Calculations of GVA(I) generated within the CAZ, NIOD, and their approximately 1km fringes in 2012 (£ million rounded to the nearest £10 million)

Area	GVA (£ million)
CAZ	139,840
CAZ 1km Fringe	22,340
NIOD	15,150
NIOD 1km Fringe	1,870
CAZ & NIOD	154,990
CAZ, NIOD & a 1km Fringe	179,200

Source: ONS, BRES and GLA Economics' calculations

Given that in 2012 London's GVA stood at £325,613 million, these estimates would suggest that the CAZ accounted for around 43 per cent of London's GVA. While they further suggest that the CAZ and NIOD accounted for around 48 per cent of London's GVA and the CAZ, NIOD and the 1 km fringe around these areas accounted for nearly 55 per cent of London's GVA. UK GVA stood at £1,475,948 million in 2012 implying that the CAZ, NIOD and their fringes accounted for just over 12 per cent of UK GVA.

2.4.2 Employment in the CAZ and NIOD

The CAZ along with the NIOD and the immediate areas that border them are also home to a large number of jobs, as shown in Tables 2.3 and 2.4 which show the evolution of employees and employment[11] in the CAZ, NIOD and their approximately 1 km fringes over the years 2009 to 2014. There was a large increase in both employees and employment within this area over the six years under consideration, with numbers of employees increasing at a faster rate in the CAZ, NIOD and their fringes compared to the increases seen in London as a whole. In employment terms the growth was in a similar range and again higher than growth in London as a whole. It should be noted that employment growth in the NIOD was particularly strong with it increasing from around 99,000 in 2009 to around 133,000 in 2014 an increase of around 34 per cent. In terms of the total number of employees and employment in London, the CAZ accounts for around 36 per cent, with this increasing to 38 per cent when the NIOD is included, and around 45 per cent when their respective fringes are taken into account. However, given the calculation that the CAZ, NIOD and their fringes account for 55 per cent of London's output this employment figure would imply that employment in this area is generally more productive than the London average[12].

Table 2.3: Employees in the CAZ, NIOD, and an approximately 1km fringe around them and London in 2009 to 2014 (million) and their growth over those years (% change)

	2009	2010	2011	2012	2013	2014	Change from 2009 to 2014
CAZ	1.42	1.46	1.51	1.55	1.61	1.68	18.3%
CAZ 1km Fringe	0.27	0.28	0.29	0.30	0.30	0.31	13.9%
NIOD	0.10	0.10	0.12	0.12	0.13	0.13	34.4%
NIOD 1km Fringe	0.02	0.03	0.03	0.03	0.03	0.03	20.5%
CAZ & NIOD	1.52	1.55	1.63	1.67	1.74	1.81	19.3%
CAZ, NIOD & their 1km Fringes	1.82	1.86	1.95	2.00	2.07	2.15	18.5%
London	4.14	4.21	4.30	4.45	4.56	4.73	14.2%

Source: BRES

Table 2.4: Employment in the CAZ, NIOD, and an approximately 1km fringe around them and London in 2009 to 2014 (million) and their growth over those years (% change)

	2009	2010	2011	2012	2013	2014	Change from 2009 to 2014
CAZ	1.47	1.50	1.57	1.62	1.67	1.73	17.8%
CAZ 1km Fringe	0.28	0.28	0.30	0.31	0.31	0.32	13.7%
NIOD	0.10	0.10	0.12	0.12	0.13	0.13	33.8%
NIOD 1km Fringe	0.02	0.03	0.03	0.03	0.03	0.03	20.3%
CAZ & NIOD	1.57	1.60	1.69	1.73	1.80	1.86	18.8%
CAZ, NIOD & their 1km Fringes	1.87	1.91	2.02	2.07	2.14	2.21	18.1%
London	4.27	4.32	4.50	4.59	4.71	4.85	13.6%

Source: BRES

The nature of employment in the CAZ, NIOD and their fringes is, as could be expected, heavily concentrated in a few sectors as shown by Table 2.5, with Professional, scientific and technical being particularly important. The five sectors considered in Table 2.6 accounted for around 65 per cent of the total employment in the CAZ in 2014, 67 per cent of employment in the CAZ & NIOD, and 63 per cent of the employment in these two areas and their fringe. In the NIOD alone these five sectors accounted for 82 per cent of employment. Compared to London as a whole, these five sectors accounted for around 46 per cent of employment in 2014.

Table 2.5: Employment by sector in 2014 in the CAZ, NIOD, and an approximately 1 km fringe around them (top five sectors only)

	CAZ	CAZ as % of sector total for London	CAZ 1km Fringe	CAZ Fringe as % of sector total for London	NIOD	NIOD as % of sector total for London	NIOD 1km Fringe	NIOD Fringe as % of sector total for London	CAZ & NIOD	CAZ & NIOD as % of sector total for London	CAZ, NIOD & their Fringes	CAZ, NIOD & their Fringes as % of sector total for London
Professional, scientific and technical activities	384,000	59%	39,000	6%	19,000	3%	2,000	0%	403,000	61%	444,000	68%
Financial & insurance activities	243,000	68%	12,000	3%	57,000	16%	1,000	0%	300,000	84%	312,000	87%
Information & communication	189,000	50%	28,000	7%	13,000	3%	3,000	1%	202,000	53%	232,000	61%
Administrative and support services activities	179,000	36%	25,000	5%	15,000	3%	9,000	2%	195,000	39%	229,000	46%
Accommodation & food services activities	137,000	37%	40,000	11%	5,000	1%	2,000	1%	142,000	39%	184,000	50%

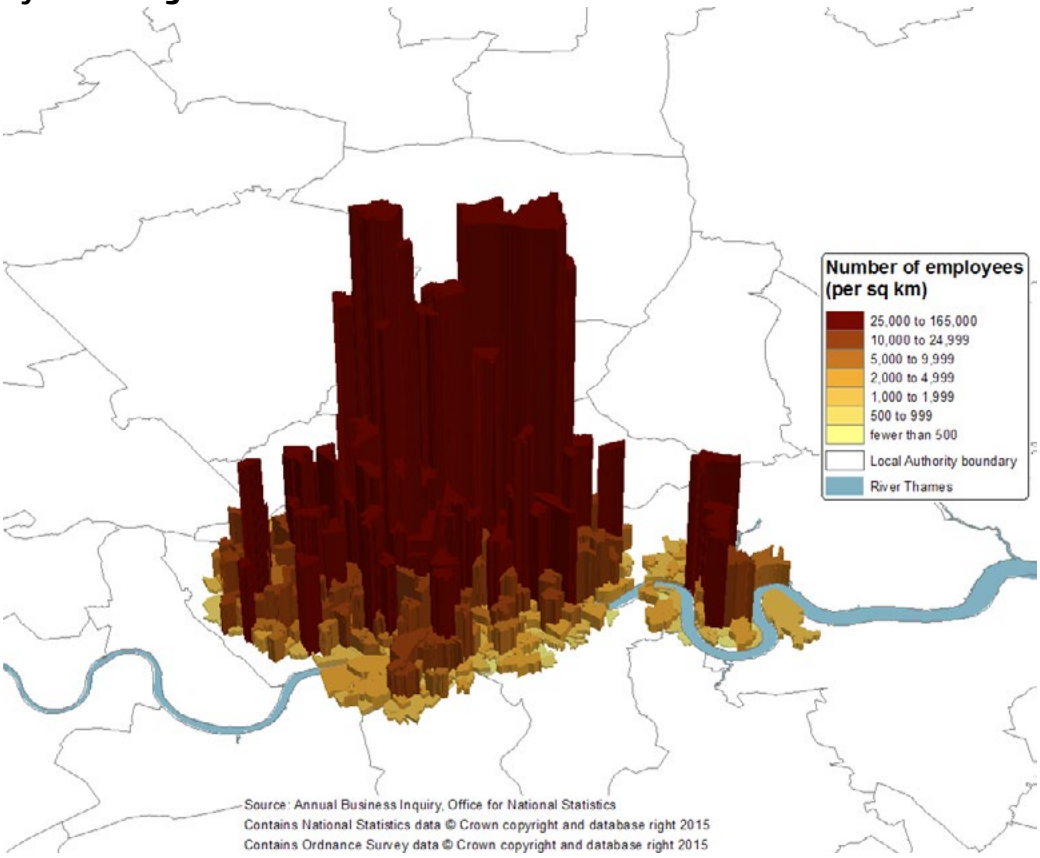
Source: BRES & GLA Economics calculations

The large number of employees in the CAZ, NIOD and their bounding areas is further underlined by Maps 2.4 and 2.5[13]. These maps show employees per square kilometre, with the higher the bar illustrating a larger number of employees, and emphasises the concentration of employees in most areas of the CAZ and NIOD and some areas of their fringes and shows how this concentration has increased between 2003 and 2014. In particular they especially highlight the high concentration of employees in the centre of the CAZ and the NIOD and show how this has become more marked over time.

Although a clear concentration of employees can be observed in this geography, this does not imply that there is a uniform dispersal of employment in the dominant sectors of the economy across the CAZ, NIOD and their fringes. In fact, a geographic concentration of employment by industrial sector in certain areas of the CAZ etc. could well be expected from knowledge of industries clustering together whether it is, for example, insurance firms around Lloyds or tech firms around 'Silicon Roundabout'[14].

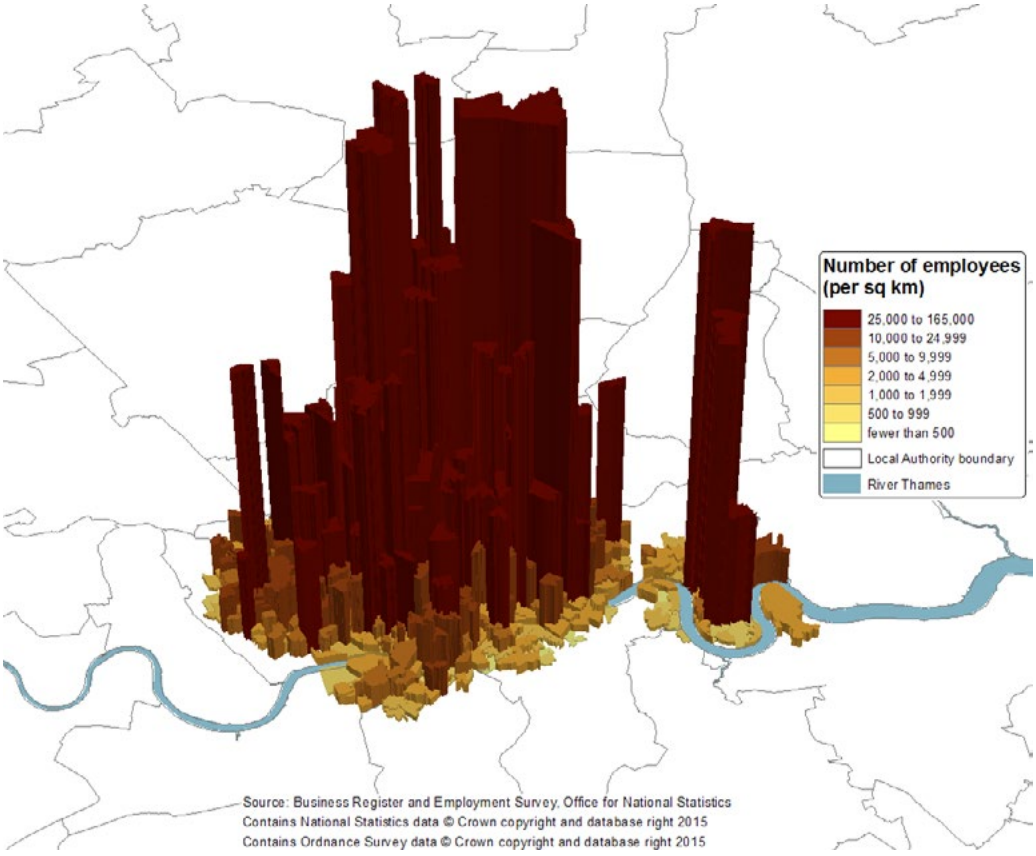
Map 2.6, using statistical analysis[15] of census employment data (and is for the year 2011), shows the effect of these economies of agglomeration[16] to form employment clusters for a number of industries.

Map 2.4: Number of employees per square kilometre in 2003 in the CAZ, NIOD and an approximately 1km fringe around them



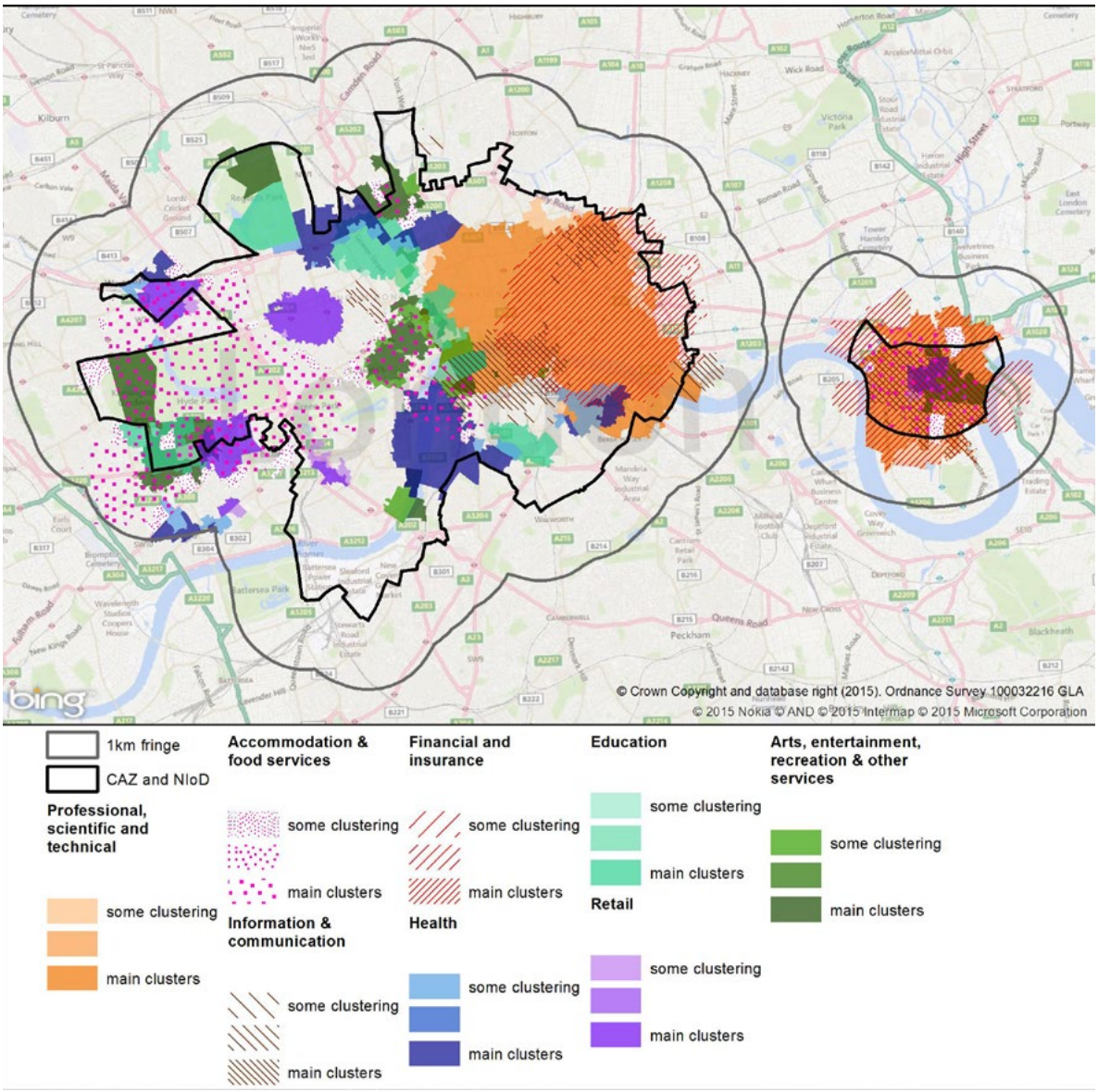
Source: Annual Business Inquiry (ABI)[17]

Map 2.5: Number of employees per square kilometre in 2014 in the CAZ, NIOD and an approximately 1km fringe around them



Source: BRES

Map 2.6: Clustering[18] by industry employment type in the CAZ, NIOD and an approximately 1km fringe around them



Source: Census[19] and GLA Intelligence Unit analysis

There are a number of areas in London which are of particular interest, given the potential future development potential of these areas. Further analysis of some of these areas is included in the Appendix to this chapter.

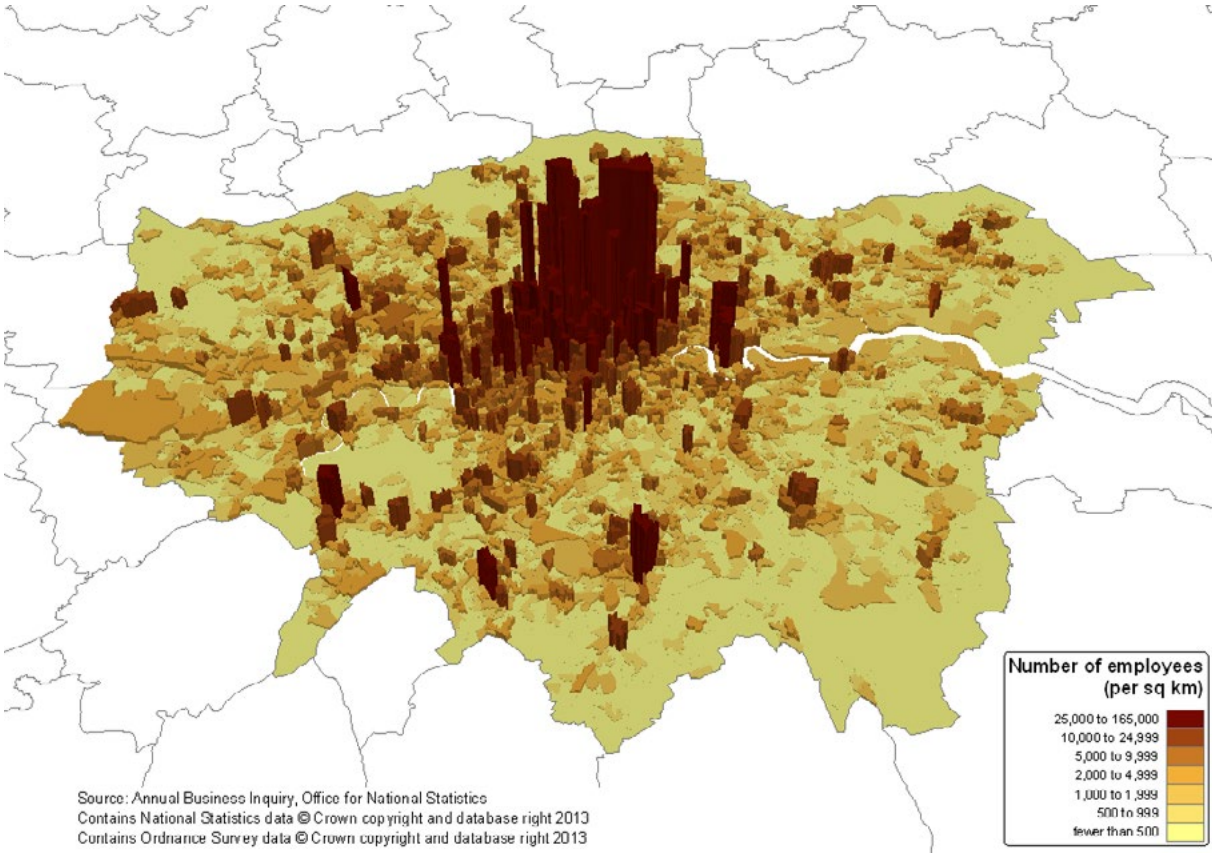
2.5 The wider London economy

This section examines the wider London economy, beyond that already examined in Chapter 1.

2.5.1 Employment levels and concentration, density and changes over time

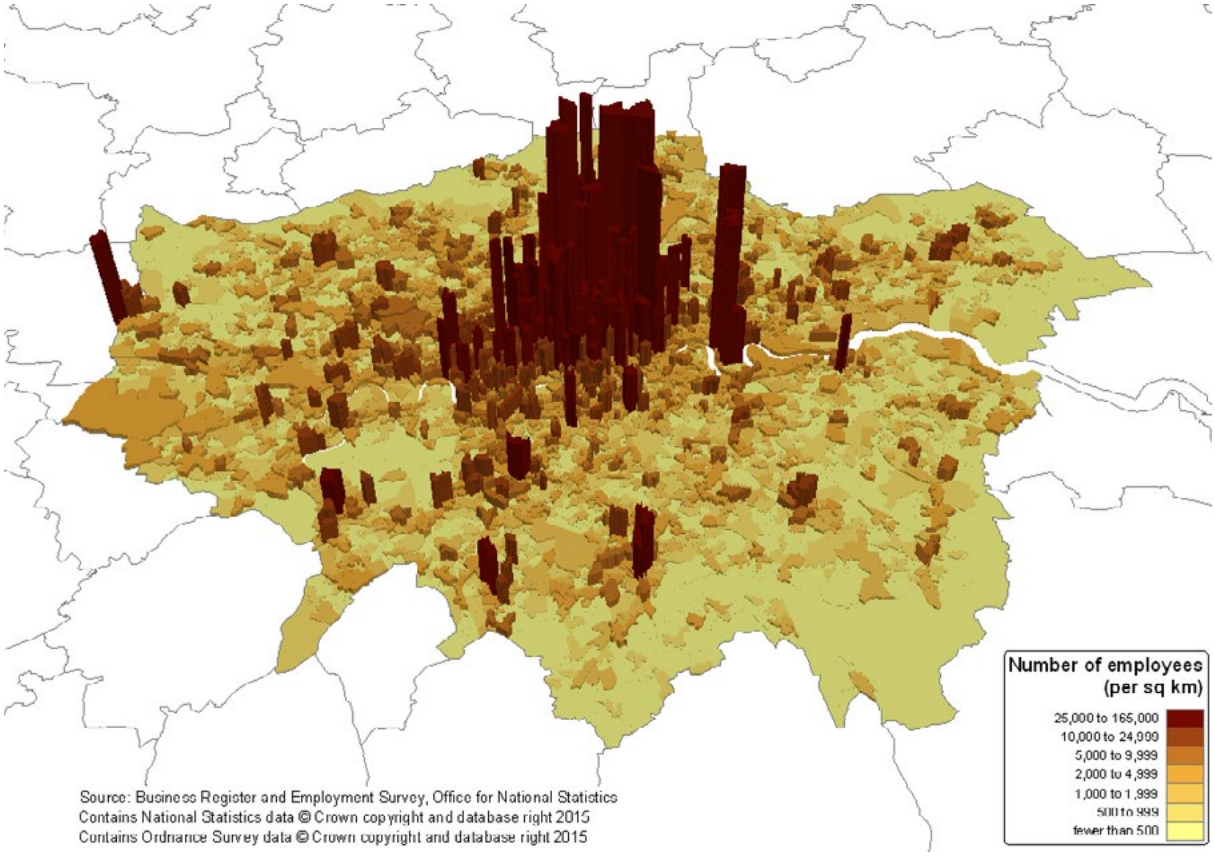
Maps 2.7 and 2.8 shows how employment concentration in London has evolved since 2003 and shows that while employment is highly concentrated in the CAZ and NIOD other areas such as Hillingdon (although surprisingly not so much around Heathrow), some industrial areas and various town centres also see significant employment concentration. The maps also highlight the strong growth in employment seen in those areas. The Appendix to this report provides Map B1 to B5 which examine employment in London at the lower NUTS2 geography levels. The dominance of London as an employment centre can also be observed from Map 2.9 which shows employment concentration per square kilometre in the GSE in 2014.

Map 2.7: Number of employees per square kilometre in 2003 in London



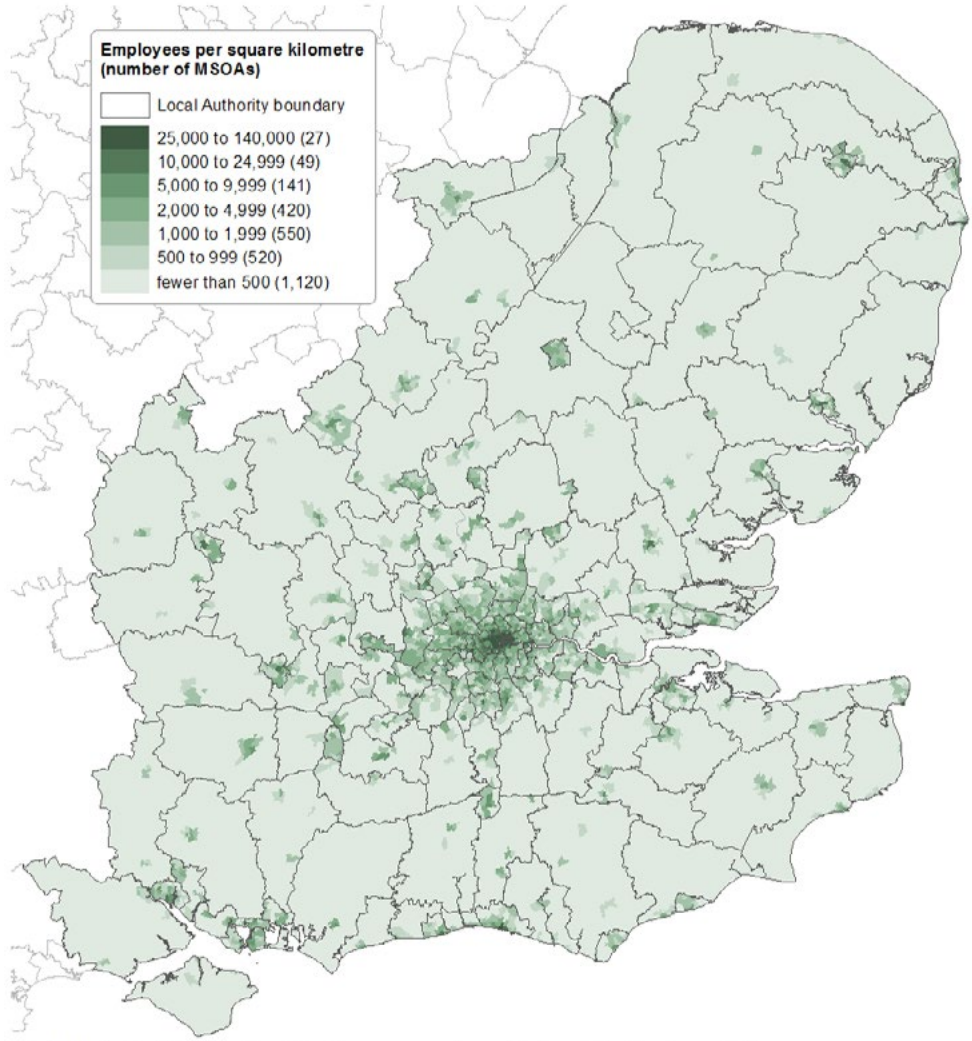
Source: Annual Business Inquiry (ABI)

Map 2.8: Number of employees per square kilometre in 2013 in London



Source: BRES

Map 2.9: Number of employees per square kilometre in 2013 in the Greater South East



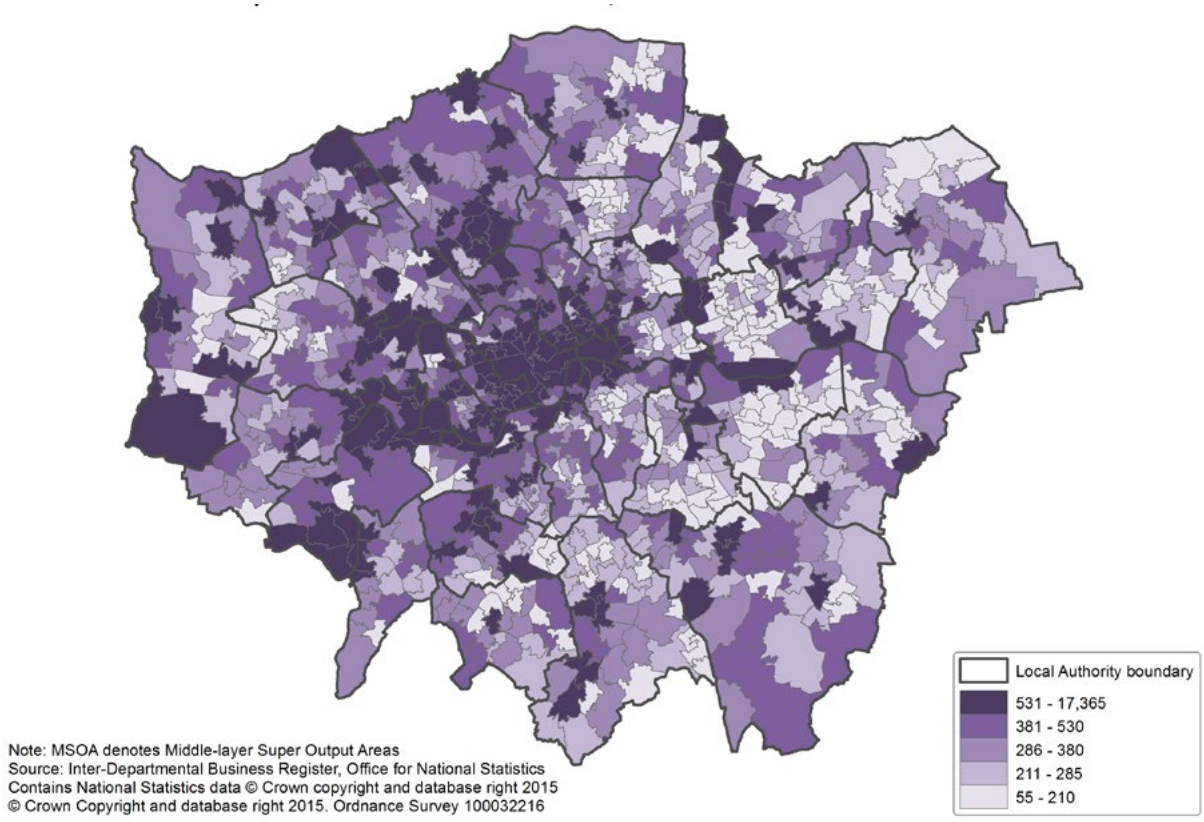
Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics

Source: BRES

2.5.2 Firms in London

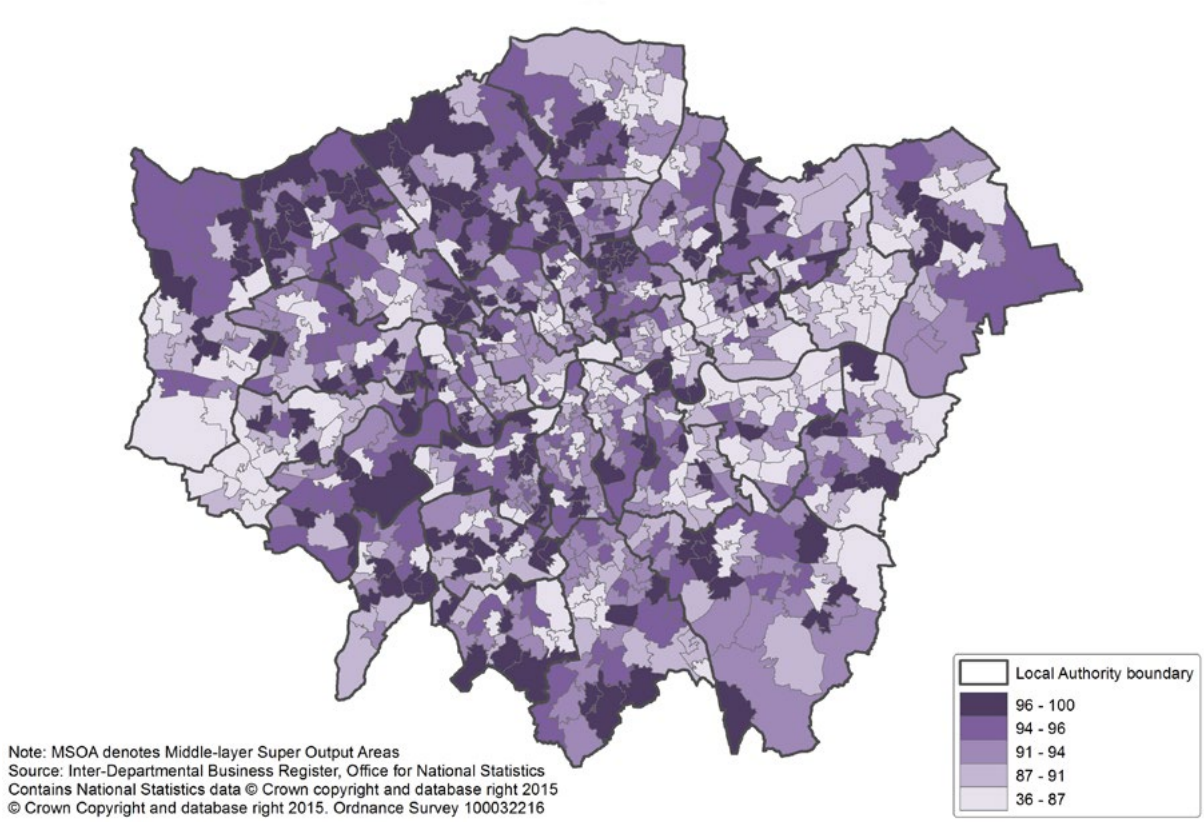
London is home to a large number of workplaces especially in the CAZ, but as can be seen from Map 2.10 other areas of London, especially in the west of London, as well as various town centres and several Strategic Industrial Locations (SIL) such as Park Royal, the Thames Gateway SILs in Newham (Royals), Charlton and Barking and Dagenham (River Road) also have significant concentration of workplaces. Conversely, it can be seen that some areas of east London have relatively few workplaces concentrated within them. The nature of the firms also varies across London with smaller workplaces (those employing less than 250) generally being more important in the south and north west of London with very few firms of this size trading in the city (see Map 2.11), while large workplaces (those employing 250 or more people) being more visible in a belt that runs from West London through Central London to small areas of South London and North London (see Map 2.12). It should however be noted that large employment workplaces are relatively rare as a percentage of all workplaces across all of London with most workplaces being small employment workplaces.

Map 2.10: Workplaces in London in 2014 by MSOA[20]



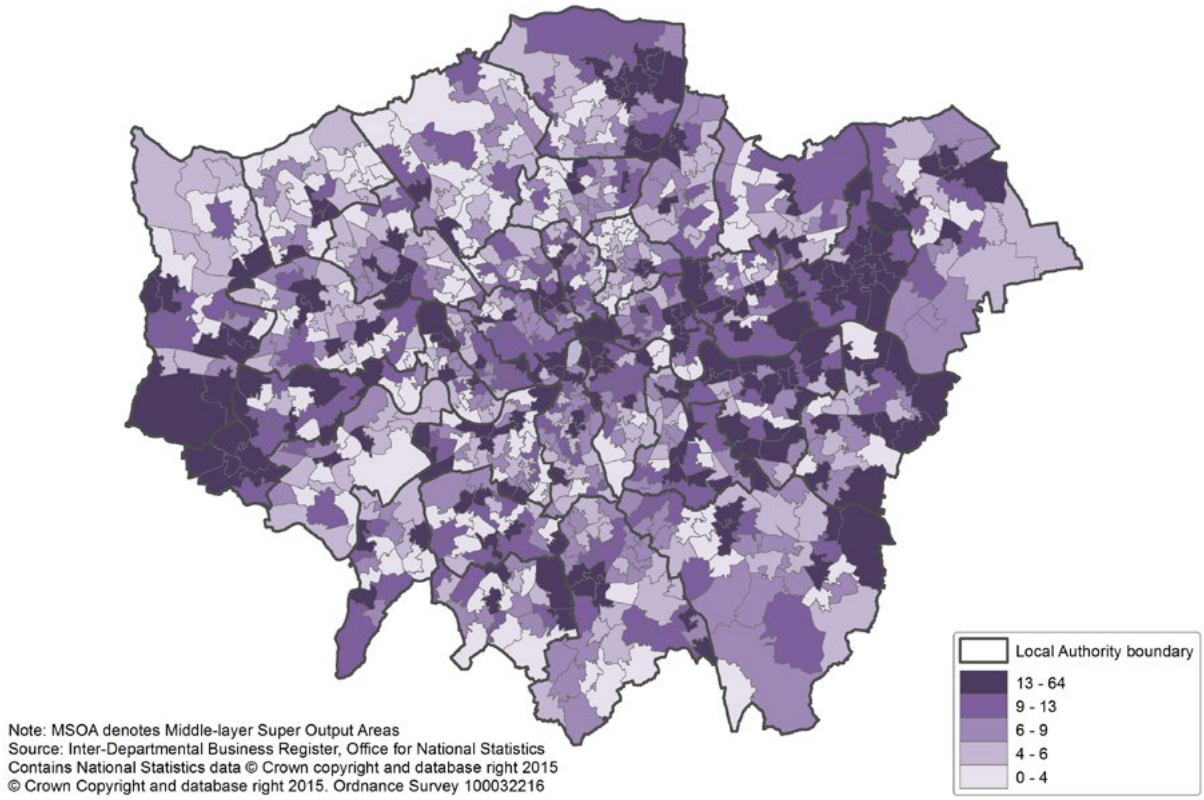
Source: ONS and GLA Intelligence Unit

Map 2.11: Workplaces that employ less than 250 people by MSOA in London in 2014 as a percentage of the MSOA's total workplaces



Source: ONS and GLA Intelligence Unit

Map 2.12: Workplaces that employ 250 or more people by MSOA in London in 2014 as a percentage of the MSOA's total workplaces



Source: ONS and GLA Intelligence Unit

2.6 Selected sectors of the London economy

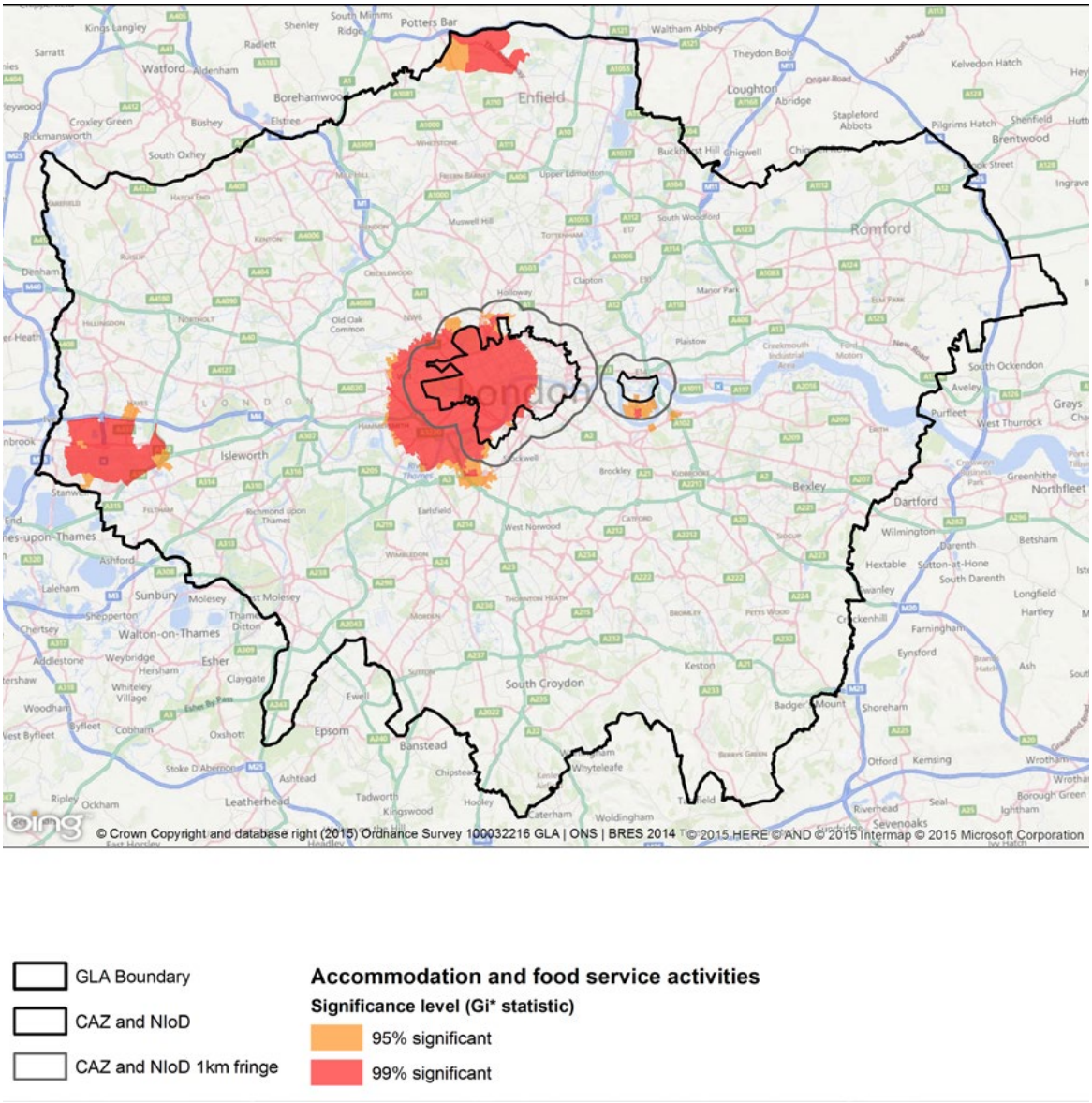
This section sets out to examine the spatial nature of selected broad sectors of the economy in London. GLA Economics has also in the past examined the spatial nature of employment in the science and technology category[21] and the creative industries[22] and sections B.2 and B.3 of the Appendix provides brief summaries and where necessary updates on these areas of the economy.

2.6.1 Employment clustering in London

Distinct clustering of firms can be seen across London, but the importance of the CAZ as a location for business is still evident. Maps 2.13 to 2.20 show clustering for a number of industrial sectors[23]. At this level of geography these clusters highlight the dominate areas of employment for these sectors in London but do not necessarily include every small area of high employment concentration in a given sector in London. Still as can be seen from these maps the CAZ is an important area of employment for all these sectors but other areas of interest are visible too.

Map 2.13 examines employment concentration in Accommodation and food service activities and as well as highlighting the CAZ as an area of high employment for this sector. The map also highlights the area around Heathrow and an area adjacent to Potter's Bar as areas of importance for this sector.

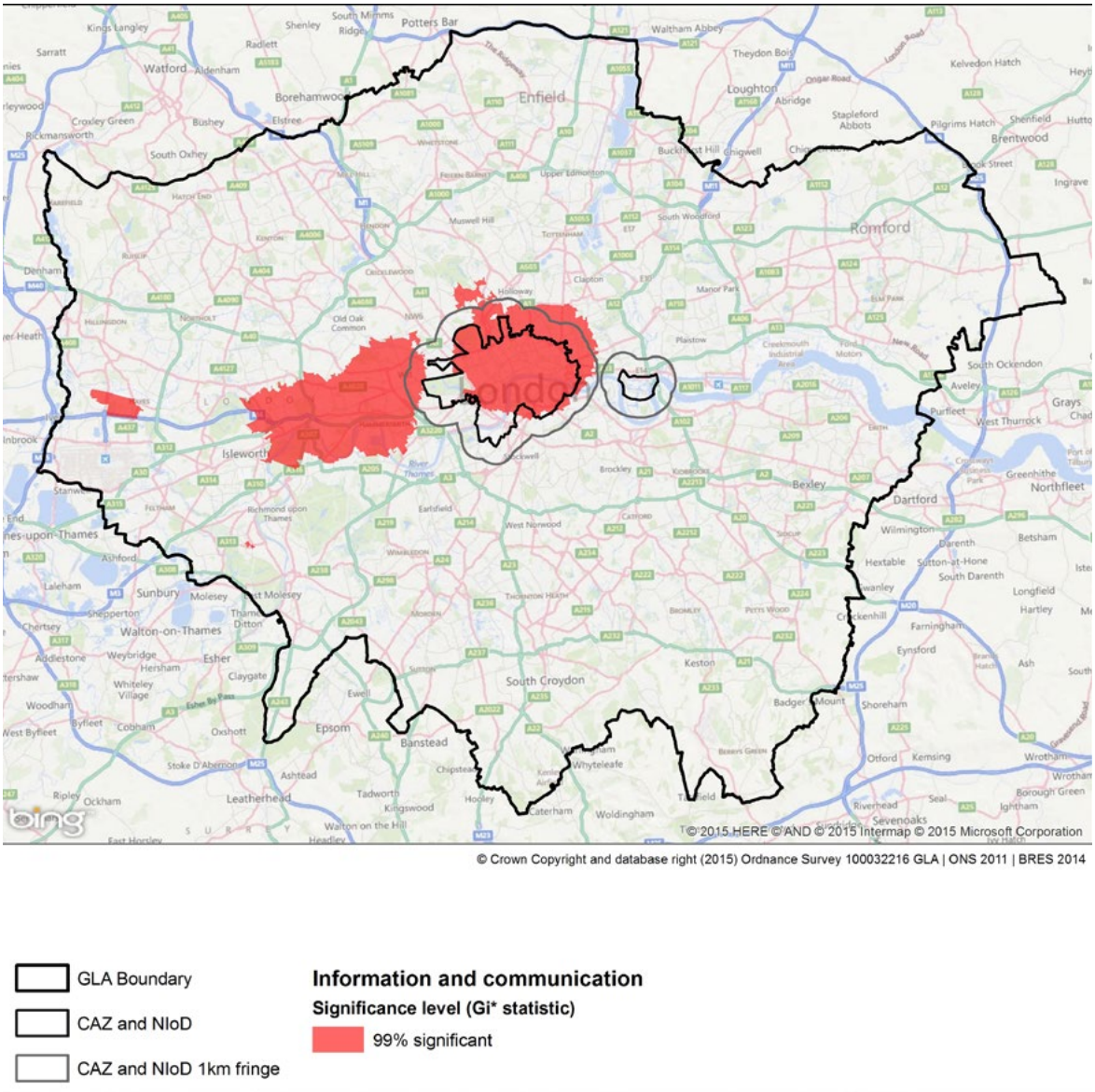
Map 2.13: Clustering in Accommodation and food service activities employment in London



Source: Census and GLA Intelligence Unit analysis

Map 2.14 shows employment clustering in Information and communication in Central London and to the west following a path through Hammersmith and along the M4.

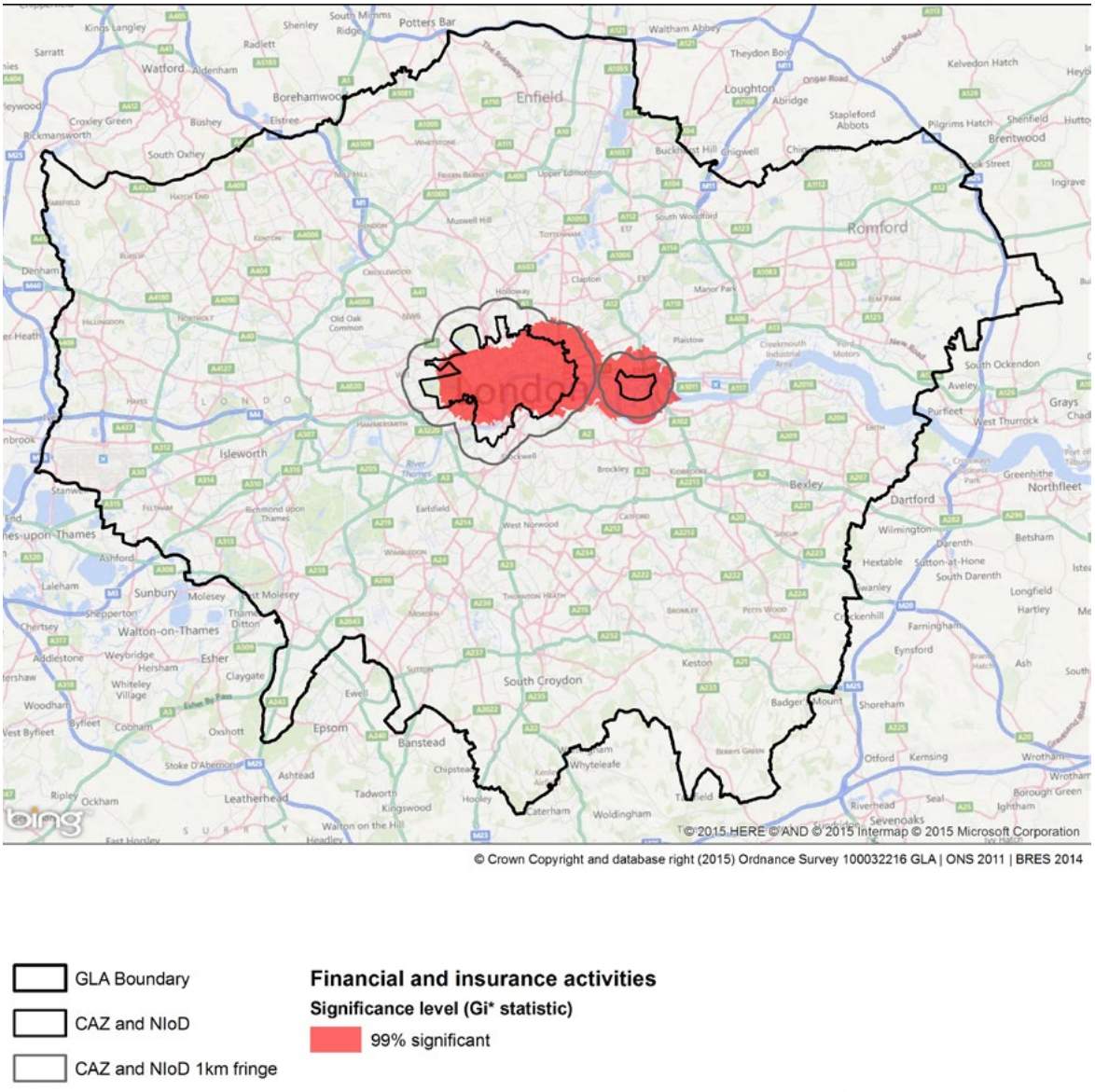
Map 2.14: Clustering in Information and communication employment in London



Source: Census and GLA Intelligence Unit analysis

Perhaps unsurprisingly Map 2.15 shows Financial and insurance activities clustering in the CAZ and Isle of Dogs.

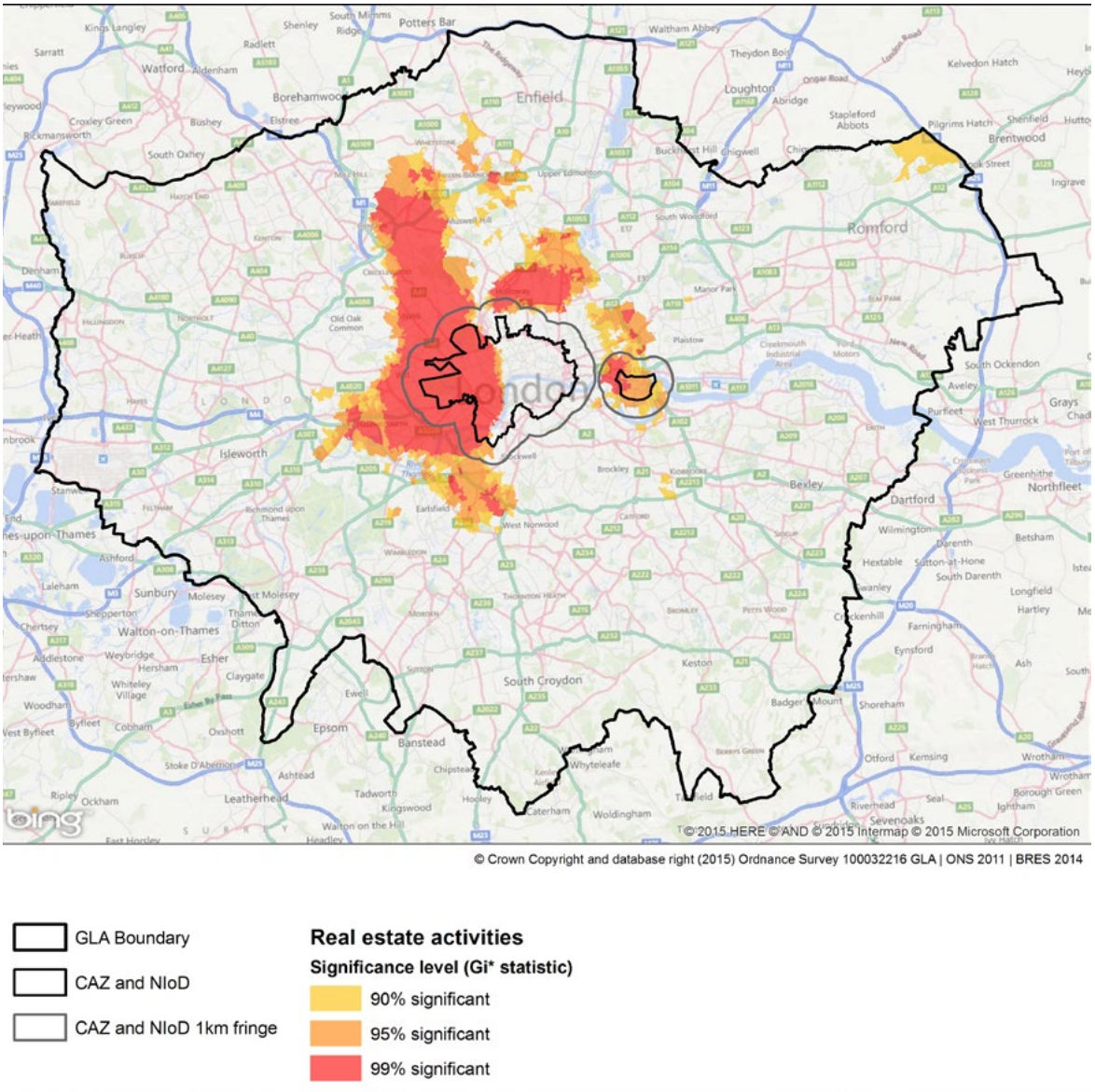
Map 2.15: Clustering in Financial and insurance activities employment in London



Source: Census and GLA Intelligence Unit analysis

Map 2.16 shows clustering in employment in Real estate activities in and to the west of the CAZ, around its northern perimeter and with a swathe into north London.

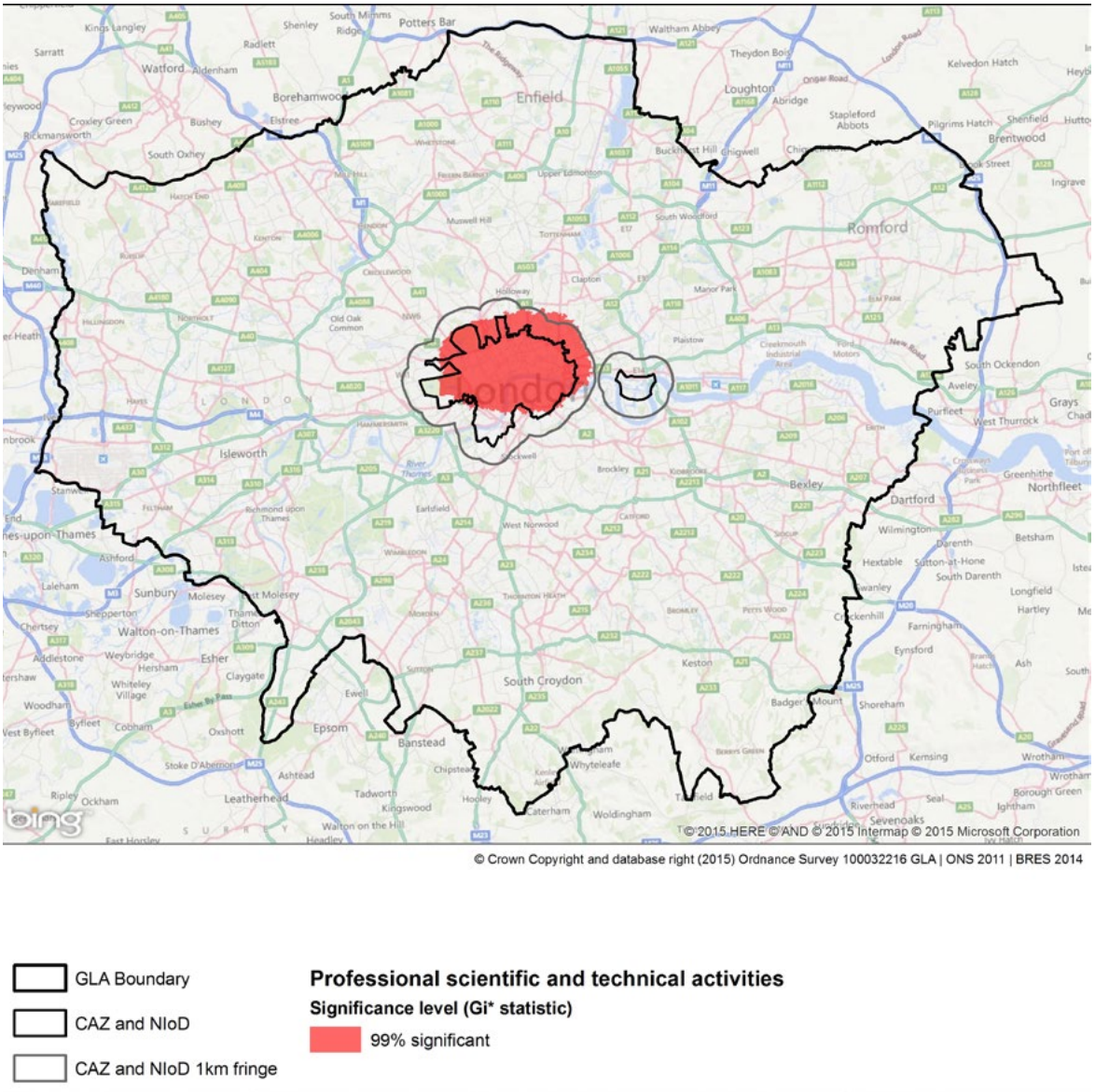
Map 2.16: Clustering in Real estate activities employment in London



Source: Census and GLA Intelligence Unit analysis

As shown by Map 2.17 employment in Professional, scientific and technical activities is highly concentrated in the CAZ.

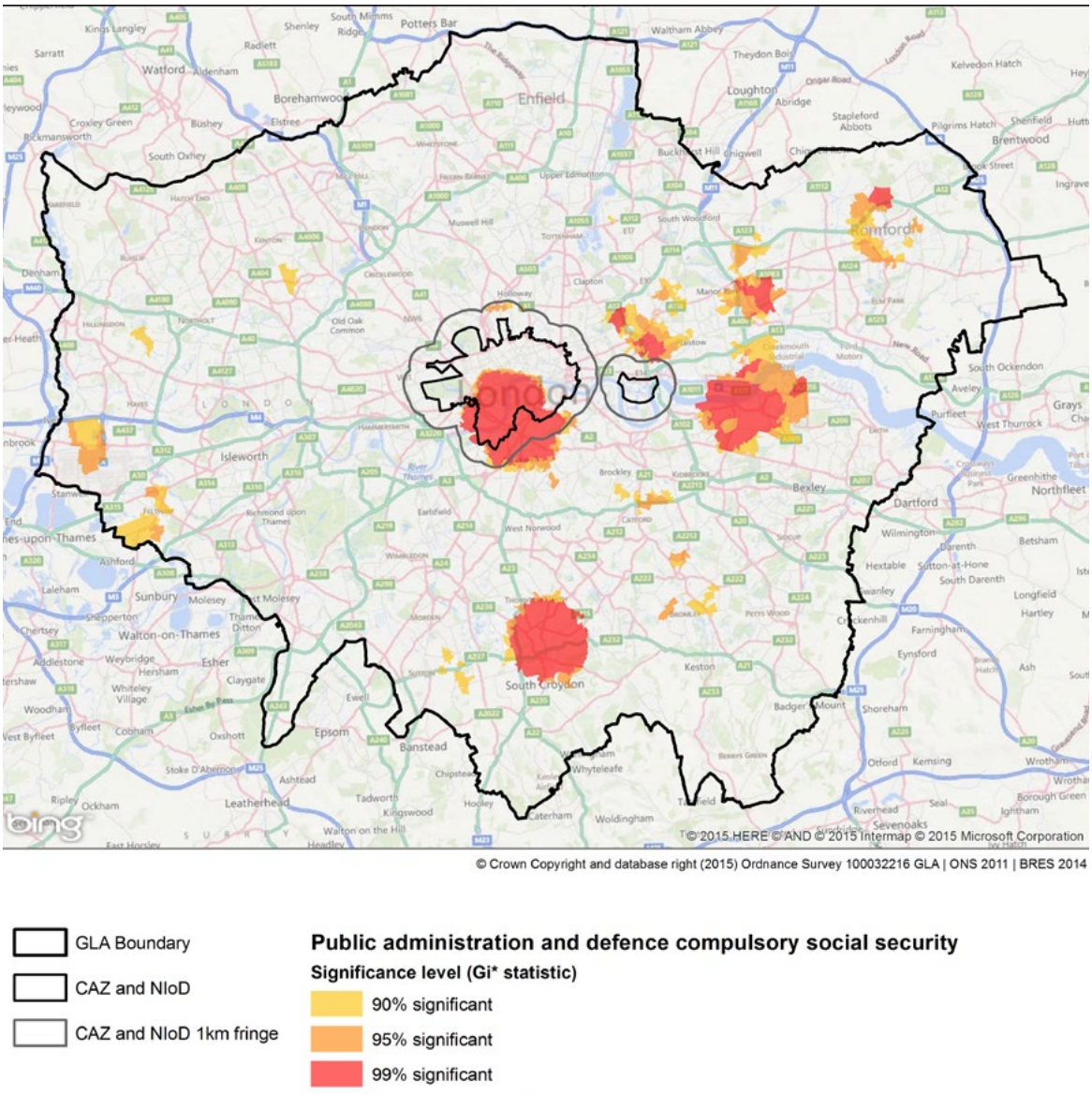
Map 2.17: Clustering in Professional, scientific and technical activities employment in London



Source: Census and GLA Intelligence Unit analysis

Clustering in Public administration and defence, compulsory social security employment is shown in Map 2.18 and highlights central government in Westminster, but also an area in Corydon most likely related to the Home Office immigration office; the cluster further south from City Airport is potentially related to the Royal Artillery Barracks in Woolwich.

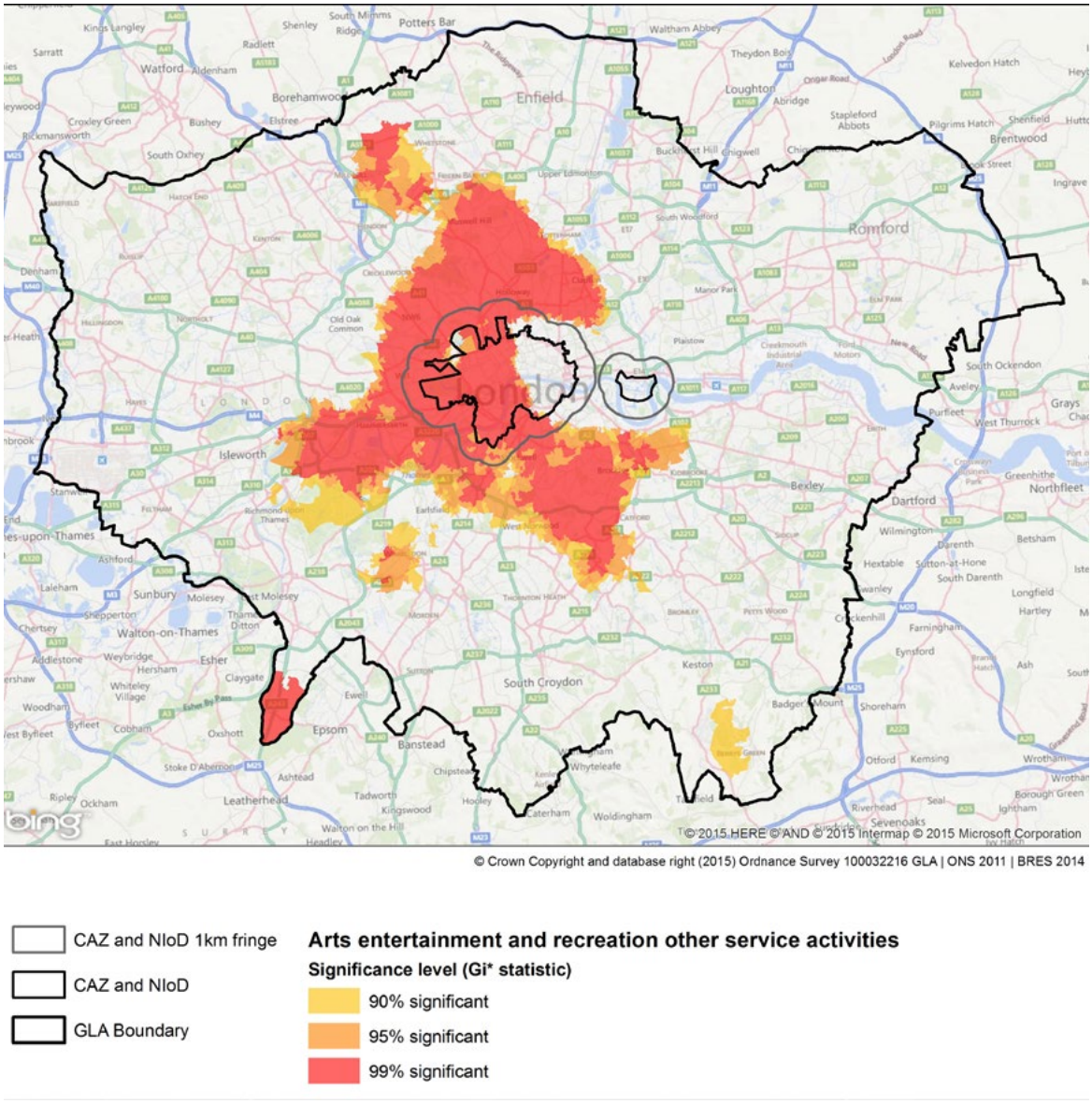
Map 2.18: Clustering in Public administration and defence, compulsory social security employment in London



Source: Census and GLA Intelligence Unit analysis

Map 2.19 shows clustering in Arts entertainment and recreation other service activities employment emanating out from the CAZ across a wide part of central London and an area west of Epsom most likely picking up Chessington World of Adventures.

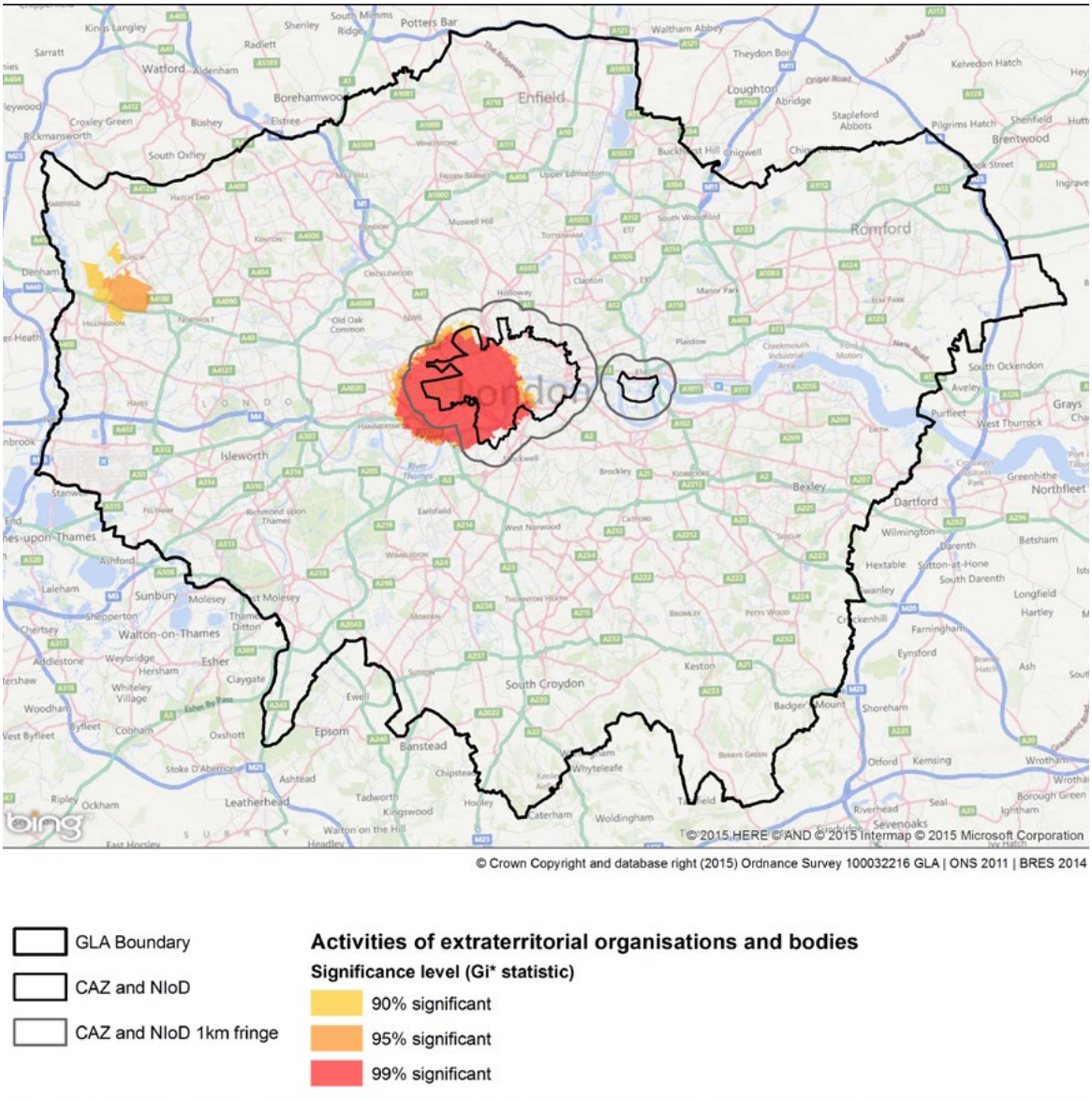
Map 2.19: Clustering in Arts entertainment and recreation other service activities employment in London



Source: Census and GLA Intelligence Unit analysis

Finally, Map 2.20 shows clustering in Activities of extraterritorial organisations and bodies employment in the west of the CAZ and its fringe.

Map 2.20: Clustering in Activities of extraterritorial organisations and bodies[24] employment in London



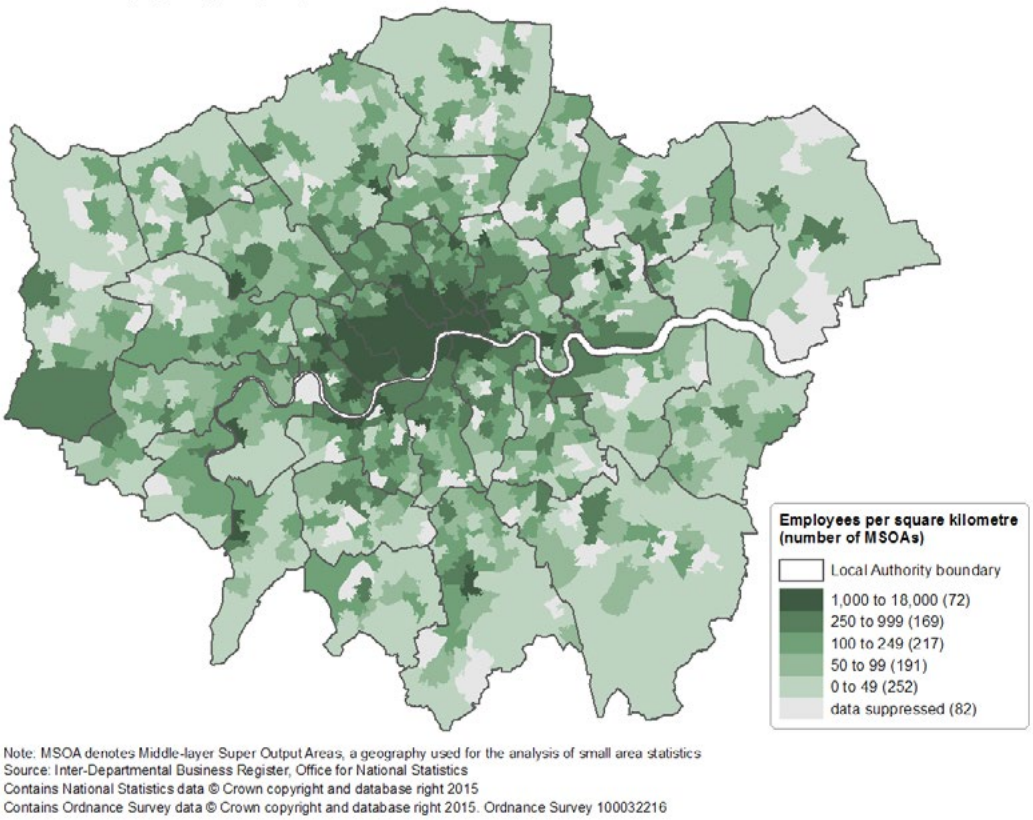
Source: Census and GLA Intelligence Unit analysis

2.6.2 Broad industrial sectors of the economy

This sub section examines the geography of employment concentration by broad industrial sectors in London in greater detail. However, it should be noted that some industrial sectors are not presented in this chapter. Those sectors cannot be analysed at low-level geographies because of confidentiality.

Map 2.21 shows that Central London is an important area of employment in the Accommodation and food service sector. There are also other clear smaller areas of employment concentration in this sector across London.

Map 2.21: Employee concentration in Accommodation & food service activities in London in 2014

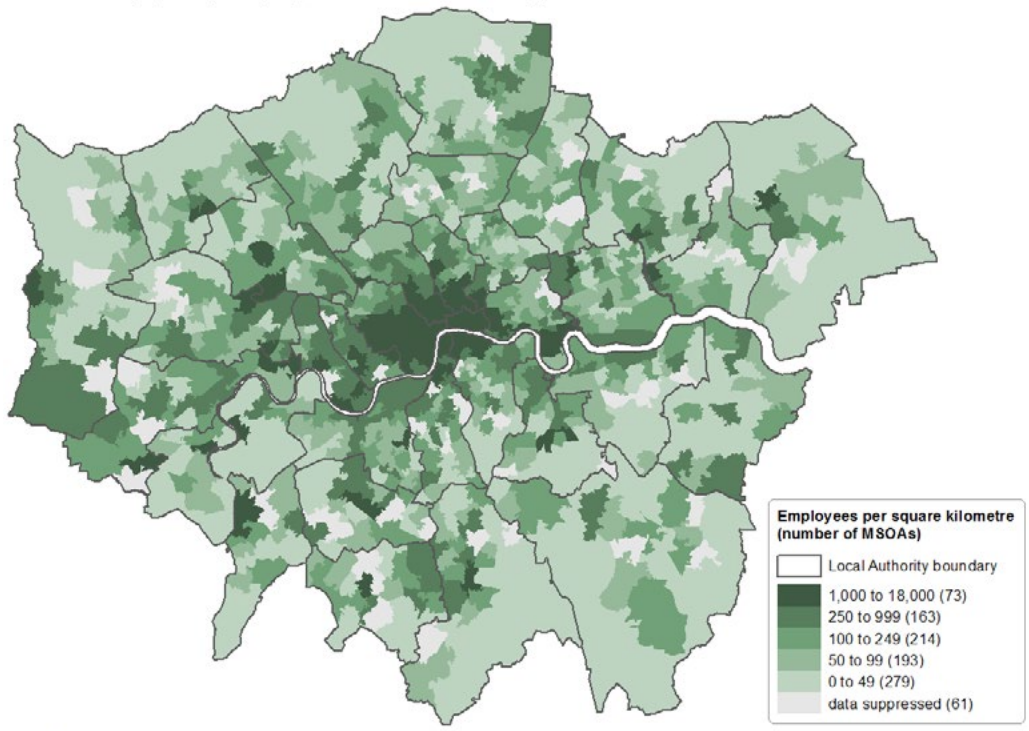


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics

Source: Inter-Departmental Business Register (IDBR)

Employees in Administrative and support services are also heavily concentrated in Central London and the NIOD but as seen from Map 2.22 other areas, especially in West London around the Thames and Heathrow, also see large numbers of employees in this sector.

Map 2.22: Employee concentration in Administrative and support services in London in 2014

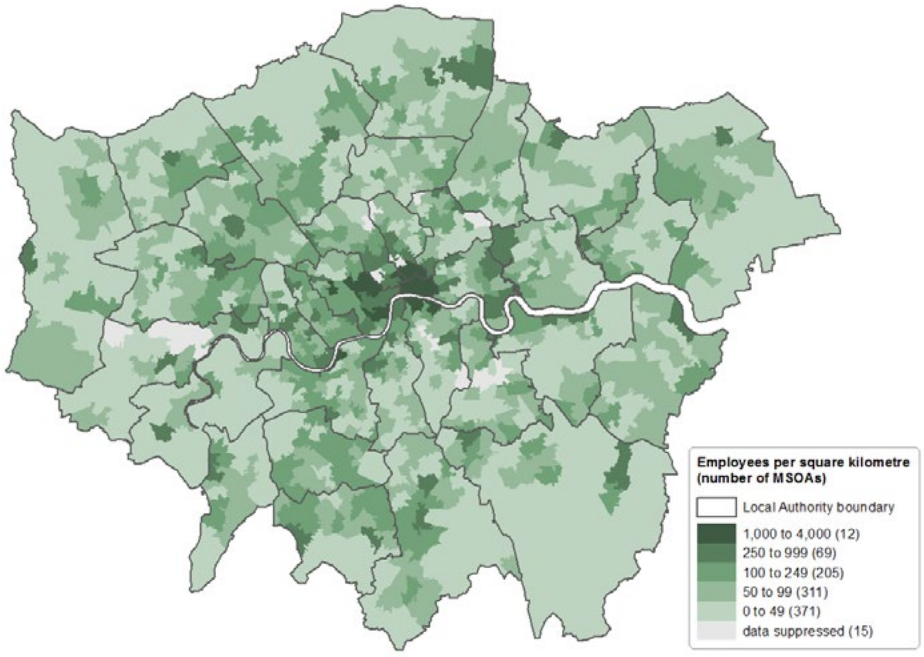


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics

Source: IDBR

Map 2.23 shows that beyond Central London there are concentrations of employees in London east of the city, some areas of South London, around Heathrow and to the northern most part of London.

Map 2.23: Employee concentration in Construction in London in 2014

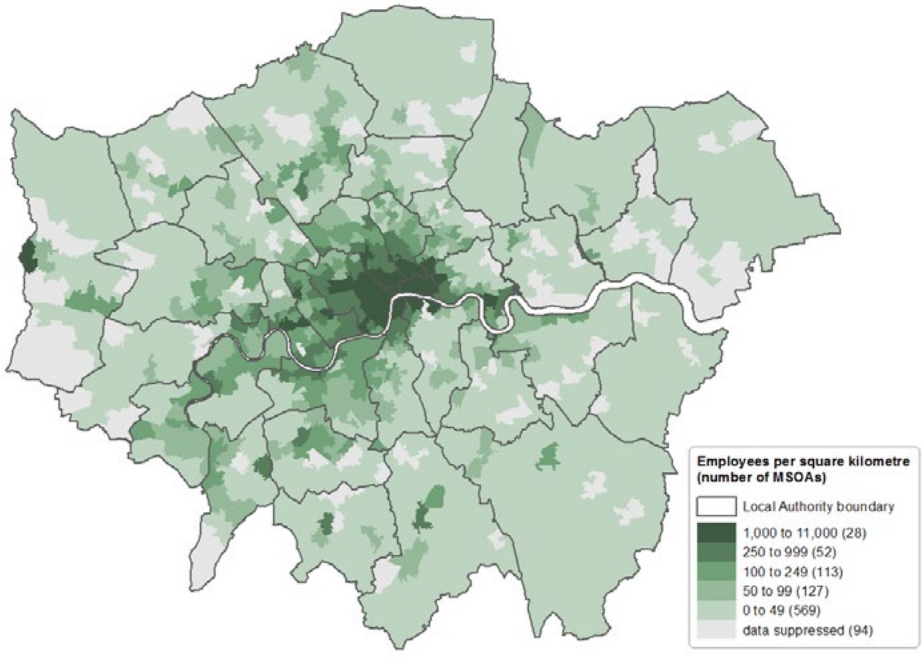


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics

Source: IDBR

Head offices and management consultancy as shown by Map 2.24 is unsurprisingly concentrated in Central London, the NIOD and also around Heathrow.

Map 2.24: Employee concentration in Head offices and management consultancy in London in 2014

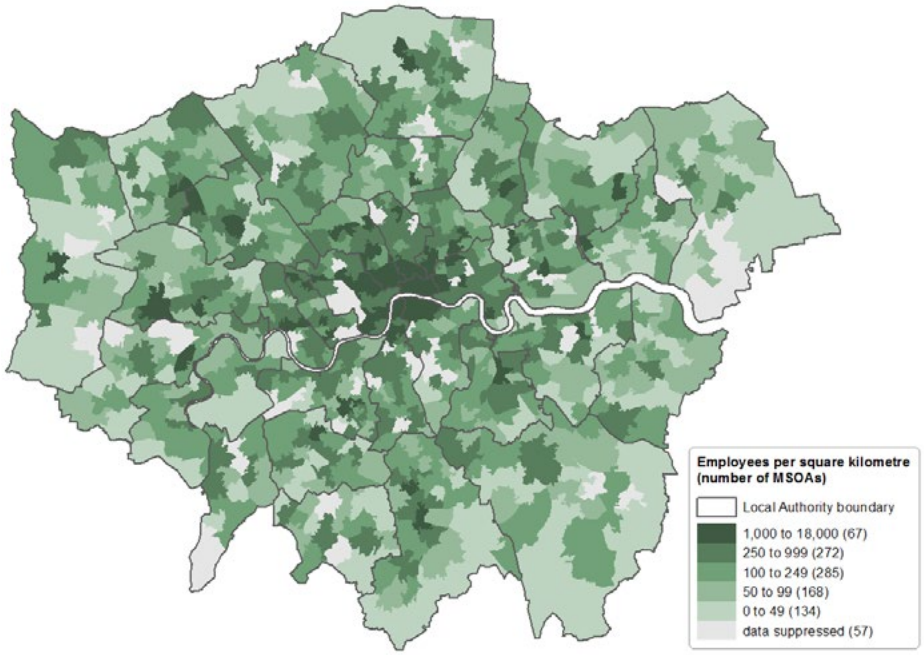


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics

Source: IDBR

Map 2.25 shows that employees in Human health and social work activities are highly concentrated in a number of areas of London, but in contrast to other activities are more spread out across London, most likely due to the wider distribution of the London population.

Map 2.25: Employee concentration in Human health and social work activities in London in 2014

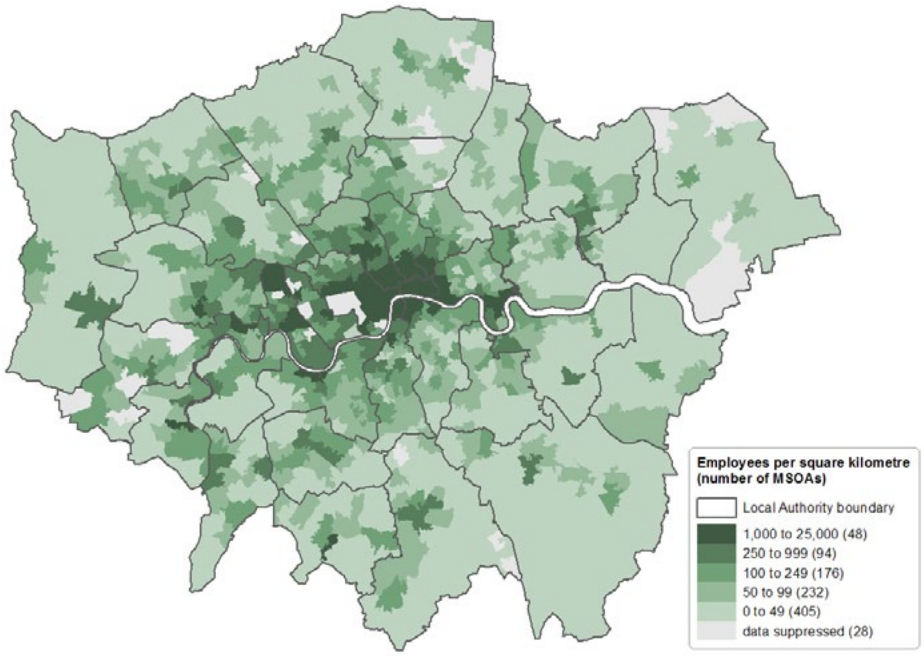


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics
Contains National Statistics data © Crown copyright and database right 2015
Contains Ordnance Survey data © Crown copyright and database right 2015. Ordnance Survey 100032216

Source: IDBR

Map 2.26 shows that employees in Information and communications are concentrated in Central London and the NIOD, as well as areas in West London parts of Richmond upon Thames and Sutton.

Map 2.26: Employee concentration in Information and communications in London in 2014

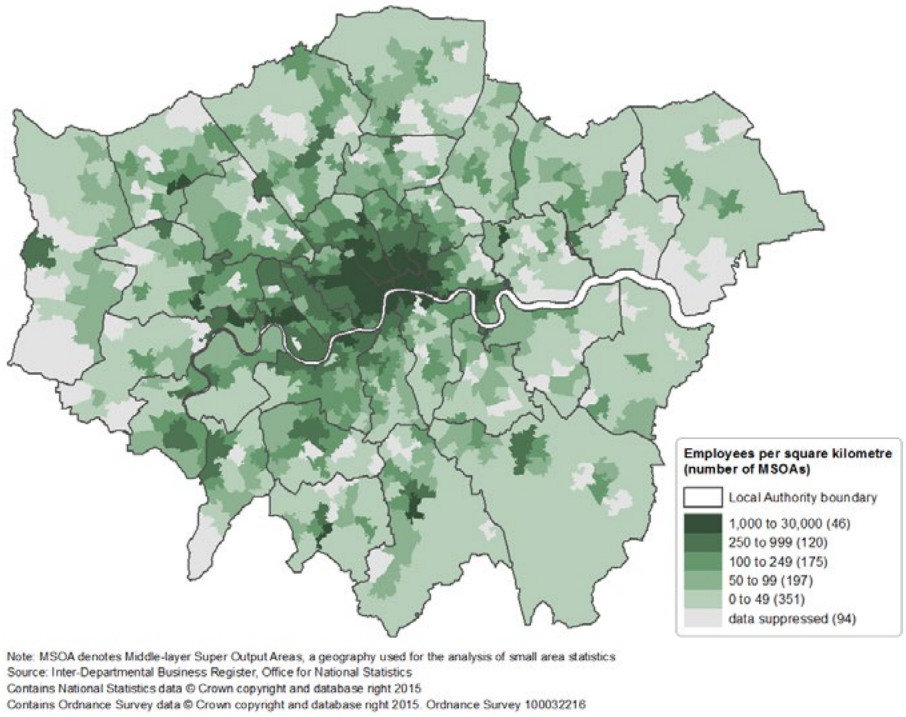


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics
Contains National Statistics data © Crown copyright and database right 2015
Contains Ordnance Survey data © Crown copyright and database right 2015. Ordnance Survey 100032216

Source: IDBR

Employees in Professional, scientific and technical activities (excluding Head office and management consultancy) are concentrated in Central London, the NIOD and spreading into west London. However, Map 2.27 also shows areas of concentration in Croydon, Harrow, Newham, and Sutton.

Map 2.27: Employee concentration in Professional, scientific and technical activities (excluding Head office and management consultancy) in London in 2014

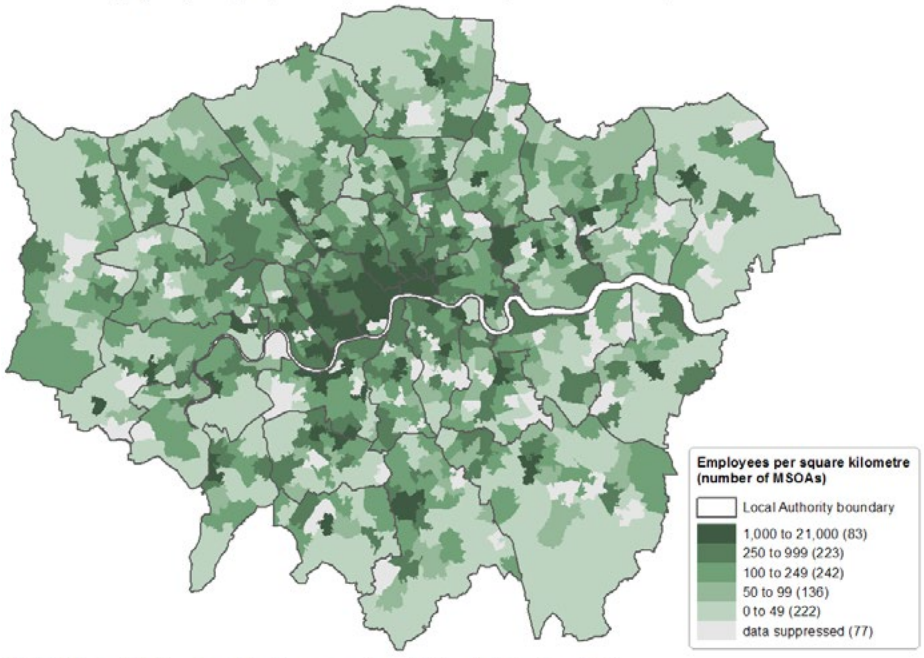


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics
Contains National Statistics data © Crown copyright and database right 2015
Contains Ordnance Survey data © Crown copyright and database right 2015. Ordnance Survey 100032216

Source: IDBR

Map 2.28 shows employees in Retail (excluding motor services) being concentrated in Central London but with other areas of concentration spread across the whole of London and often associated with the various town centres in the capital.

Map 2.28: Employee concentration in Retail (excluding motor services) in London in 2014

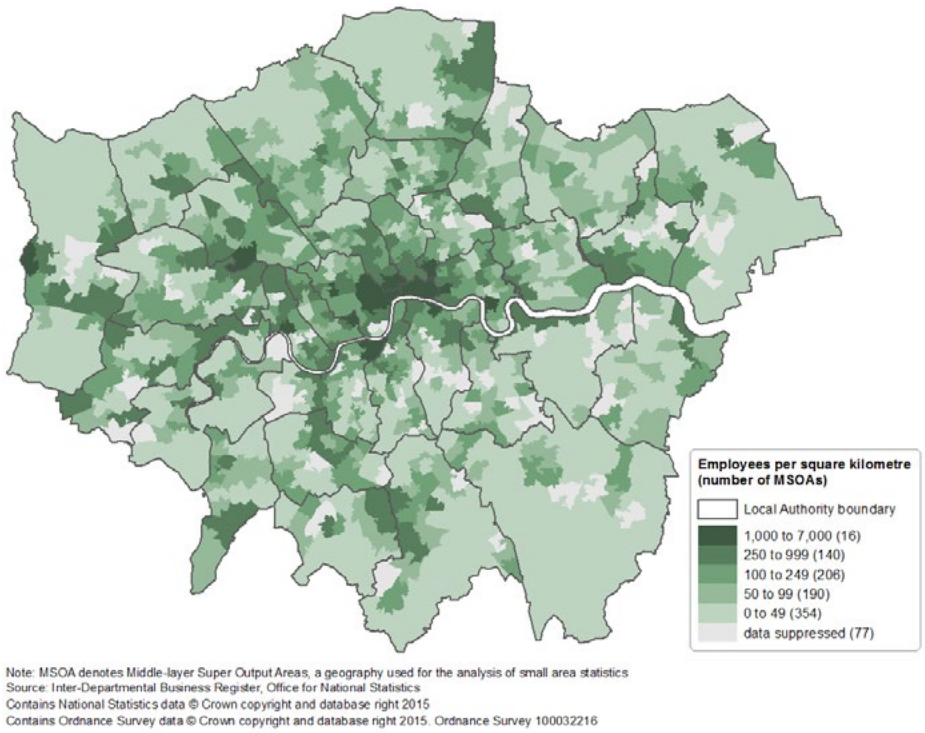


Note: MSOA denotes Middle-layer Super Output Areas, a geography used for the analysis of small area statistics
Source: Inter-Departmental Business Register, Office for National Statistics
Contains National Statistics data © Crown copyright and database right 2015
Contains Ordnance Survey data © Crown copyright and database right 2015. Ordnance Survey 100032216

Source: IDBR

Finally, Map 2.29 shows that employees in Wholesale (including motor services) are concentrated in a broad swathe of Central and West London and around Heathrow. While other areas are visible in Barking and Dagenham, Bexley, Croydon, Enfield, Greenwich, Harrow, Havering, Hounslow, Kingston upon Thames, and Sutton.

Map 2.29: Employee concentration in Wholesale (including motor services) in London in 2014



Source: IDBR

2.7 London's links

This section examines the links to London of those areas economically tied to the capital including those that lie well beyond the Greater London boundary, as well as looking at what links London together. It begins by examining commuter flows into London. It then moves on to transport which is an important area as London faces a number of issues which might be considered as reflecting the 'costs of congestion'. These include: a shortage of housing; shortage of school places; congestion/excessive crowding on public transport; and, air/noise pollution. It is notable that all of these issues involve the public sector in some shape or form – suggesting public policy has a potentially significant role to play.

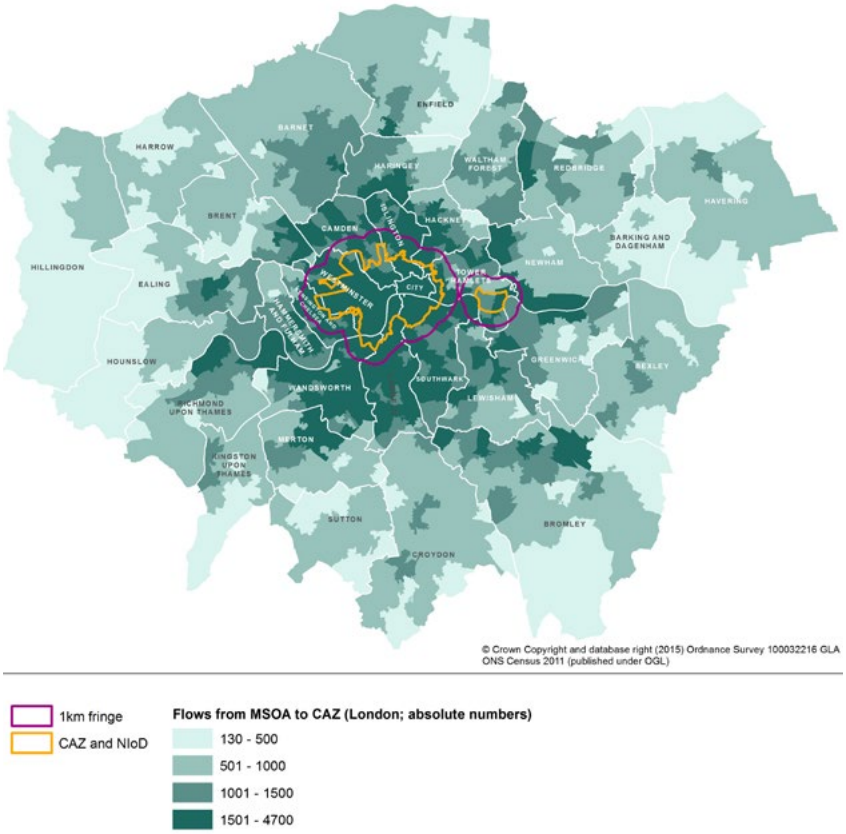
2.7.1 London's commuter geography

London sees commuters flowing into it from the wider South East and beyond but also sees much internal travel between different areas of the capital. This sub section looks at these commuters in some detail.

2.7.1.2 Commuters into the CAZ

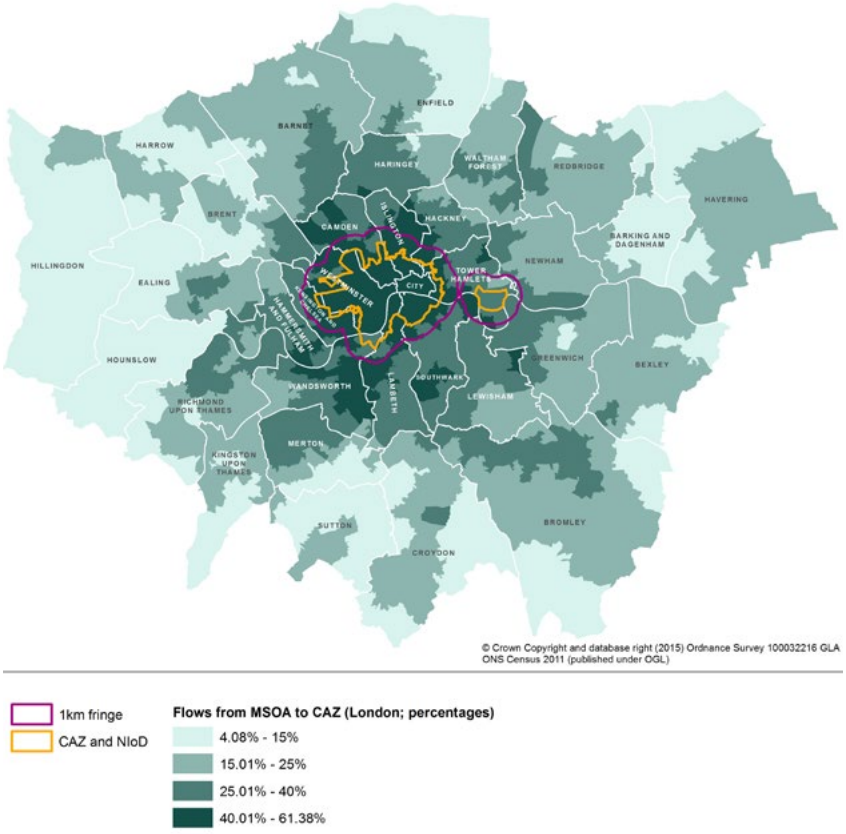
A larger number of people both within London and the wider Greater South East work in the CAZ and need to commute into it every work day. Maps 2.30 and 2.32 show worker residence data for the CAZ on a map of London and the Greater South East respectively at the Middle Layer Super Output Area (MSOA) level and indicates the importance of certain areas for workers into the CAZ. In addition, Maps 2.31 and 2.33 show the number of workers coming from different MSOAs as a percentage of the areas workforce indicating the importance of the CAZ as an employment destination for these areas. The patterns shown in these maps are consistent with the TTWA for London analysed earlier in the chapter, which showed less reliance of West London on the CAZ, with a separate TTWA for Heathrow and West London compared to the rest of the capital.

Map 2.30: Workers in CAZ only based workplaces by residence origin in London, 2011, absolute numbers



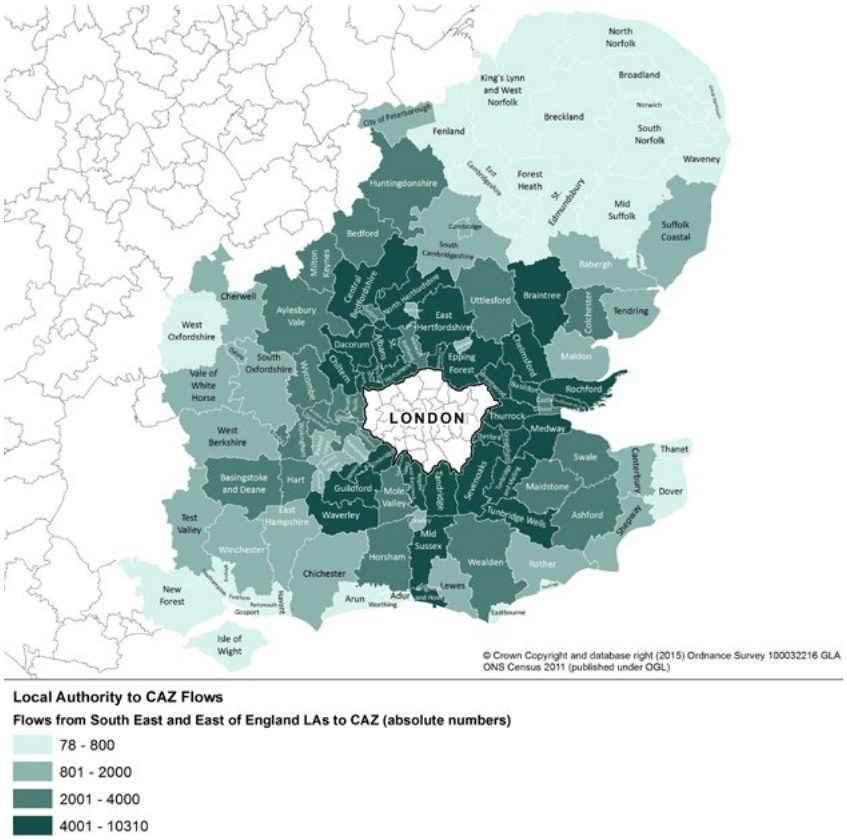
Source: Census and GLA Intelligence Unit analysis

Map 2.31: Workers in CAZ only based workplaces by residence origin in London, 2011, as percentage of an areas workforce



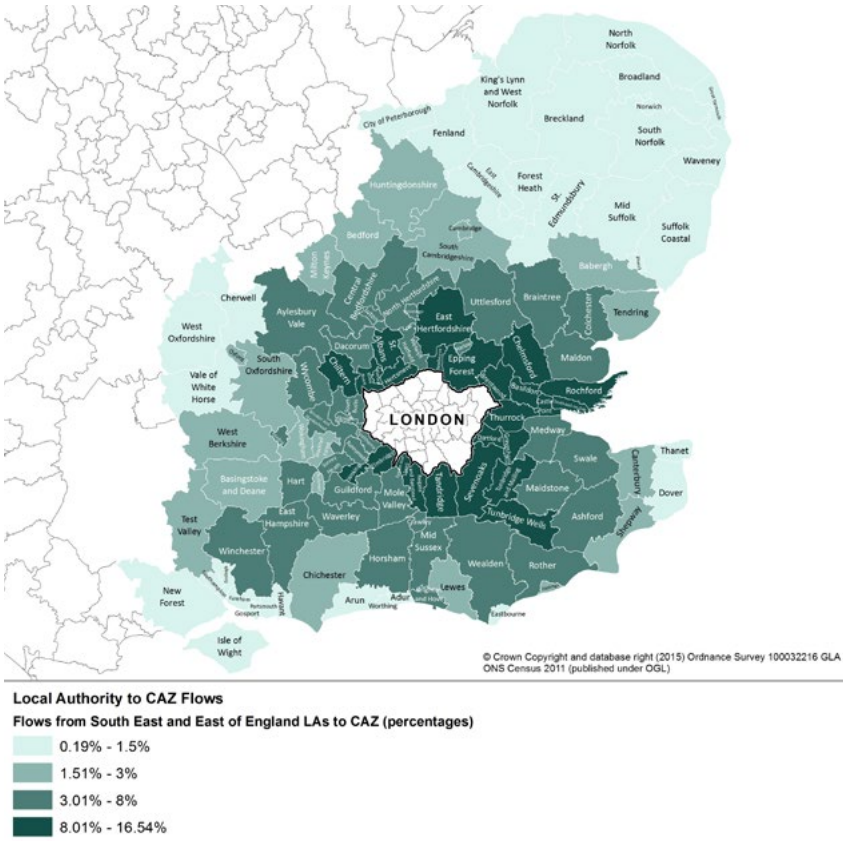
Source: Census and GLA Intelligence Unit analysis

Map 2.32: Workers in CAZ only based workplaces by residence origin in the Greater South East (excluding London), 2011, absolute numbers



Source: Census and GLA Intelligence Unit analysis

Map 2.33: Workers in CAZ only based workplaces by residence origin in the Greater South East (excluding London), 2011, as percentage of an areas workforce

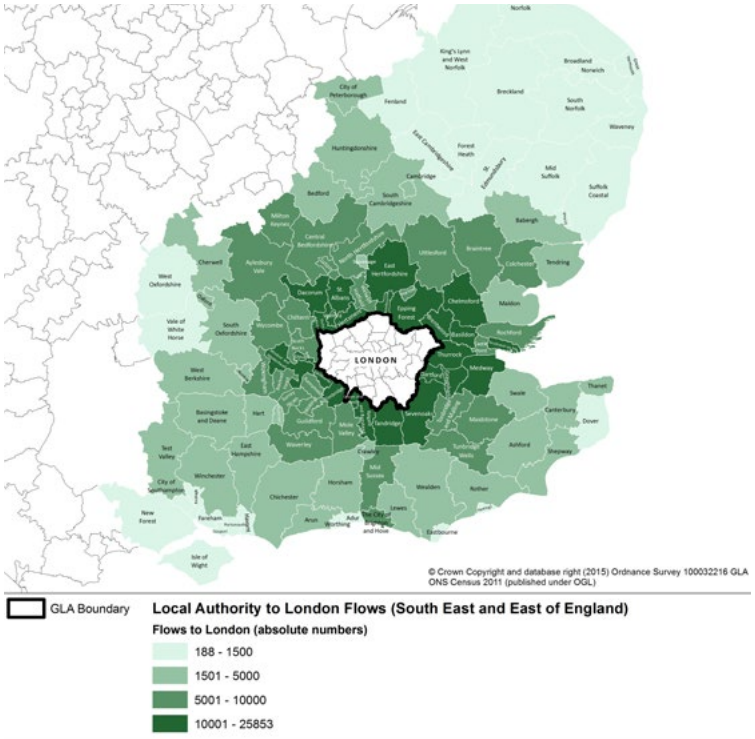


Source: Census and GLA Intelligence Unit analysis

2.7.1.3 Commuters into London as a whole

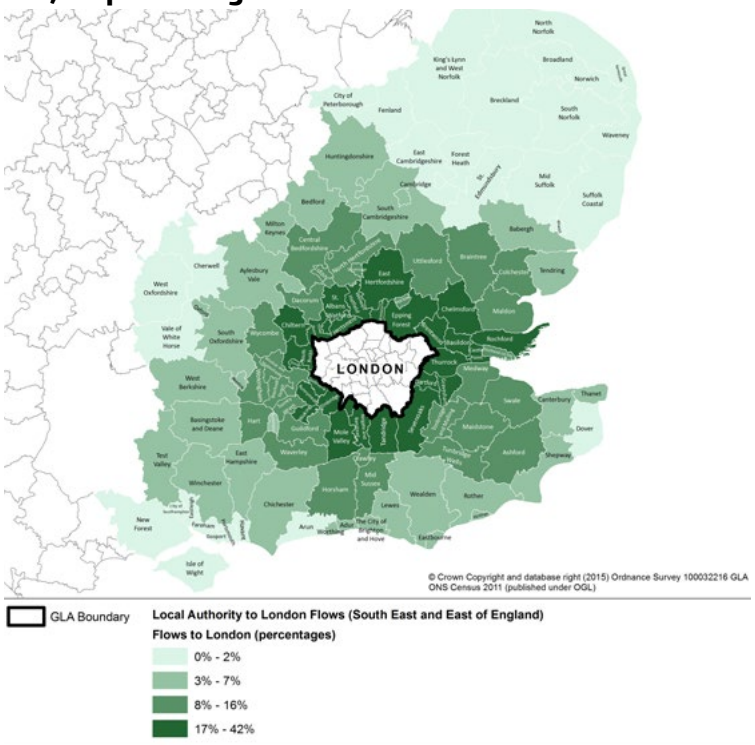
London is an important work destination for people living in the Greater South East outside of London with Map 2.34 showing the absolute number of workers an area provides to London and Map 2.35 showing the percentage of an areas workforce that work in London.

Map 2.34: Workers in London based workplaces by residence origin in the Greater South East (excluding London), 2011, absolute numbers



Source: Census and GLA Intelligence Unit analysis

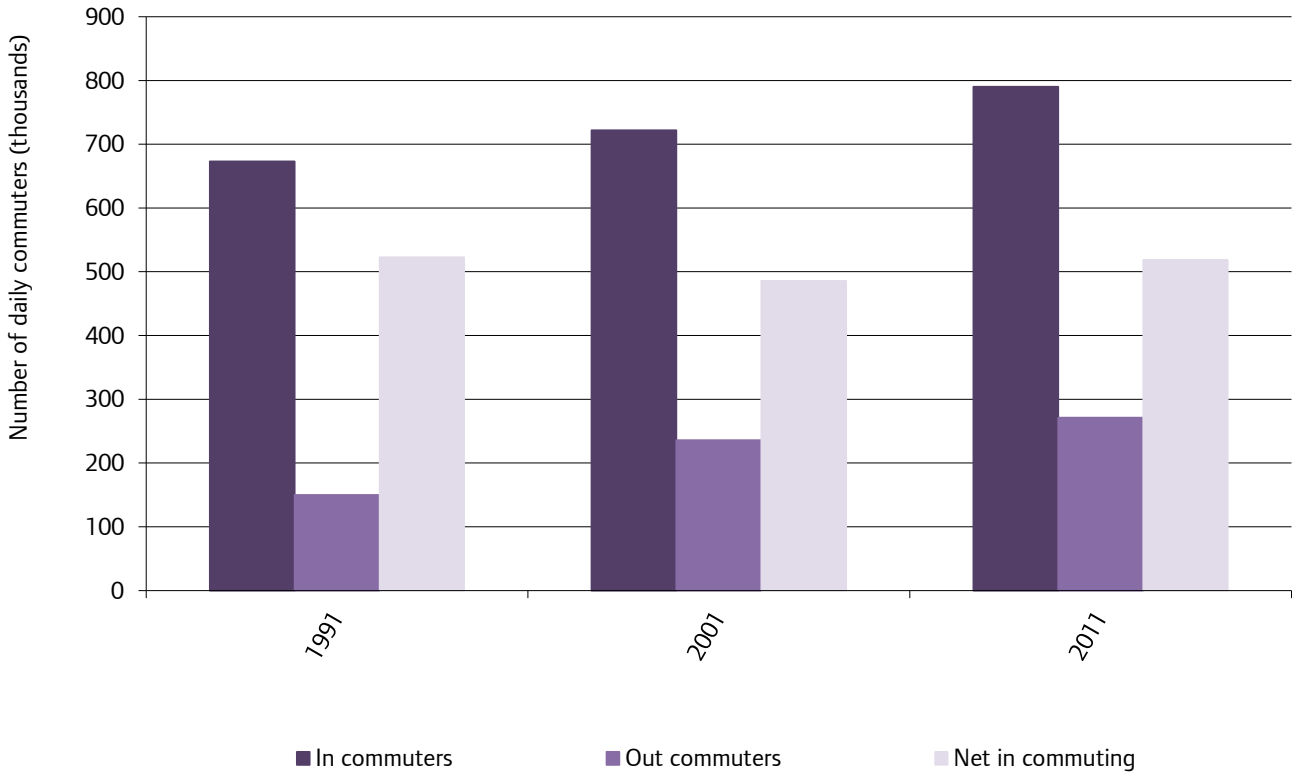
Map 2.35: Workers in London based workplaces by residence origin in the Greater South East (excluding London), 2011, as percentage of an areas workforce



Source: Census and GLA Intelligence Unit analysis

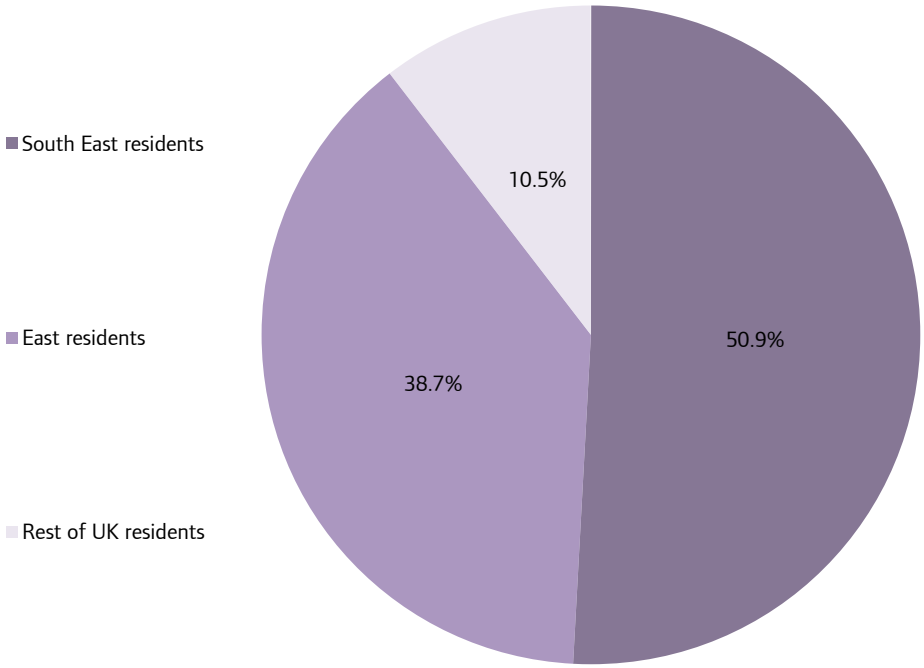
Figures 2.1 to 2.3 examine London's commuters in more detail; with Figure 2.1 showing the steady increase in out and in-commuting that has occurred since 1991. While Figure 2.2 shows that most but not all commuters in London come from the Greater South East. In looking at the source and characteristics of commuters in to London, Transport for London (TfL) observes that "unsurprisingly, the local authorities hosting the largest numbers of commuters into London are those closest to the London boundary, such as Epping Forest, Thurrock, and St Albans. Outside of the South East and East regions, Wiltshire was the local authority with the highest number of commuters to London". TfL further notes that "commuters from outside London tend to be older on average than London workers – 44 per cent are aged 35 to 49 and more than 20 per cent are aged over 50. The vast majority also use one of two modes of transport to travel to London, with 45 per cent travelling by rail and 40 per cent by car. Commuting into London by train is much more common if the workplace is in Inner (including Central) London, whereas car dominates in outer London workplaces. For example, 85 per cent of (non-resident) commuters to the London borough of Hillingdon travel by car"[25].

Figure 2.1: Long term trend in commuting to and from London



Source: Census via TfL – Travel in London 7

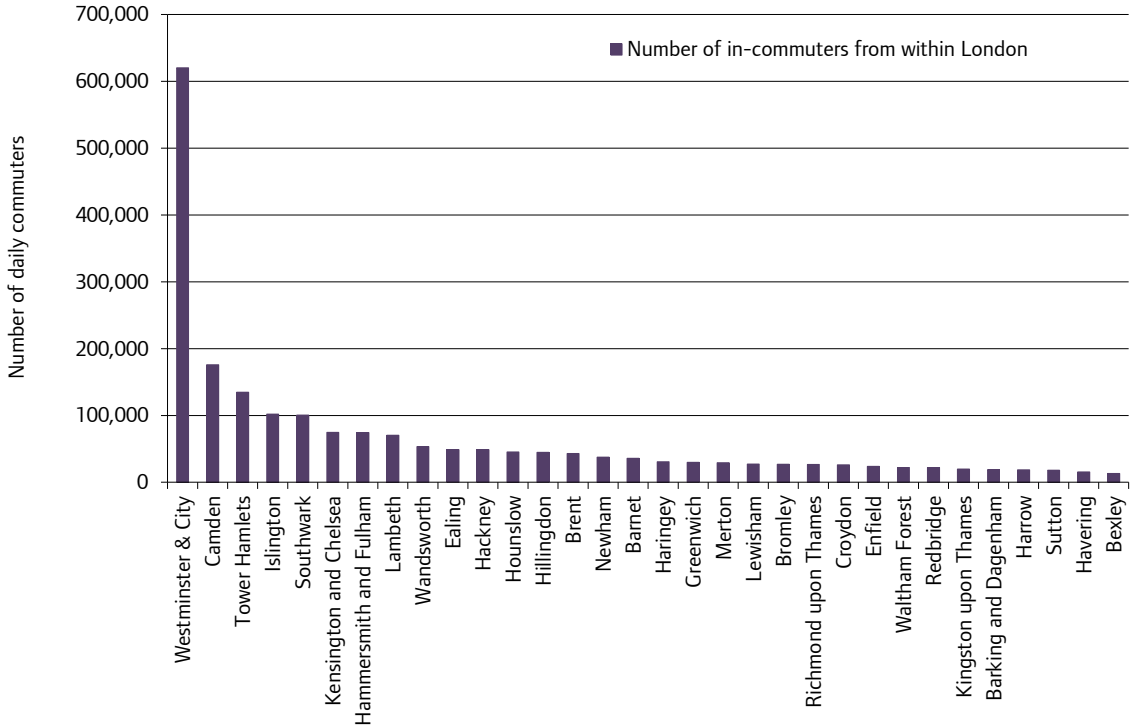
Figure 2.2: Proportion of commuters into London by region of residence, 2011



Source: Census via TfL – Travel in London 7

Looking at commuters within London itself TfL observe that "the majority of London residents that work in London are employed in a different borough to where they live – just over 71 per cent"[26]. However, as can be seen from Figure 2.3, Inner London boroughs dominate as a destination for commuters from within London with nearly 30 per cent of total commuters in London commuting to Westminster and the City.

Figure 2.3: Commuting inflows from within London by borough, 2011. London residents only

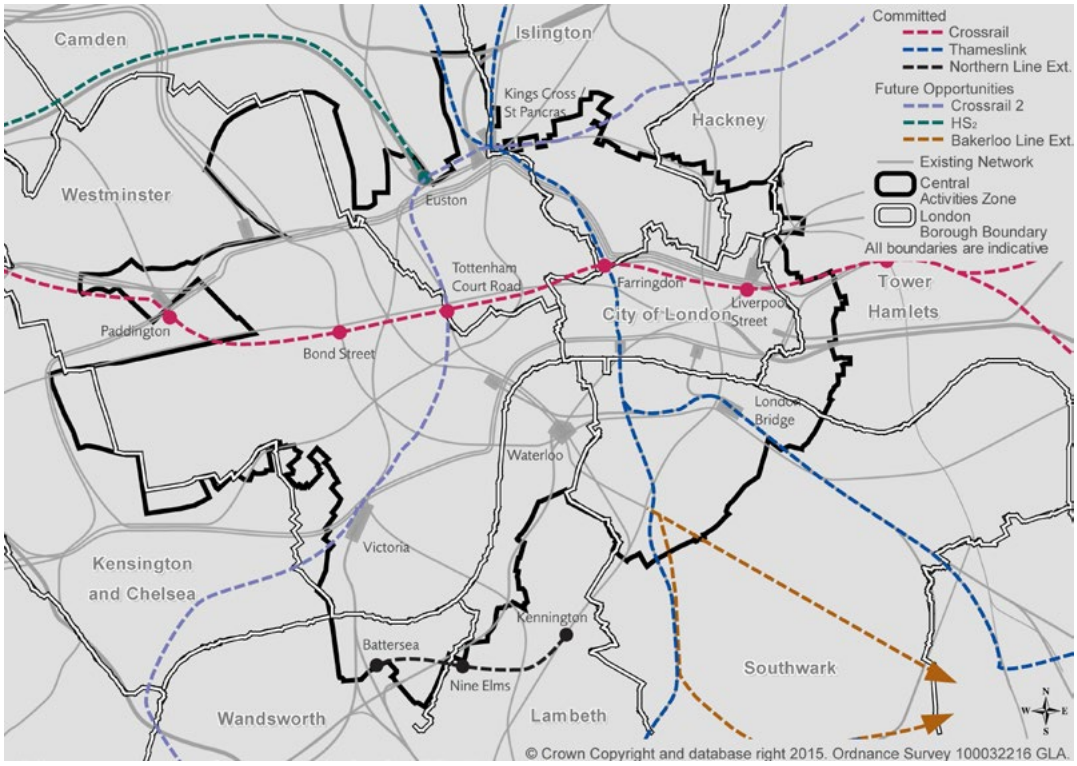


Source: Census via TfL – Travel in London 7

2.7.2 Transport in the CAZ

Public transport is vital for the functioning of the CAZ, with it being the only realistic way in which to provide to transport for a significant part of its large workforce into such a confined area. Thus the CAZ is well serviced by public transport, with this likely to improve in the future as a number of public transport schemes are in the process of being built, have been committed to or proposed as shown by Map 2.36.

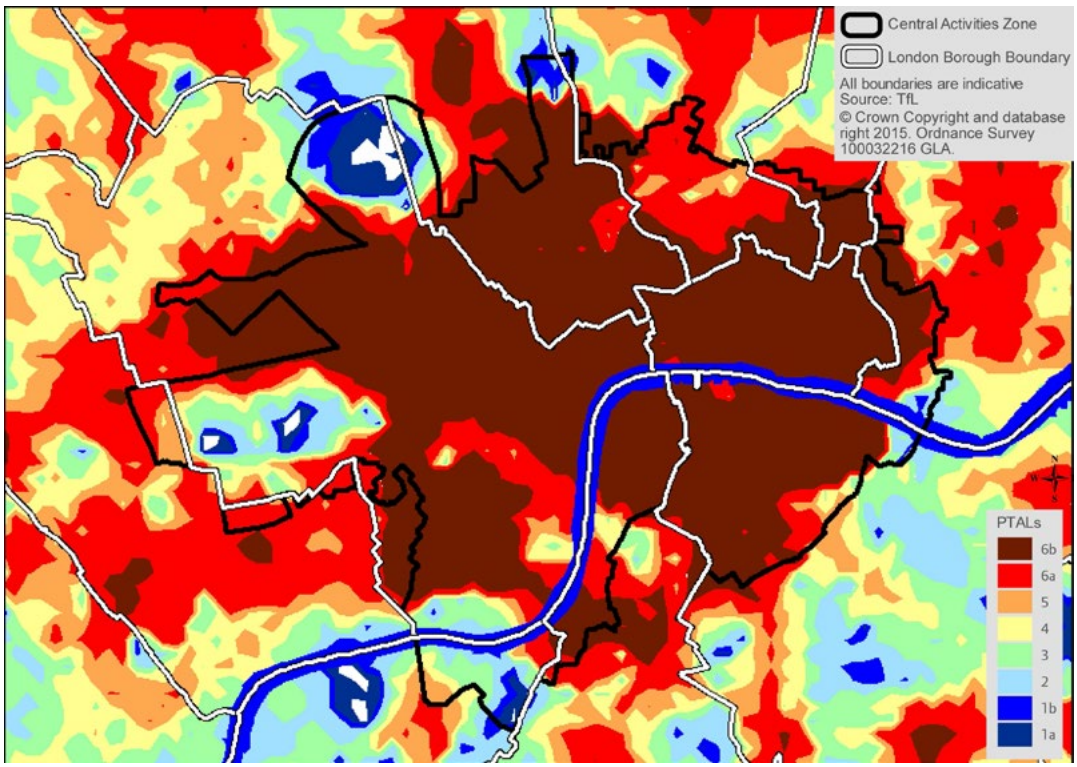
Map 2.36: Major public transport infrastructure schemes including committed and future opportunities



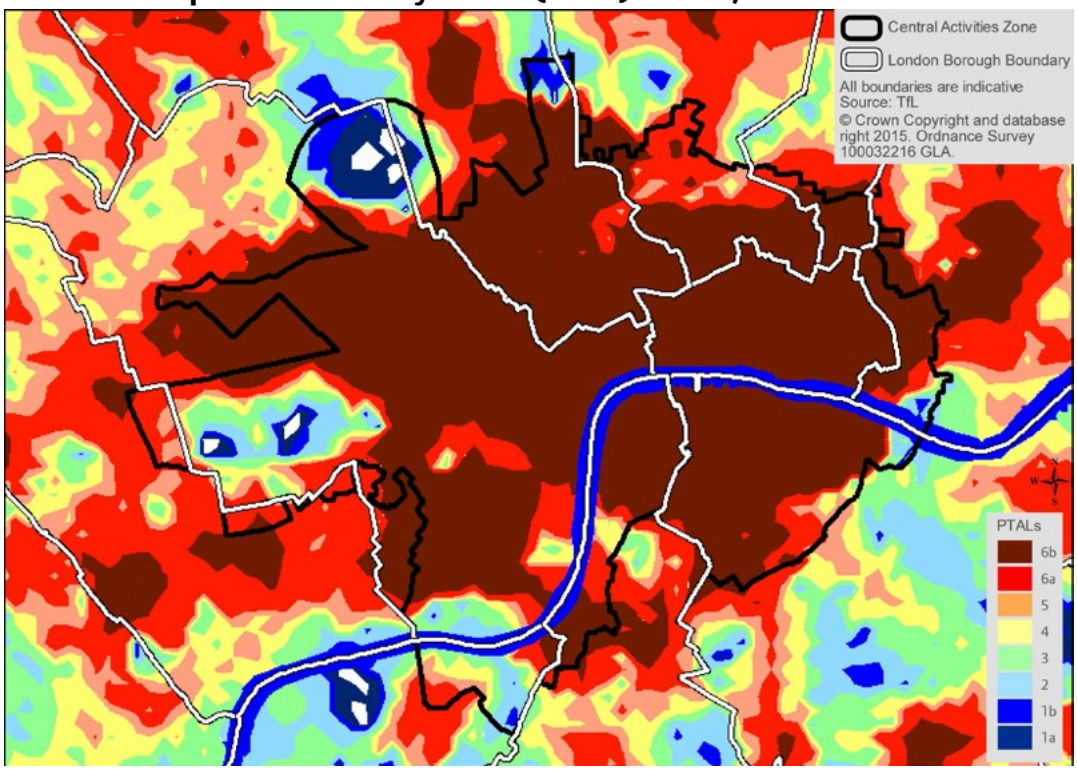
Source: GLA & TfL

Maps 2.37a and 2.37b below illustrate the transport situation in 2015 and that projected for 2021 for public transport access levels (PTAL) in the CAZ incorporating the phasing of committed public transport projects. It should be noted that the high levels of public transport connectivity in the CAZ supports the close integration of transport and development of this area.

Map 2.37a: Public Transport Accessibility Levels (PTAL) in CAZ, 2015



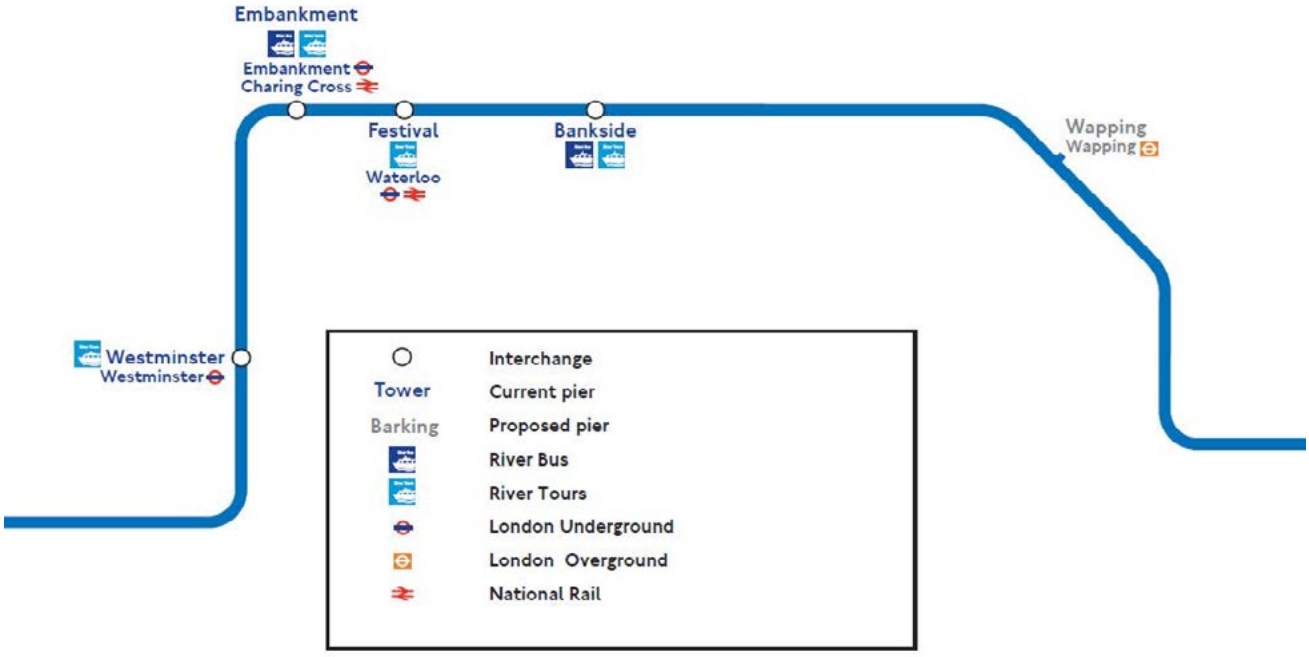
Map 2.37b: Public Transport Accessibility Levels (PTAL) in CAZ, 2021



Source: GLA & TfL

The River Thames provides a number of transport solutions and Map 2.38 highlights plans for the extension of piers at Westminster, Embankment and Bankside. There is also potential to bring Wapping Pier back into use as a river bus stop and TfL is also considering the feasibility of the re-development of Festival Pier, including increasing its size and capacity.

Map 2.38: Location of piers with proposed improvements and potential new pier in Central London

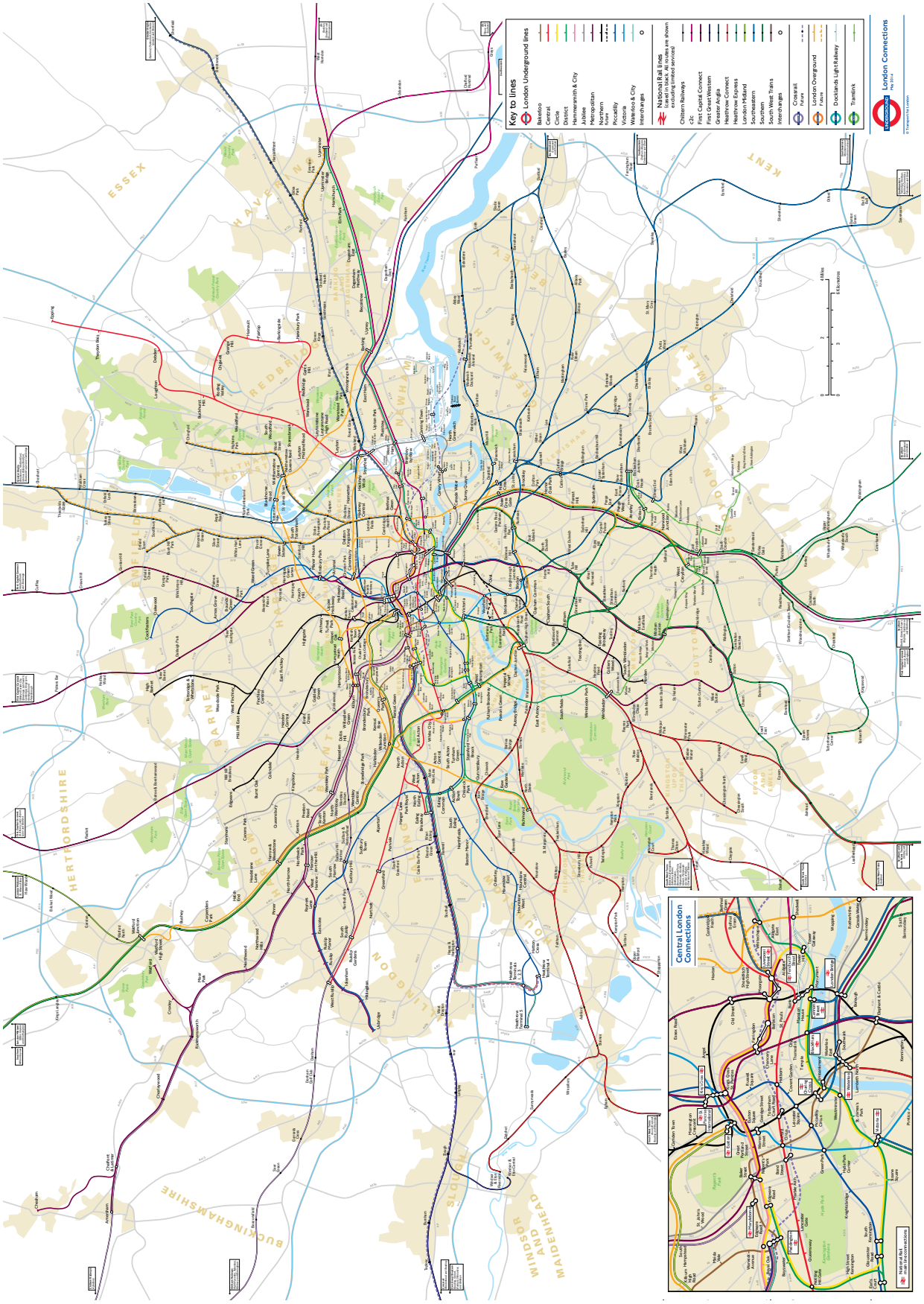


Source: GLA & TfL

2.7.3 Transport in London as a whole

The transport connections in wider London are extensive and snake into the wider South East as highlighted by Map 2.39, which shows the rail and tube routes in London and the surrounding geographies.

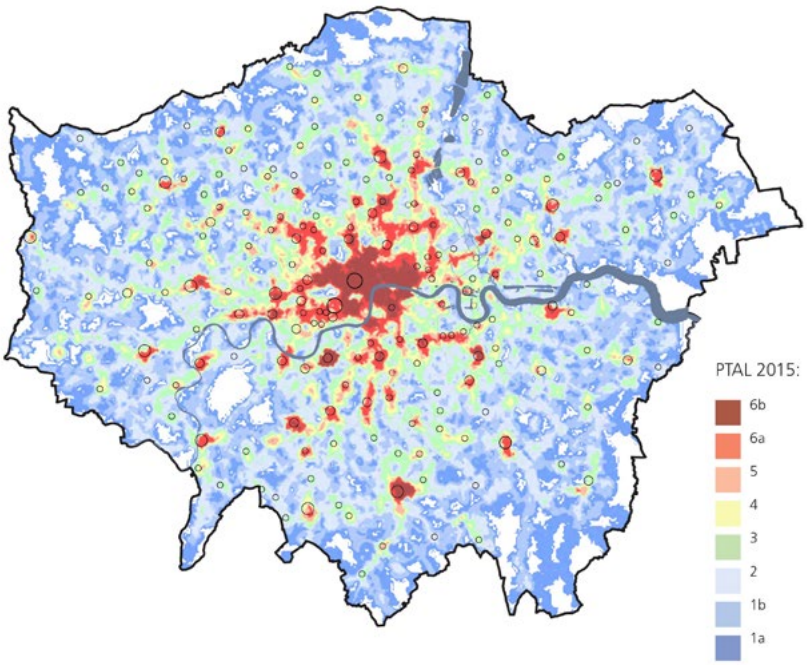
Map 2.39: Geographically accurate tube and rail map



Source: TfL[27]

However, although London's transport network is extensive as shown by Map 2.40, the PTAL across London is variable. It is the case though, as highlighted by the circles on the map, that public transport accessibility in London's town centres is generally quite high. Further, recent research for the GLA has found that "in terms of improvements in PTAL ratings there is one centre - St John's Wood – where the PTAL rating between 2009-2020 is estimated to rise from 4 to 6a and a further four centres where the PTAL rating is projected to rise from 5 to 6a: Canada Water, Chiswick, Dalston and Kentish Town. Centres with improved accessibility are centres that are likely to be able to absorb greater capacity"[28]. In terms of visits to town centres recent research for TfL has found that the "bus is the most widely used mode to travel to most town centres. Overall, 34 per cent use the bus on the day of visit. Bus use is lower to travel to Central London, where tube use is greater"[29].

Map 2.40: PTAL in London with highlighted town centres, 2015

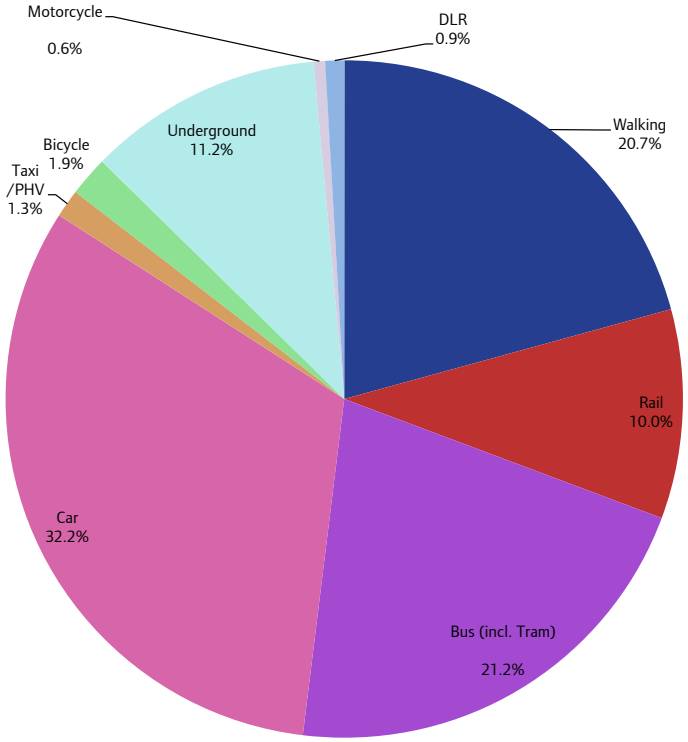


Source: GLA

Looking at the mode of transport used in London as a whole it can be seen from Figure 2.4 that private vehicle transport only accounts for around a third of daily journeys, with its share having declined significantly over recent years as is shown in Table 2.6. This is perhaps unsurprising given that low average traffic speed in London have been consistent for some time and would suggest that the road system is at near capacity thus limiting the ability of car use to take up the increase in travel demand that has been seen in London.

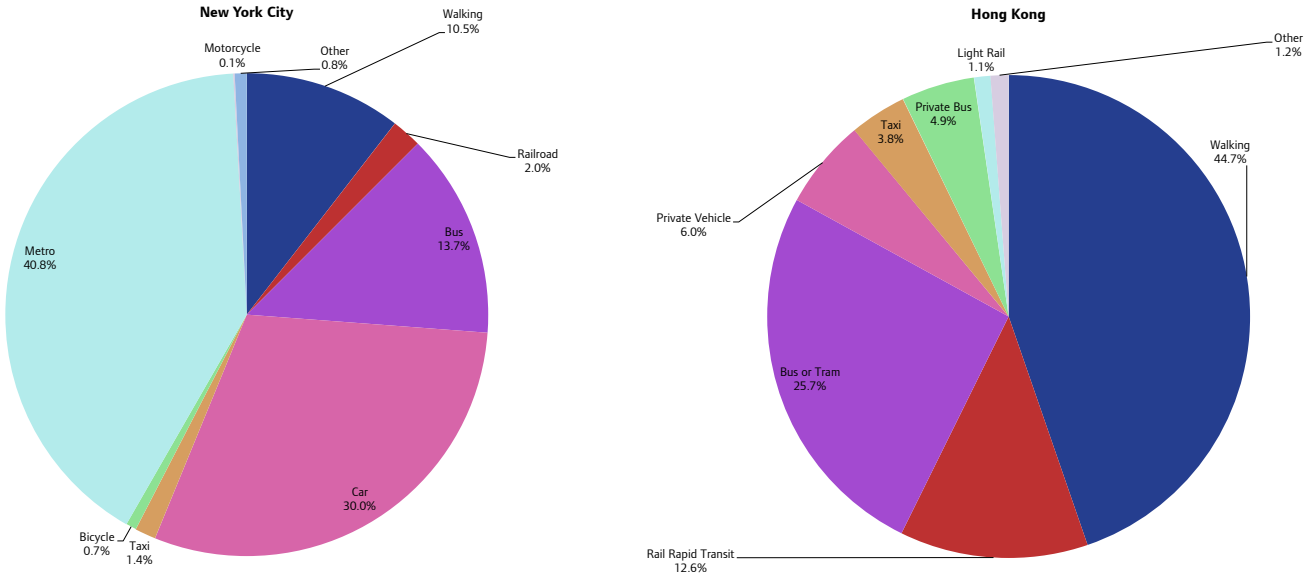
Large sections of Inner London are within 45 minutes public transport travel time of a significant number of jobs as is shown by Map 2.41, whereas Map 2.42 shows population accessibility by public transport. Placing this into an international context, Figure 2.5 shows how London's transport modes compare to two other global cities, New York and Hong Kong and shows the differing importance of transport modes between the cities, highlighting the importance of public transport in global cities. Of particular interest is the importance of walking in Hong Kong's relatively small but highly densely populated environment.

Figure 2.4: Transport modal shares of daily journey stages in London, 2013



Source: TfL – Travel in London 7

Figure 2.5: Transport modal shares in comparison cities[30]



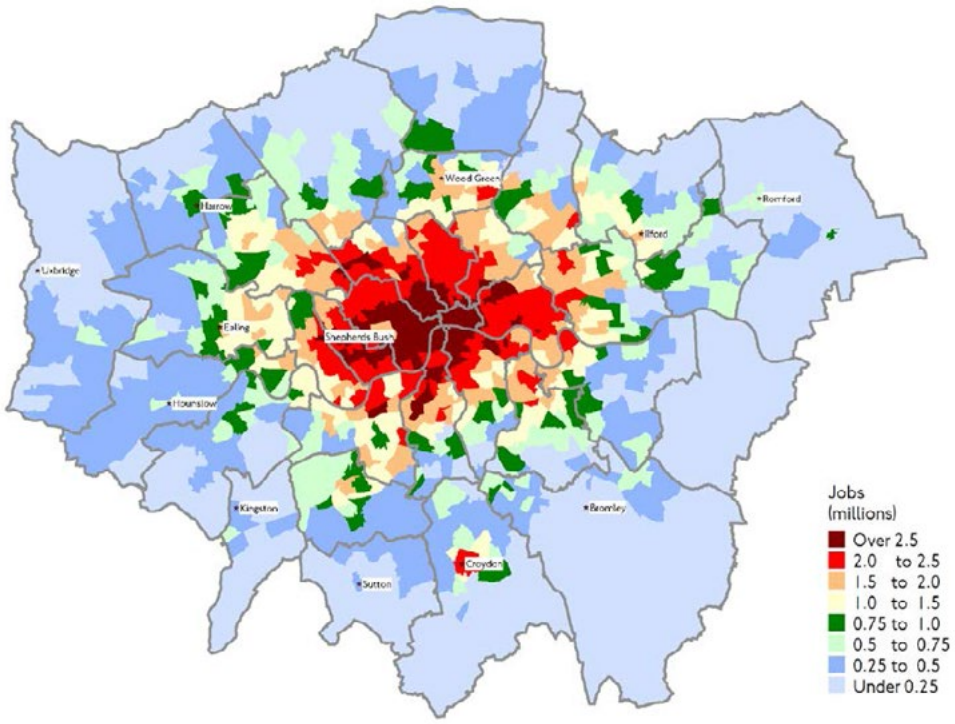
Source: LSE, urban age project[31]

Table 2.6: Percentage shares of journey stages by type of transport, 1993 to 2013

	Public Transport	Private Transport	Cycle	Walk
1993	30%	46%	1%	22%
1994	30%	46%	1%	22%
1995	31%	46%	1%	22%
1996	31%	46%	1%	22%
1997	32%	45%	1%	22%
1998	33%	45%	1%	22%
1999	33%	44%	1%	22%
2000	34%	43%	1%	21%
2001	35%	43%	1%	22%
2002	35%	42%	1%	21%
2003	37%	41%	1%	21%
2004	38%	39%	1%	21%
2005	38%	39%	2%	21%
2006	39%	39%	2%	21%
2007	41%	37%	2%	20%
2008	42%	36%	2%	21%
2009	42%	35%	2%	21%
2010	43%	35%	2%	21%
2011	43%	34%	2%	21%
2012	44%	33%	2%	21%
2013	45%	33%	2%	21%

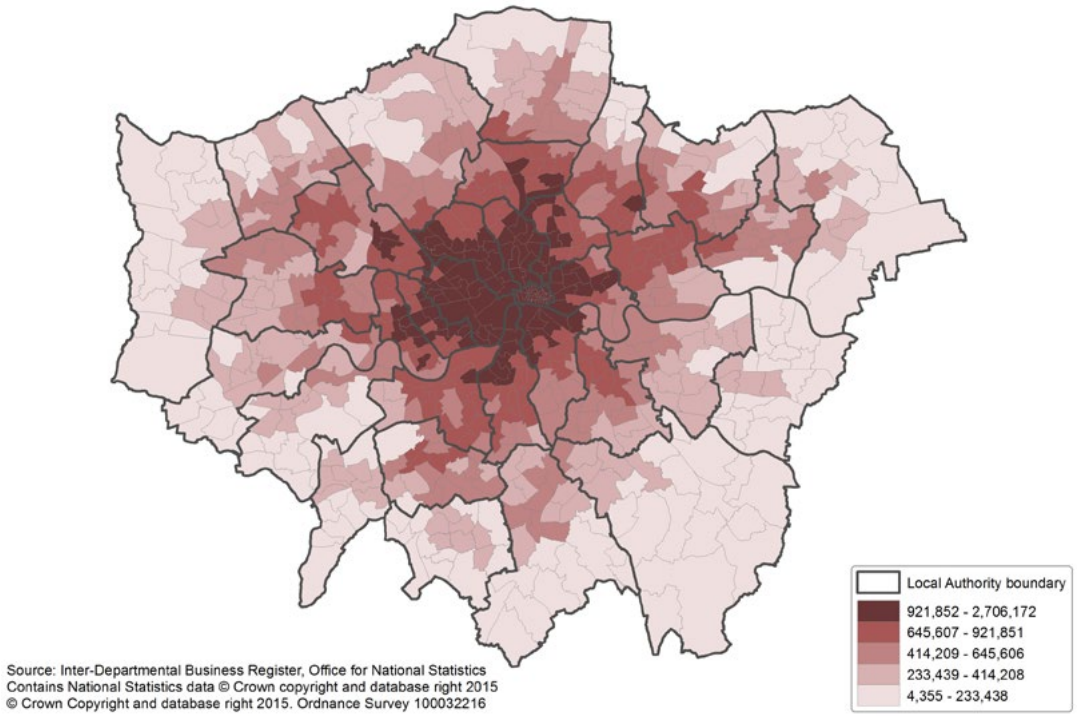
Source: TfL – Travel in London 7

Map 2.41: Number of jobs available by mass public transport within 45 minutes travel time, 2012



Source: TfL – Travel in London 7

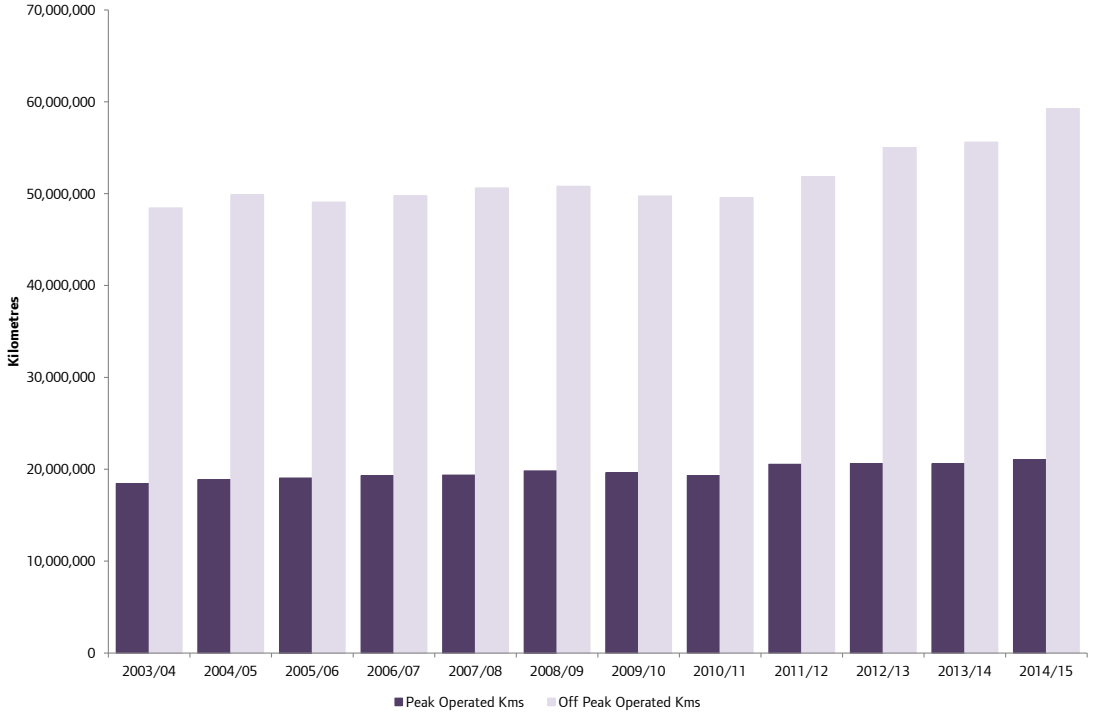
Map 2.42: Population accessibility by public transport within 45 generalised minutes, by ward in London



Source: GLA Intelligence Unit

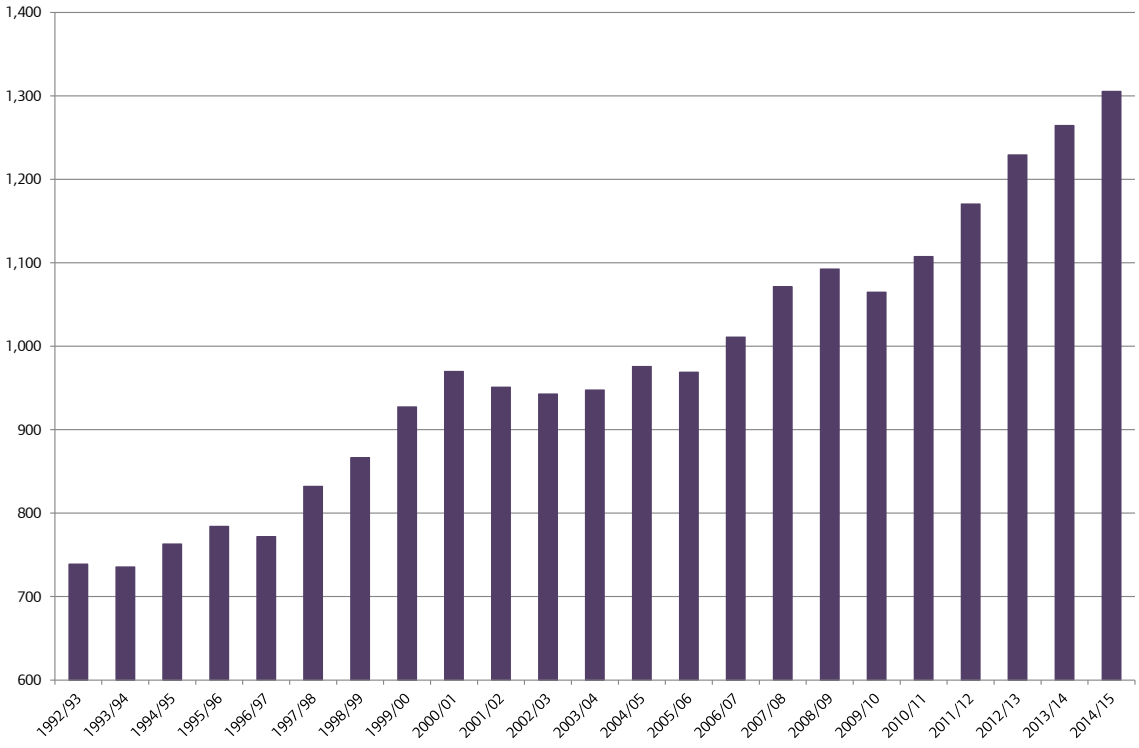
With respect to the Tube Figure 2.6 shows that operated kilometres on the Underground network in both peak and off peak times continues to rise. This increase in capacity has been matched by an increase in the number of passenger journeys as shown by Figure 2.7. While the service has also seen an improvement in reliability "with a 43 per cent reduction in the amount of time customers lost to delays in five years" meaning that "in the five years since 2008/09, the total was cut from more than 36 million lost customer hours to less than 21 million if the impact of industrial action is excluded"[32]. The underground has also seen a reduction in average journey time as shown by Figure 2.8, with TfL noting that "across the Tube network as a whole, the average journey is now almost two minutes faster than it was in 2008/09, thanks to faster scheduled journey times and a reduction in delays"[33]. Finally, Figure 2.9 provides a longer time series of passenger journeys and shows that the growth in passenger kilometres and journey stages on London Underground has been ongoing since at least the late 1980s to early 1990s.

Figure 2.6: Operated kilometres on the London Underground



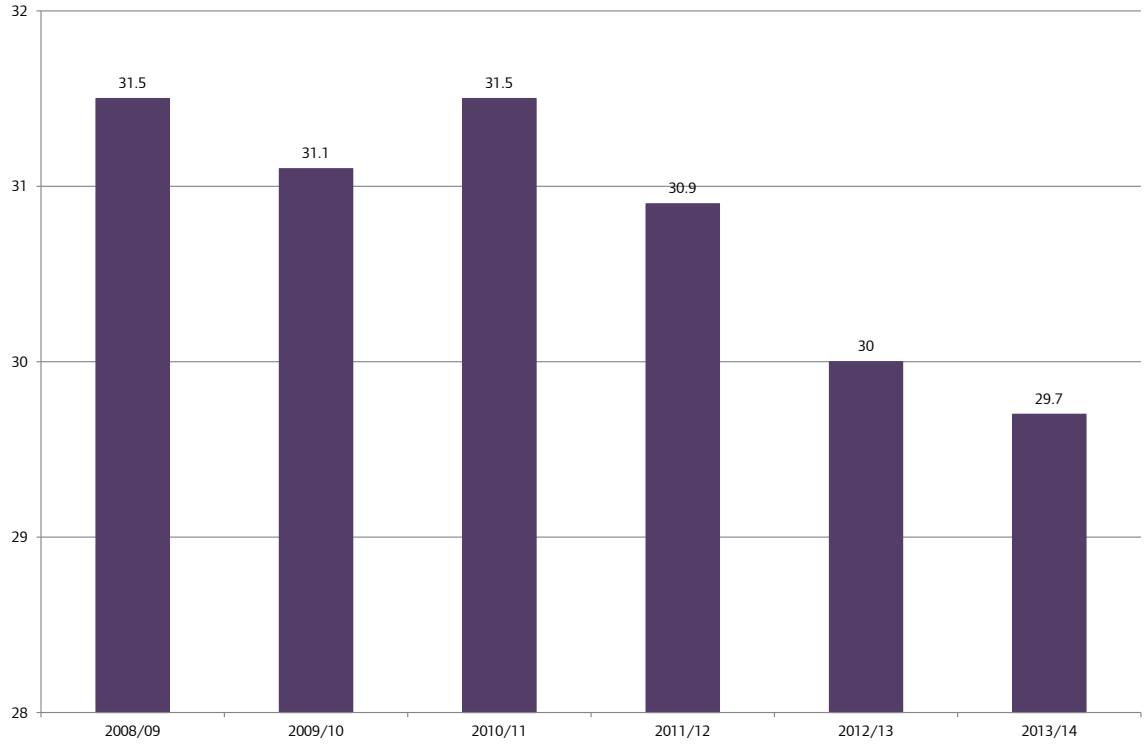
Source: TfL

Figure 2.7: London underground passenger journeys (millions)



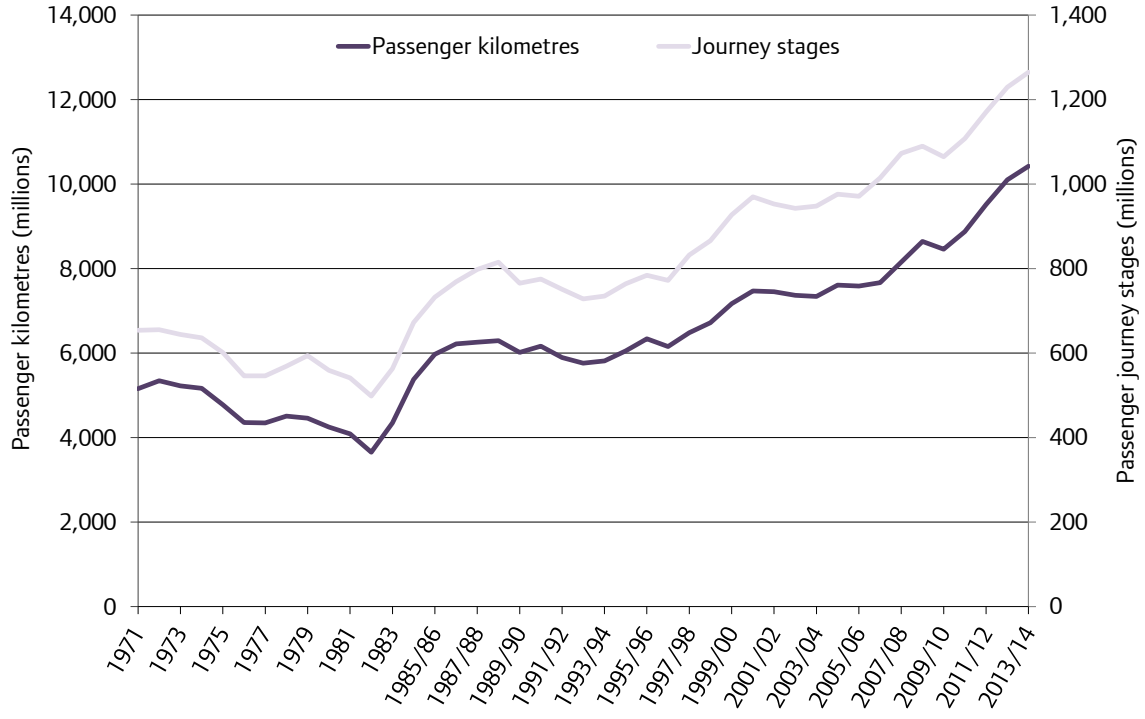
Source: TfL

Figure 2.8: Average journey times on the London Underground (minutes)



Source: TfL

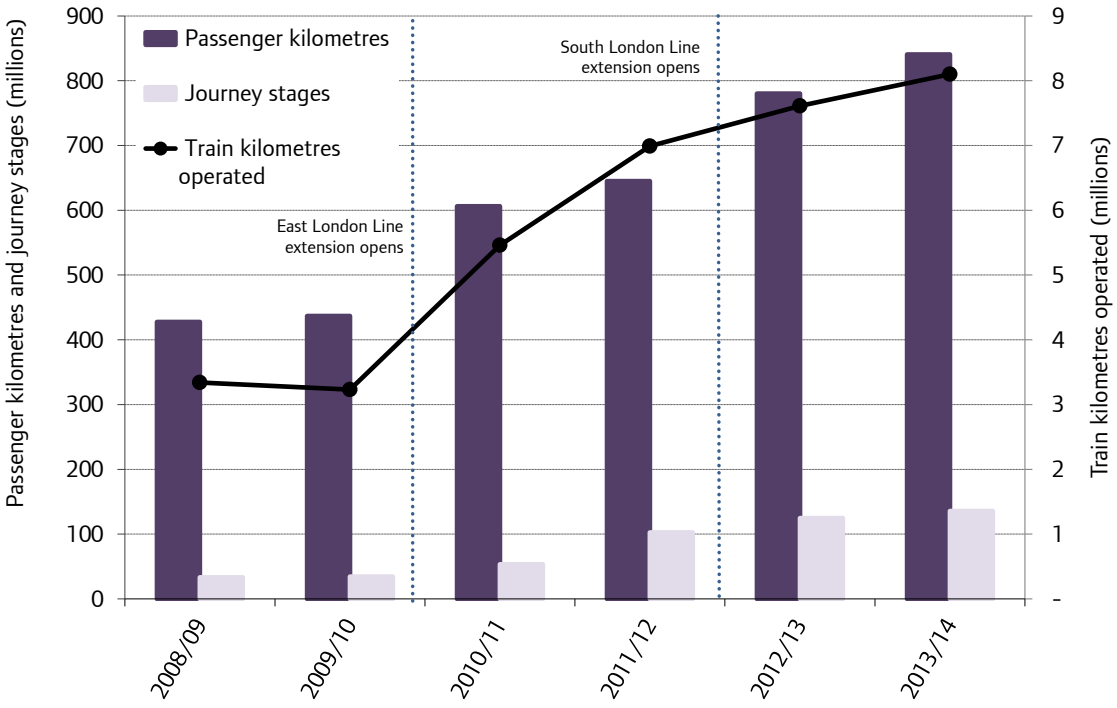
Figure 2.9: Passenger kilometres and journey stages by Underground



Source: TfL – Travel in London 7

Looking beyond the Underground, Figure 2.10 shows the importance of continued transport innovation as shown by the rapid growth of London Overground journeys since the inception of the service. This highlights the pent-up demand that exists for rail travel within London this demand is also present in the Greater South East as shown by Table 2.7.

Figure 2.10: Passenger kilometres and journey stages by London Overground



Source: TfL – Travel in London 7

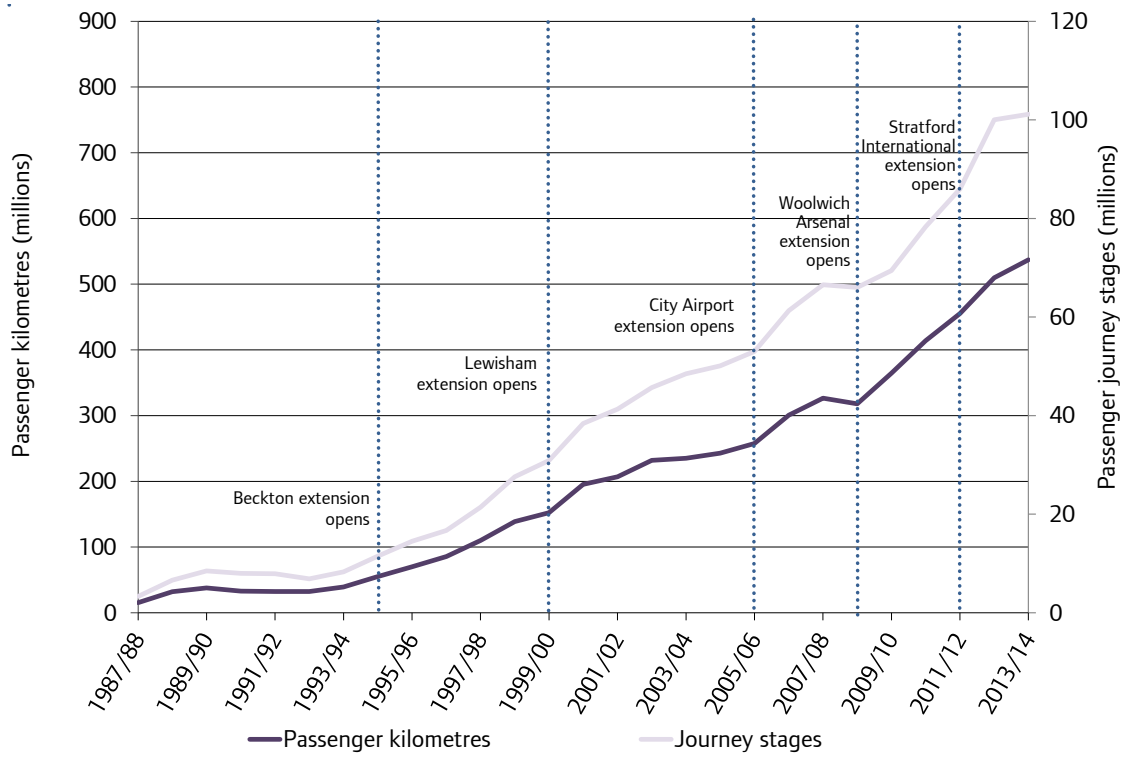
Table 2.7: Passenger kilometres and passenger journey stages by National Rail – operators classified by the Office of Rail Regulation as London and South East operators

Year	Passenger kilometres (billions)	Year-to- year percentage change	Passenger journeys (millions)	Year-to- year percentage change
1998/99	17.1	..	616	..
1999/00	18.4	7.6%	639	3.6%
2000/01	19.2	4.3%	664	4.0%
2001/02	19.3	0.5%	663	-0.1%
2002/03	19.8	2.6%	679	2.4%
2003/04	20.1	1.7%	690	1.6%
2004/05	20.5	1.9%	704	2.1%
2005/06	20.7	1.1%	720	2.2%
2006/07	22.2	7.1%	769	6.9%
2007/08	23.5	6.1%	828	7.7%
2008/09	24.2	2.9%	854	3.1%
2009/10	23.8	-1.8%	842	-1.4%
2010/11	25.0	5.2%	918	9.0%
2011/12	26.5	5.7%	994	8.3%
2012/13	27.4	3.4%	1,033	3.9%
2013/14	28.6	4.4%	1,107	7.2%

Source: Office of Rail regulation via TfL – Travel in London 7

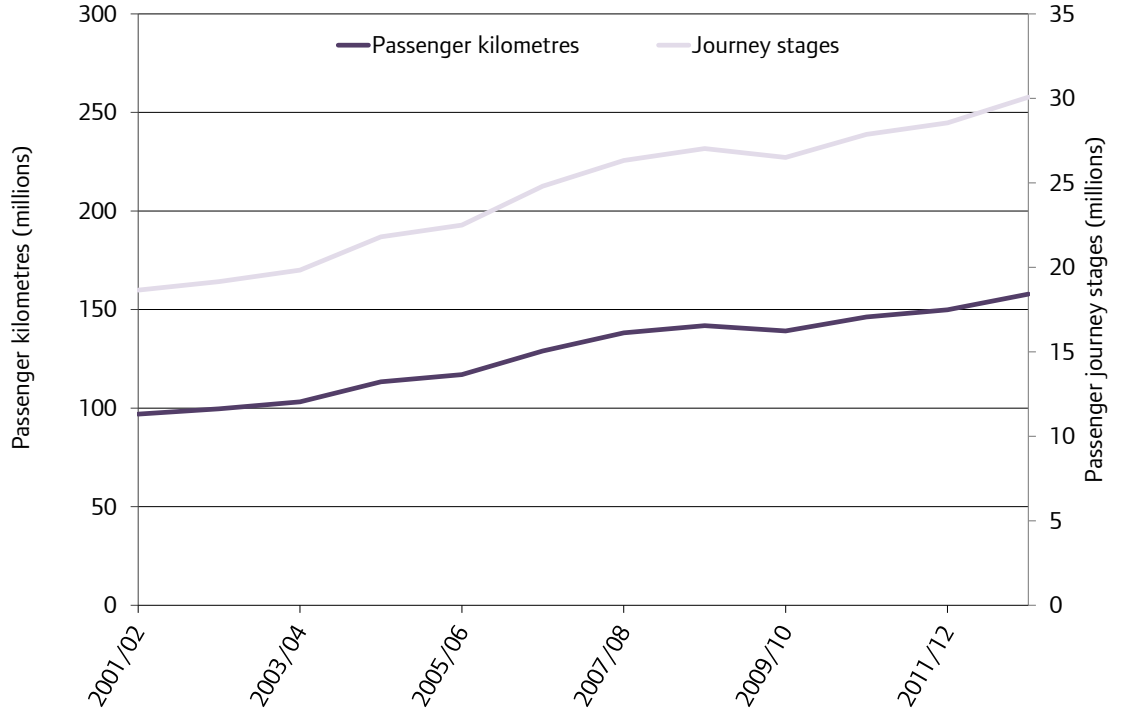
However, growth in demand for the use of public transport is not restricted to the Tube and rail services as highlighted by Figures 2.11 to 2.13 which show the growth in usage of the DLR, Tramlink, and bus services. While, Table 2.8 highlights the growth in trips in recent years, and in particular highlights the strong growth in bus, rail, and Tube usage. Table 2.9 demonstrates that cycling has become an increasingly popular mode of transport in the city.

Figure 2.11: Passenger kilometres and journey stages by DLR



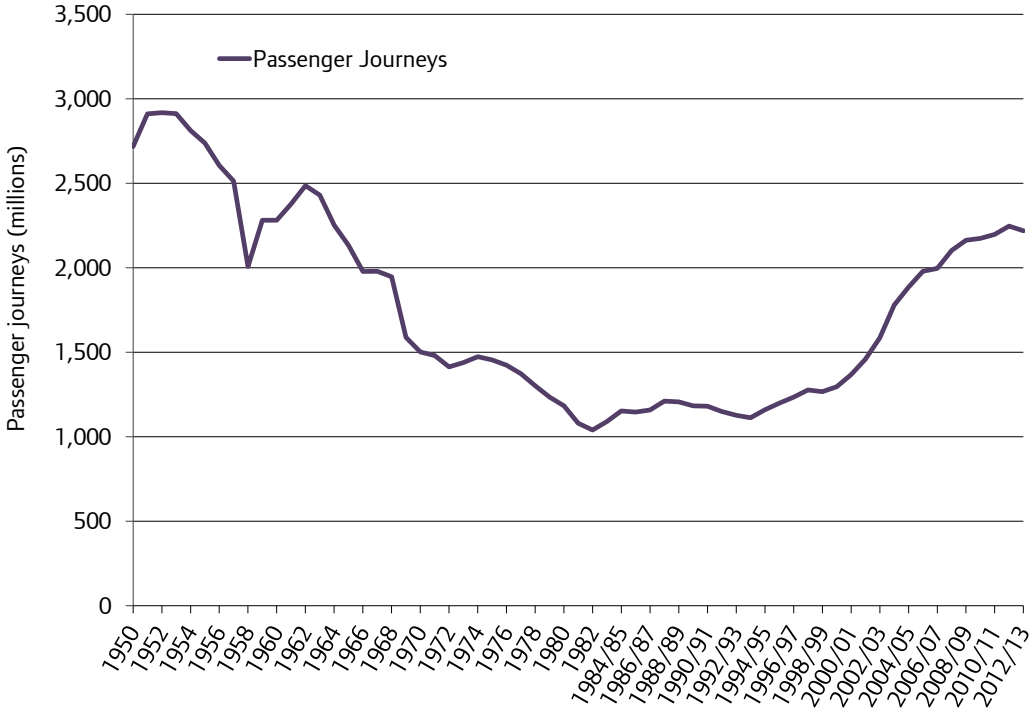
Source: TfL – Travel in London 7

Figure 2.12: Passenger kilometres and journey stages by London Tramlink



Source: TfL – Travel in London 7

Figure 2.13: Bus demand in London over time



Source: TfL – Travel in London 7

Table 2.8: Aggregate travel volumes in Greater London, estimated daily average number of trips by main mode of travel, 1993 to 2013, Seven-day week (Millions of trips)

Year	Rail	Under-ground/ DLR	Bus (in-cluding tram)	Taxi/ PHV	Car driver	Car pas-senger	Motor cycle	Cycle	Walk	All modes
1993	1.3	1.4	2.1	0.3	6.6	3.6	0.2	0.3	5.2	20.9
1994	1.3	1.5	2.1	0.3	6.7	3.6	0.2	0.3	5.2	21.1
1995	1.3	1.6	2.2	0.3	6.6	3.6	0.2	0.3	5.2	21.2
1996	1.4	1.5	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.5
1997	1.5	1.6	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.8
1998	1.5	1.7	2.3	0.3	6.7	3.6	0.2	0.3	5.3	21.9
1999	1.6	1.8	2.3	0.3	6.9	3.6	0.2	0.3	5.4	22.4
2000	1.7	2	2.4	0.3	6.8	3.6	0.2	0.3	5.5	22.7
2001	1.7	1.9	2.6	0.3	6.8	3.6	0.2	0.3	5.5	22.9
2002	1.7	1.9	2.8	0.3	6.8	3.5	0.2	0.3	5.6	23.2
2003	1.8	1.9	3.2	0.3	6.7	3.5	0.2	0.3	5.6	23.4
2004	1.8	2	3.3	0.3	6.6	3.4	0.2	0.3	5.6	23.6
2005	1.8	1.9	3.2	0.3	6.5	3.4	0.2	0.4	5.7	23.4
2006	1.9	2	3.1	0.3	6.4	3.5	0.2	0.4	5.7	23.6
2007	2.1	2	3.6	0.4	6.3	3.5	0.2	0.4	5.8	24.3
2008	2.2	2.1	3.8	0.3	6.1	3.5	0.2	0.5	5.9	24.6
2009	2.1	2.2	3.9	0.3	6.2	3.5	0.2	0.5	6	24.8
2010	2.3	2.1	4	0.3	6.1	3.6	0.2	0.5	6.1	25.1
2011	2.4	2.2	4.1	0.3	5.9	3.6	0.2	0.5	6.2	25.3
2012	2.6	2.4	4.1	0.3	5.9	3.6	0.2	0.5	6.3	25.8
2013	2.7	2.5	4.1	0.3	5.8	3.6	0.2	0.5	6.3	26.1

Source: TfL – Travel in London 7

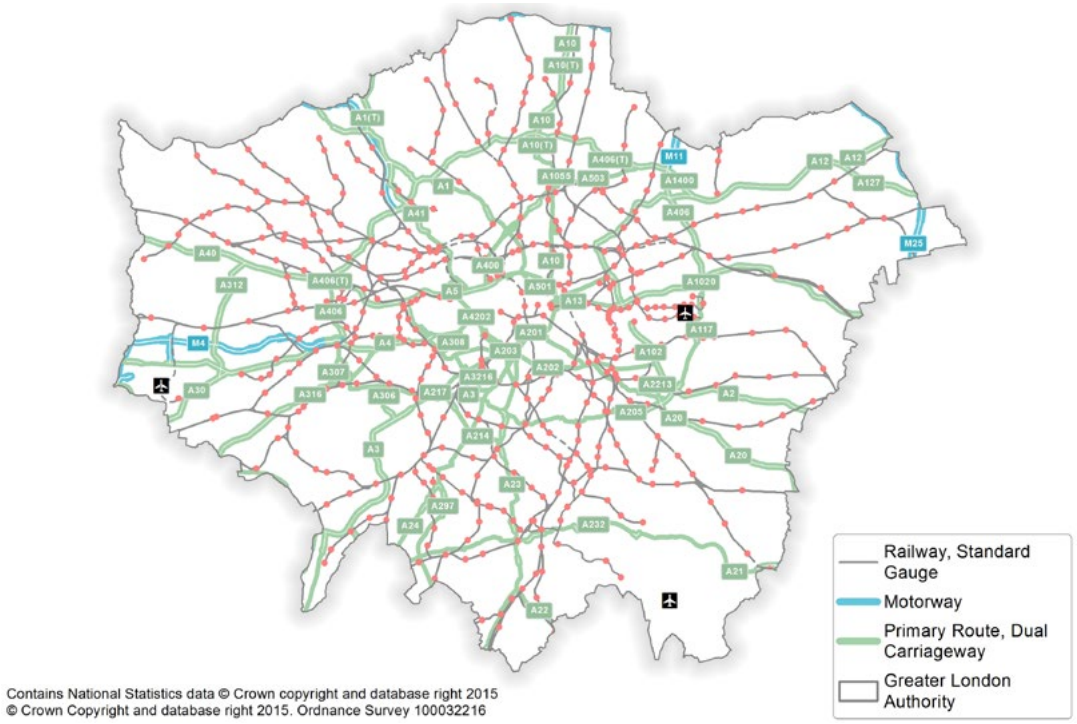
Table 2.9: Daily average cycle stages and trips in London

Year	Cycle stages		Cycle trips
	Millions	Year on year % change	Millions
2003	0.37	14%	0.32
2004	0.38	3%	0.33
2005	0.41	9%	0.39
2006	0.47	12%	0.42
2007	0.47	0%	0.42
2008	0.49	5%	0.44
2009	0.51	5%	0.47
2010	0.54	6%	0.49
2011	0.57	5%	0.49
2012	0.58	2%	0.5
2013	0.58	1%	0.5

Source: TfL – Travel in London 7

Looking at road transport in London, Map 2.43 highlights the major roads, rail lines and airports in London, however as shown by Table 2.10 the usage of these roads has declined in recent years, unlike for Great Britain as a whole. Figure 2.14 shows that even though the general trend in road usage has been downwards, this has not been the case for light goods vehicles which saw growth from 2001 until 2008 (and the recession); usage has recently picked up again after a few years of flat lining.

Map 2.43: Roads, rail and airports in London



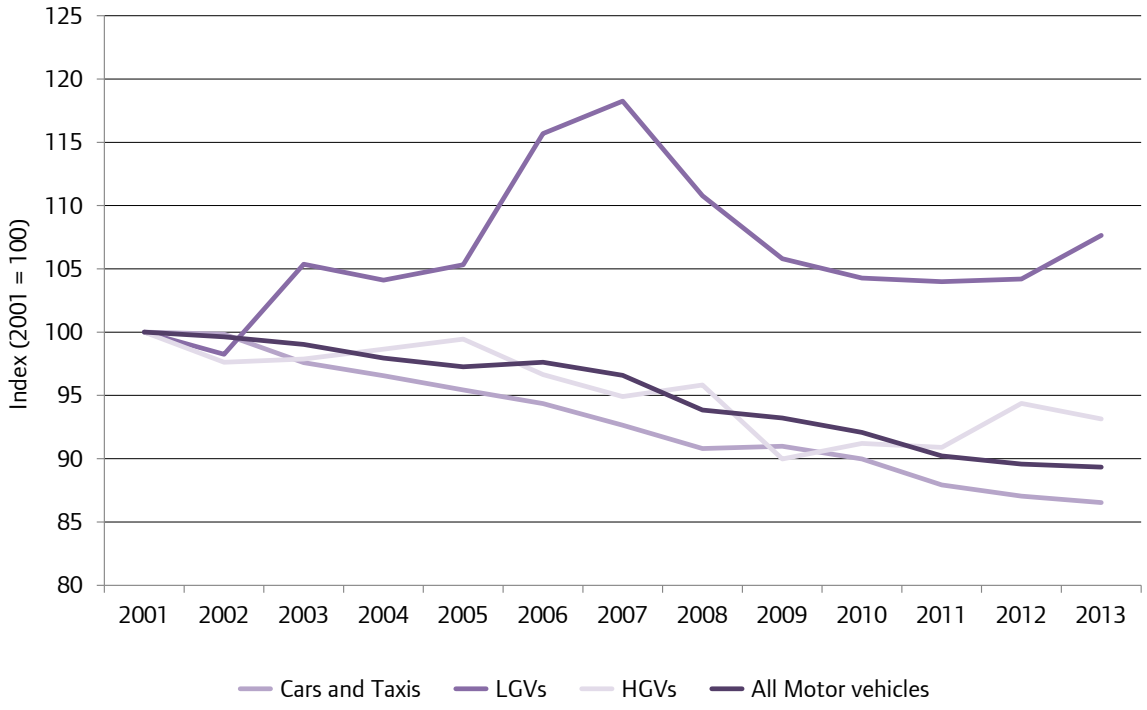
Source: GLA Intelligence Unit

Table 2.10: London road traffic (billion vehicle kilometres) by central, inner, outer London and Great Britain, all motor vehicles

Year	Central London	Inner London	Outer London	Greater London	Great Britain
1993	1.3	8.7	20.7	30.7	412.3
1994	1.3	8.8	21	31.1	421.5
1995	1.3	8.9	21	31.2	429.7
1996	1.3	8.9	21.3	31.5	441.1
1997	1.3	8.9	21.5	31.7	450.3
1998	1.3	8.9	21.7	31.9	458.5
1999	1.3	9.1	22.3	32.7	467
2000	1.3	9	22.1	32.4	466.2
2001	1.2	9	22	32.3	472.6
2002	1.2	8.9	22	32.1	483.7
2003	1.2	8.8	21.9	31.9	486.7
2004	1.2	8.7	21.7	31.6	493.9
2005	1.2	8.5	21.7	31.4	493.9
2006	1.2	8.5	21.8	31.5	501.1
2007	1.2	8.6	21.4	31.2	505.4
2008	1.1	8.3	20.9	30.3	500.6
2009	1	8.2	20.8	30.1	495.8
2010	1	8	20.6	29.7	487.9
2011	1	7.8	20.3	29.1	488.9
2012	1	7.6	20.3	28.9	487.1
2013	1	7.4	20.4	28.8	488.8

Source: Department for Transport via TfL – Travel in London 7

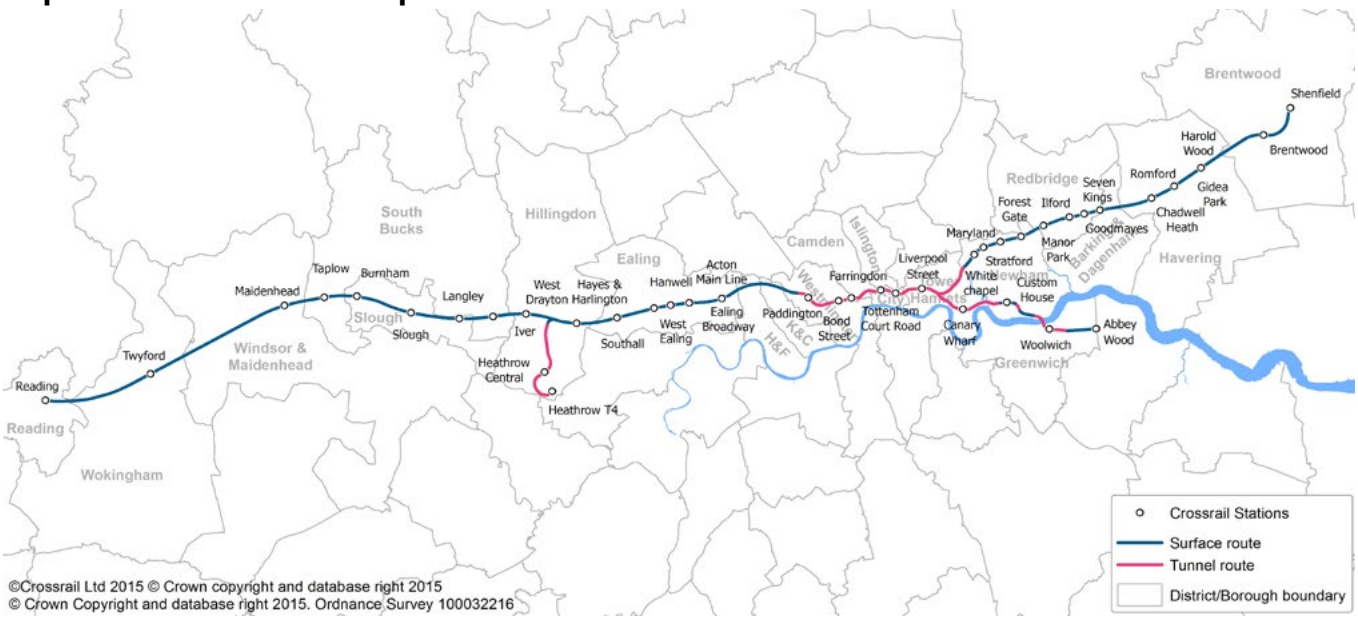
Figure 2.14: Growth in road traffic in London, 2001 to 2013



Source: TfL – Travel in London 7

London's transport system continues to evolve and provide connections to the wider South East as shown by Map 2.44 which shows the route Crossrail will take when it opens. It is estimated that this transport investment will provide "better access to the capital for the 750,000 workers who already commute into London", while "overall the benefits of Crossrail are estimated to be at least £42 billion in current prices"[34].

Map 2.44: Crossrail route map



Source: GLA Intelligence Unit mapping

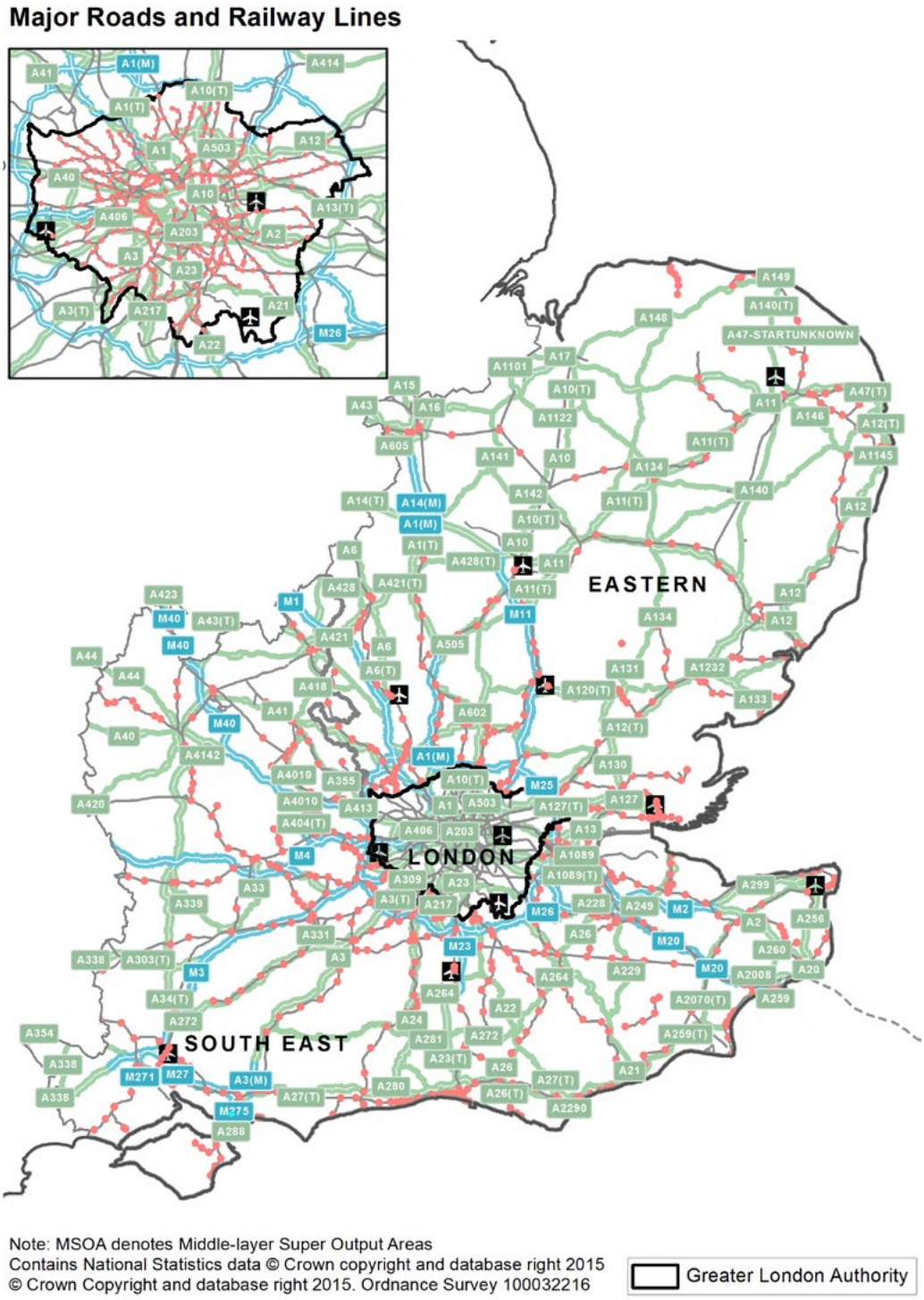
2.7.4 Transport in the Greater South East

As highlighted previously London is connected to the Greater South East in terms of commuters coming into and out of London but also significant parts of London's transport are of vital importance to the economies of the Greater South East as well as London such as airport capacity. This sub section examines these transport links in more depth.

2.7.4.1 Rail travel

Map 2.45 shows London's motorway and rail connections with the wider South East and highlights the connections between London and the rest of the UK.

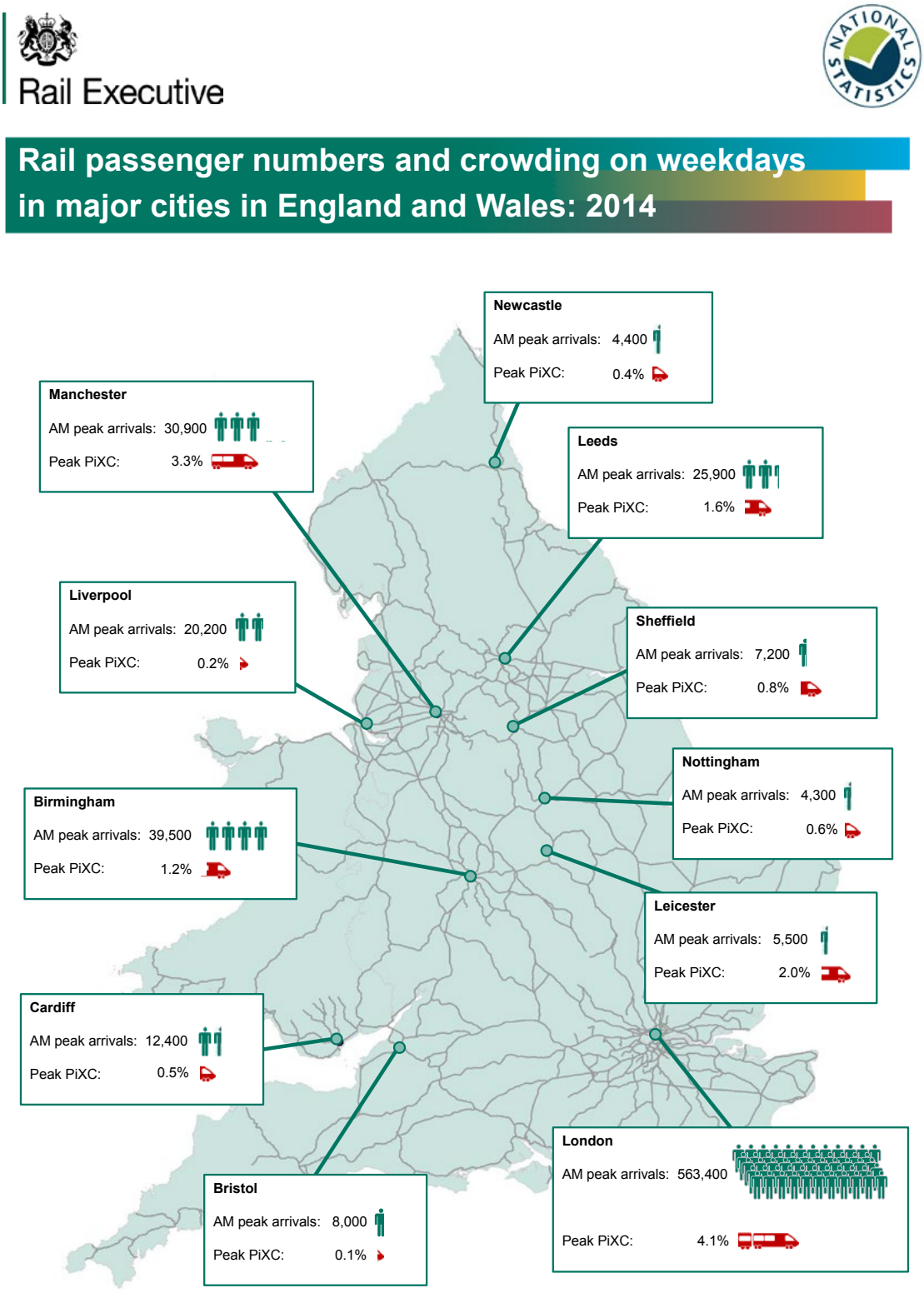
Map 2.45: Airport, rail and road infrastructure in the South East region



Source: GLA Intelligence Unit

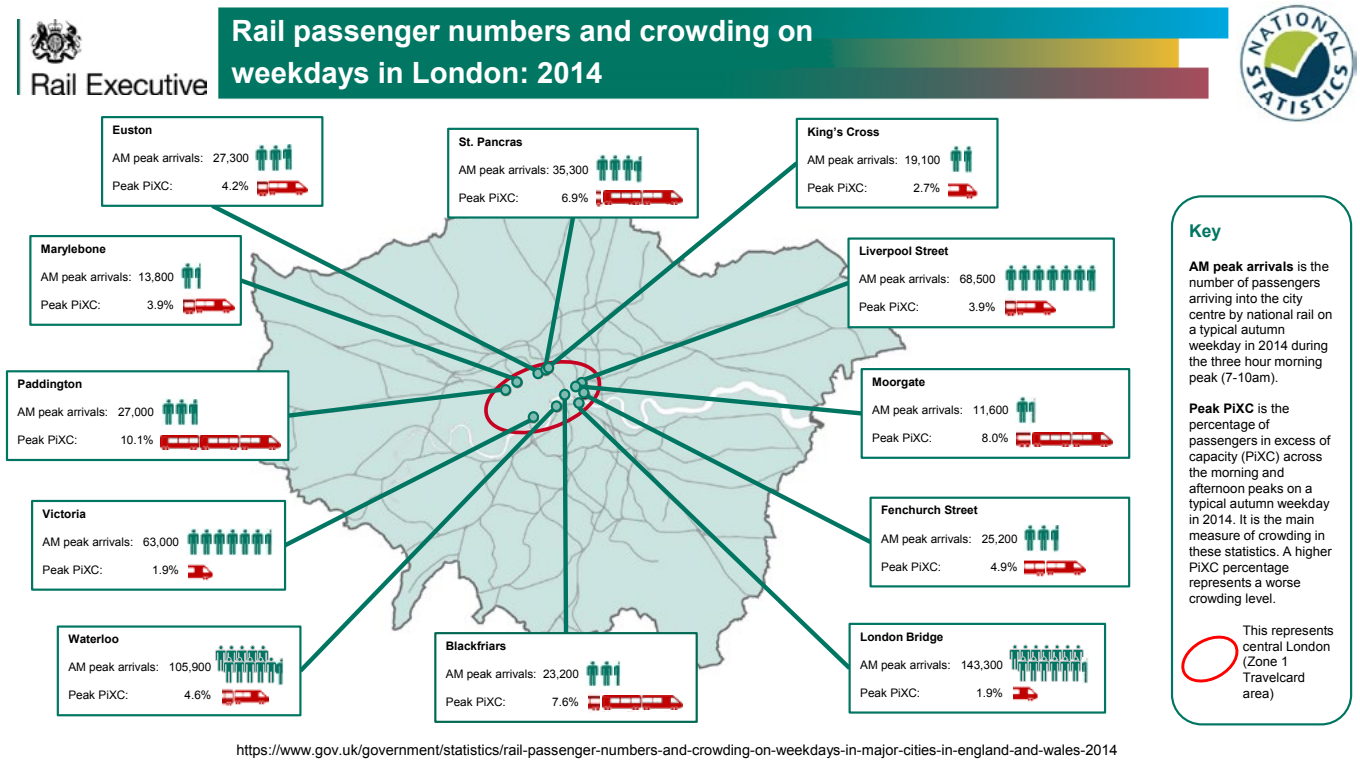
However, London's transport flows overshadow those seen in the rest of the UK. This can be seen by examining morning peak time passenger arrivals as shown in Maps 2.46a and 2.46b, which show that London far outweighs any other English or Welsh city. While in terms of overcrowding, the Department for Transport (DfT) found on a typical autumn weekday in 2014 that "overall peak crowding was higher in London than in other cities, with 4.1 per cent of passengers in excess of capacity (PiXC) in London compared to 1.4 per cent PiXC across the other 10 cities". While, "139 thousand passengers were standing at trains' busiest points on arrival into London in the morning peak, 22 per cent of all passengers. 26 per cent of morning peak trains were over capacity and in total 59 per cent had passengers standing". And "in the morning peak 563 thousand passengers arrived by rail into central London (Zone 1 of the travelcard area), a 3 per cent increase from the year before. Just over one million passengers arrived into central London by rail across the whole day"[35].

Map 2.46a: Rail passenger numbers and crowding on weekdays in major cities in England and Wales (2014)



Source: Department for Transport[36]

Map 2.46b: Rail passenger numbers and crowding on weekdays in London (2014)



Source: Department for Transport

Table 2.11 below, examines overcrowding at peak times in London and other English and Welsh cities as well as London rail terminals in more detail. These data show that London is more congested than other rail destinations, with most of London's terminals suffering from significant overcrowding. Table 2.12 examines this in more detail, looking at the 1 hour and 3 hour am and pm peak based on congestion and standing on trains arriving in various cities and individual London stations.

Table 2.13 looks at peak time over-capacity for London and South East train operators and shows that overcrowding holds for most operators, although some face significantly higher overcrowding than others. Table 2.14 meanwhile highlights that crowding on peak time trains has been a persistent problem in London since 1990 but with the trend worsening in recent years to hit its highest level since at least 1990 in 2014. While Table 2.15 shows the busyness of London stations with, for instance, London Bridge station having nearly double the number of passenger arrivals in a given day than all Birmingham stations combined and over 3.5 times the number of arrivals at the morning peak. It also highlights the lack of seating on a number of trains entering London in relation to the number of passengers on these trains with numbers at some London stations such as Vauxhall (for Waterloo) and London Bridge being particularly unfavourable and shows the capacity constraints some London train services are facing. Finally, the size of train usage in London compared to elsewhere in Britain has also been highlighted by national rail statistics which show that "in 2012/13, 62 per cent of all rail journeys in Great Britain started or finished in London", while in the Greater South East London dominates as a starting point or terminus with "sixty six per cent of journeys in the South East and 76 per cent in the East of England started or finished in London"[37].

Table 2.11: Passengers in excess of capacity (PiXC) by city, 2014, and percentage point change from 2013

City	AM Peak (7:00 to 9:59)		PM Peak (16:00 to 18:59)		Both Peaks	
	PiXC	Change from 2013	PiXC	Change from 2013	PiXC	Change from 2013
Birmingham	1.6%	0.8%	0.8%	-0.1%	1.2%	0.4%
Bristol	0.0%	-1.2%	0.2%	-0.6%	0.1%	-0.9%
Cardiff	0.5%	-0.4%	0.5%	0.1%	0.5%	-0.1%
Leeds	1.8%	0.2%	1.4%	-0.1%	1.6%	0.0%
Leicester	1.0%	-0.1%	2.9%	2.0%	2.0%	1.0%
Liverpool	0.0%	-0.3%	0.4%	0.4%	0.2%	0.1%
Manchester	4.3%	1.8%	2.3%	1.6%	3.3%	1.7%
Newcastle	1.0%	1.0%	0.0%	0.0%	0.4%	0.4%
Nottingham	0.2%	0.2%	1.0%	1.0%	0.6%	0.6%
Sheffield	1.1%	-2.9%	0.6%	-0.9%	0.8%	-1.8%
Total for cities outside London	**1.7%**	**0.4%**	**1.1%**	**0.4%**	**1.4%**	**0.4%**
Blackfriars (via Elephant and Castle)	10.6%	0.4%	3.2%	1.8%	7.6%	0.9%
Euston	3.6%	-0.9%	4.7%	-0.6%	4.2%	-0.8%
Fenchurch Street	7.0%	1.0%	2.4%	0.8%	4.9%	0.9%
King's Cross	2.7%	1.3%	2.8%	0.8%	2.7%	1.0%
Liverpool Street[38]	5.5%	2.0%	2.1%	0.6%	3.9%	1.3%
London Bridge[39]	3.1%	1.0%	0.5%	0.0%	1.9%	0.5%
Marylebone[40]	4.9%	1.3%	2.8%	1.7%	3.9%	1.5%
Moorgate	10.6%	8.6%	5.4%	5.2%	8.0%	6.8%
Paddington[41]	13.5%	3.7%	6.0%	-2.6%	10.1%	0.8%
St. Pancras International	7.2%	4.0%	6.6%	4.9%	6.9%	4.4%
Victoria[42]	3.3%	-0.1%	0.3%	0.3%	1.9%	-0.2%
Waterloo[43]	5.5%	0.5%	3.6%	0.6%	4.6%	0.6%
London	5.4%	1.4%	2.5%	0.6%	4.1%	1.0%
Total for all cities	**4.6%**	**1.2%**	**2.2%**	**0.5%**	**3.5%**	**0.9%**

Source: Department for Transport

Table 2.12: Peak crowding on a typical autumn weekday in London by terminal (2014)

		Passengers in excess of capacity (PiXC)		Passengers standing		Services with PiXC		Services with passengers standing	
AM peak arrivals (07:00-09:59)[44]		Number	%[45]	Number	%[46]	Number	%[47]	Number	%[48]
Blackfriars (via Elephant and Castle)[49]	1 hour peak	2,076	17%	4,530	37%	11	79%	13	93%
	3 hour peak	2,461	11%	6,200	27%	15	44%	24	71%
Euston	1 hour peak	475	4%	1,750	15%	3	13%	11	46%
	3 hour peak	918	4%	3,931	16%	10	16%	27	44%

Fenchurch Street	1 hour peak	1,653	10%	5,467	32%	13	68%	19	100%
	3 hour peak	2,439	7%	9,855	28%	23	48%	43	90%
King's Cross	1 hour peak	419	4%	717	7%	3	15%	5	25%
	3 hour peak	516	3%	1,009	5%	5	11%	10	21%
Liverpool Street[50]	1 hour peak	3,355	7%	9,908	21%	23	37%	43	69%
	3 hour peak	5,280	5%	15,839	16%	39	25%	75	47%
London Bridge[51]	1 hour peak	2,950	4%	22,360	32%	29	37%	66	85%
	3 hour peak	4,375	3%	35,043	25%	43	22%	127	64%
Maryle-bone[52]	1 hour peak	615	9%	1,018	15%	9	60%	13	87%
	3 hour peak	679	5%	1,384	10%	14	32%	23	52%
Moorgate	1 hour peak	1,556	18%	3,206	37%	9	75%	11	92%
	3 hour peak	1,714	11%	4,371	27%	12	39%	18	58%
Padding-ton[53]	1 hour peak	1,981	16%	2,868	24%	11	46%	12	50%
	3 hour peak	3,824	13%	5,893	21%	26	40%	29	45%
St. Pancras Interna-tional[54]	1 hour peak	1,564	9%	4,519	25%	12	44%	19	70%
	3 hour peak	2,668	7%	8,254	22%	21	31%	39	57%
Victoria[55]	1 hour peak	1,207	3%	9,601	27%	14	31%	36	80%
	3 hour peak	2,563	3%	16,305	21%	26	21%	74	59%
Waterloo[56]	1 hour peak	3,853	8%	17,909	37%	21	38%	54	98%
	3 hour peak	5,760	5%	30,632	29%	36	24%	122	81%
London total	1 hour peak	21,703	7%	83,854	28%	158	40%	302	76%
	3 hour peak	33,198	5%	138,716	22%	270	26%	611	59%
PM peak departures (16:00-18:59)[57]									
Blackfriars (via Ele-phant and Castle)	1 hour peak	459	6%	1,292	17%	6	46%	11	85%
	3 hour peak	505	3%	2,332	15%	10	33%	17	57%
Euston	1 hour peak	554	6%	1,562	17%	4	17%	9	39%
	3 hour peak	1,170	5%	3,381	14%	9	14%	25	38%

Fenchurch Street	1 hour peak	148	1%	2,352	16%	4	20%	16	80%
	3 hour peak	718	2%	5,305	18%	11	25%	34	77%
King's Cross	1 hour peak	9	0%	316	4%	1	6%	5	28%
	3 hour peak	637	3%	1,266	6%	7	14%	15	30%
Liverpool Street	1 hour peak	865	2%	3,318	9%	5	8%	22	37%
	3 hour peak	1,756	2%	7,337	9%	14	9%	51	33%
London Bridge	1 hour peak	107	0%	8,690	18%	3	4%	41	60%
	3 hour peak	551	0%	16,510	14%	9	5%	86	45%
Maryle-bone	1 hour peak	117	3%	166	4%	3	20%	5	33%
	3 hour peak	342	3%	761	6%	9	20%	17	39%
Moorgate	1 hour peak	718	11%	1,771	26%	5	42%	8	67%
	3 hour peak	871	5%	3,011	19%	8	24%	18	55%
Padding-ton	1 hour peak	313	4%	879	10%	5	23%	8	36%
	3 hour peak	1,459	6%	3,052	13%	16	27%	22	37%
St. Pancras Interna-tional	1 hour peak	870	7%	2,051	17%	7	27%	11	42%
	3 hour peak	2,120	7%	5,745	18%	20	29%	32	46%
Victoria	1 hour peak	74	0%	4,180	16%	1	2%	24	59%
	3 hour peak	210	0%	9,136	14%	5	4%	65	54%
Waterloo	1 hour peak	1,918	6%	7,972	24%	15	29%	42	81%
	3 hour peak	3,216	4%	20,052	22%	27	18%	107	72%
London total	1 hour peak	6,151	3%	34,548	16%	59	16%	202	55%
	3 hour peak	13,554	3%	77,887	15%	145	14%	489	48%

Source: Department for Transport

Table 2.13: Passengers in excess of capacity (PiXC) on a typical autumn weekday by operator, London & South East train operators, 2014

	AM Peak PiXC (7:00 to 9:59)	PM Peak PiCX (16:00 to 18:59)	Overall PiXC
c2c	7.0%	2.4%	4.9%
Chiltern Railways[58]	4.9%	2.8%	3.9%
First Great Western[59]	13.5%	6.0%	10.1%
Govia Thameslink Railway	7.4%	5.1%	6.3%
Greater Anglia[60]	5.5%	2.1%	3.9%
London Midland	5.7%	7.4%	6.5%
London Overground[6162]	0.0%	0.0%	0.0%
South West Trains	5.5%	3.6%	4.6%
Southeastern	2.8%	0.3%	1.6%
Southern	4.9%	0.7%	3.0%
All London & South East operators	5.4%	2.5%	4.1%

Source: Department for Transport

Table 2.14: Passengers in excess of capacity (PiXC) on a typical autumn weekday on London & South East train operators' services, annual from 1990

Year	AM peak (07:00-09:59)	PM peak (16:00-18:59)	Both peaks
1990	4.3%	2.2%	3.3%
1991	3.8%	2.1%	3.0%
1992	3.7%	1.5%	2.7%
1993	3.3%	1.4%	2.5%
1994	3.2%	1.0%	2.1%
1995	3.0%	1.0%	2.1%
1996	2.6%	1.2%	1.9%
1997	3.9%	2.1%	3.1%
1998	3.7%	1.4%	2.7%
1999	3.8%	1.6%	2.8%
2000	5.1%	1.8%	3.6%
2001	5.0%	1.7%	3.6%
2002	3.7%	2.1%	2.9%
2003	3.8%	1.5%	2.7%
2004	4.1%	1.5%	2.9%
2005	4.0%	1.6%	2.9%
2006	4.7%	1.9%	3.4%
2007	4.2%	1.5%	3.0%
2008	4.0%	1.8%	3.0%
2009	2.9%	1.4%	2.2%
2010	4.0%	1.9%	3.0%
2011	4.0%	2.2%	3.2%
2012	4.1%	1.7%	3.0%
2013	4.0%	2.0%	3.1%
2014	5.4%	2.5%	4.1%

Source: Department for Transport

Table 2.15: City centre[63] (Zone 1 for London) peak and all day arrivals and departures by rail on a typical autumn weekday, by city (2014)

	AM peak arrivals (07:00-09:59)			PM peak departures (16:00-18:59)			All day arrivals			All day departures		
	Number of services	Total seats	Passengers	Number of services	Total seats	Passengers	Number of services	Total seats	Passengers	Number of services	Total seats	Passengers
Birmingham[64]	179	51,826	39,473	186	51,668	40,489	960	269,019	115,769	953	265,941	112,304
Bristol[65]	52	14,349	8,036	51	13,071	9,600	267	70,179	28,138	259	68,251	28,461
Cardiff[66]	114	20,453	12,423	116	20,631	12,952	619	109,621	34,821	621	109,259	35,778
Leeds	120	29,370	25,897	123	30,444	26,885	617	145,063	70,819	607	143,380	70,042
Leicester	37	10,908	5,472	37	10,518	6,619	202	56,551	25,641	200	56,507	25,909
Liverpool[67]	128	30,599	20,155	139	30,646	21,792	712	153,095	65,832	712	150,865	62,765
London[68]	1,027	566,089	563,354	1,004	546,699	475,540	4,708	2,223,651	1,032,610	4,727	2,210,144	1,019,261
Manchester[69]	186	40,625	30,907	193	43,100	33,703	962	207,396	92,929	961	206,919	93,217
Newcastle	34	9,863	4,447	38	9,750	5,860	199	54,009	22,420	195	53,318	22,517
Nottingham	34	7,084	4,287	40	7,498	4,775	211	43,590	14,239	208	42,271	13,977
Sheffield	58	12,049	7,224	63	12,425	9,088	345	67,633	30,892	345	68,613	31,829
London by station[70]												
Elephant and Castle (for Blackfriars)	34	18,655	23,211	30	16,040	15,167	134	71,085	32,613	134	68,737	26,257
Euston	61	30,678	27,289	66	32,616	26,360	318	129,336	73,304	319	129,578	75,394
Fenchurch Street	48	26,508	25,194	44	25,380	21,014	172	75,294	34,641	169	72,474	33,781
King's Cross	47	27,122	19,098	50	27,695	17,822	220	103,673	50,000	226	102,065	48,760
Liverpool Street[71]	153	95,383	68,545	148	92,565	59,382	657	351,404	106,652	643	340,145	109,160
London Bridge[72]	200	124,710	143,343	189	116,115	116,138	850	451,076	229,610	871	459,481	222,175
Marylebone[73]	44	13,824	13,793	44	12,932	11,876	174	44,832	24,953	180	45,456	24,818
Old Street (for Moorgate)	31	13,920	11,647	33	14,384	11,100	113	46,168	16,687	113	45,936	18,971
Paddington[74]	65	28,207	27,034	60	27,515	22,169	295	116,637	67,829	293	116,519	57,644
St. Pancras International	68	34,622	35,265	70	34,537	31,625	342	149,045	67,556	345	152,063	70,837
Victoria[75]	125	70,217	63,040	121	68,701	53,377	679	323,019	124,781	681	321,924	119,388
Vauxhall (for Waterloo)	151	82,243	105,896	149	78,219	89,509	754	362,082	203,984	753	355,766	212,075
London total	1,027	566,089	563,354	1,004	546,699	475,540	4,708	2,223,651	1,032,610	4,727	2,210,144	1,019,261

Source: Department for Transport

2.7.4.2 London's Airports

London Heathrow is the pre-eminent UK airport with it taking the third most passengers globally (Table 2.16). In the year to April 2015, preliminary estimates are that 73.7 million passengers went through Heathrow; since 2010, passenger numbers have increased by 11.5 per cent, and Heathrow overtook Chicago O'Hare as the third largest airport in the world in 2011.

Table 2.16: Cities with largest numbers of passenger numbers, and other selected global cities (millions of passengers)

Rank	Airport	2000	2005	2010	2011	2012	2013
1	Atlanta	80.2	85.9	89.3	92.4	95.5	94.4
2	Beijing	..	41.0	73.9	78.7	81.9	83.7
3	**London Heathrow**	**64.6**	**67.9**	**65.9**	**69.4**	**70.0**	**72.4**
4	Tokyo	56.4	63.3	64.2	62.6	66.8	68.9
5	Chicago	72.1	76.5	66.8	66.7	66.6	66.8
7	Dubai	..	..	47.2	51.0	57.7	66.4
8	Paris	48.2	53.8	58.2	61.0	61.6	62.1
19	New York	32.9	41.9	46.5	47.6	49.3	50.4

Source: Airports Council International

However over the course of the last five years, there has been significant growth in airports across the Middle East and Asia. Table 2.16 shows that back in the year 2000, Beijing and Dubai were not listed amongst the top 30 airports for passenger numbers (Beijing only entered the top 30 in 2004; Dubai in 2007). The Table 2.17 outlines the airports with the greatest growth in passenger numbers (amongst those within the top 30 airports by passenger numbers in both 2010 and in the year to January 2015), it thus highlights London airport capacity constraints. For more on London's airport capacity constraints, see Chapter 4.

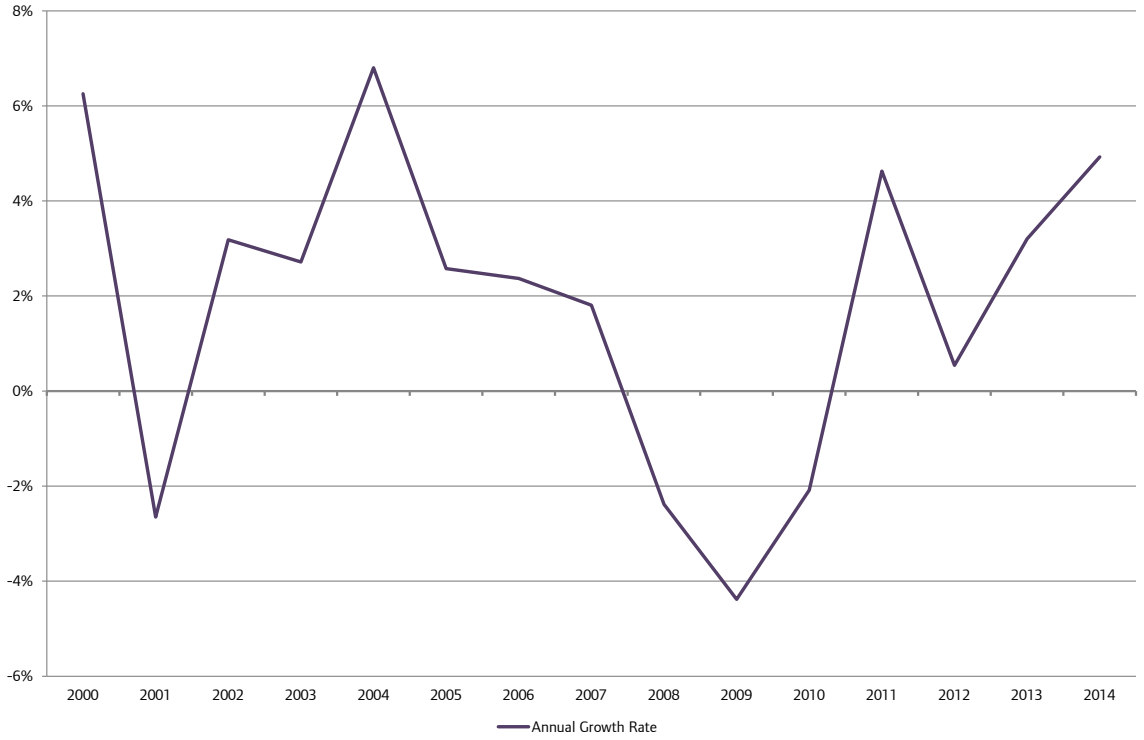
Table 2.17: Cities with the largest growth in passenger numbers, between 2010 and the year to January 2015

Rank	Airport	Average Annual Growth Rate
1	Dubai	10.7%
2	Guangzhou	7.5%
3	Singapore	6.4%
4	Shanghai	6.3%
5	Jakarta	6.2%
17	**London Heathrow**	**2.8%**

Source: GLA Economics calculations; Airports Council International

In 2014, there were a total of 135.1 million passengers at London airports (Heathrow, Gatwick, Stansted and City), an increase of 4.9 per cent on the year previous. Figure 2.15 shows that following the 2008/09 recession, there has been a pick-up in passengers from 2011 onwards, reaching record highs in 2014. Over the last fifteen years, total passenger numbers at London airports have increased by 30.3 per cent, and since 2010, the increase was 13.9 per cent.

Figure 2.15: Annual growth in total passenger numbers at London airports, 1999 – 2014



Source: GLA Economics calculations; Civil Aviation Authority

2.7.4.3 The Thames and Port of London

In recent research for the Port of London Authority, Oxford Economics found that the Thames as a public amenity[76] was responsible for sport/recreation valued at £132 million, while wards adjacent to the Thames generated economic value related to tourism to the value of £2.4 billion. Further, "some 4.7 million people visit Thames or maritime-related attractions annually", with "at least 23.4 million people visit the attractions located by the side of the Thames". While, "in 2014, almost 10 million passenger journeys were made on the River Thames, up from eight million the year before. The trips were by passengers commuting to work, sightseers, on charter boats, high speed RIBs and the Woolwich ferry".

SQW noted[77] that "the Port of London is the second biggest in the UK. The port handled 44.5 million tonnes of goods and materials in 2014". Adding that it "is made up of over 70 independently run terminals and wharves along 95 miles of the tidal Thames from Teddington Lock to the North Sea", with major operations in the port including: "the Port of Tilbury; London Gateway container port; Ford at Dagenham; building materials operations such as Tarmac and Cemex; and the Tate & Lyle Sugars refinery at Silvertown". They thus find that the overall impact in terms of output of the Thames was over £4 billion with it generating over 43,000 jobs. It should of course be noted that while a number of these facilities are outside of London's administrative boundaries, they arguably fall within London's economic geography.

2.8 Housing and land use in London

While London undoubtedly benefits from agglomeration economies, there exists a trade-off between these forces and the associated urban costs, such as congestion and expensive housing. Urban costs can take a variety of forms. Some of these costs, like higher land costs, are monetary; others, like the disutility from longer commutes or the loss of green space, are harder to measure. Mobility within and between cities however imply that urban (dis)-amenities and commuting costs will, at least to some extent, be reflected in land prices (as people 'vote with their feet'[78]).

This section examines the competition for land use in London that results from agglomeration, before presenting evidence on the location decisions of London residents, and the effect on London's housing market.

2.8.1 Competition for land use in London

Land and property are hugely important socially and economically. Having sufficient housing available to accommodate the population comfortably matters, while decisions over whether to develop land for business or housing use contribute to the structure of the economy.

Despite the spread of London, as seen in Map 2.8, Central London remains a prime location for businesses. It lies at the centre of the most populous region in the UK and millions can travel by public transport from home to Central London within 45 minutes. The transport network influences the location decision of residents who need access to jobs, schools, and other services, as well as businesses that want to maximise access to markets. Within an urban environment, the location of commercial and residential buildings is largely driven by topographical constraints, the location of public transport and other infrastructure, but also by the city's inherited traditions of urban culture and development.

2.8.1.1 Mapping the use of land

London's built environment – consisting of domestic and non-domestic buildings, roads, rail and other infrastructure – covers around 28 per cent of the total land area in London, compared to less than 5 per cent in the South East or England as a whole.

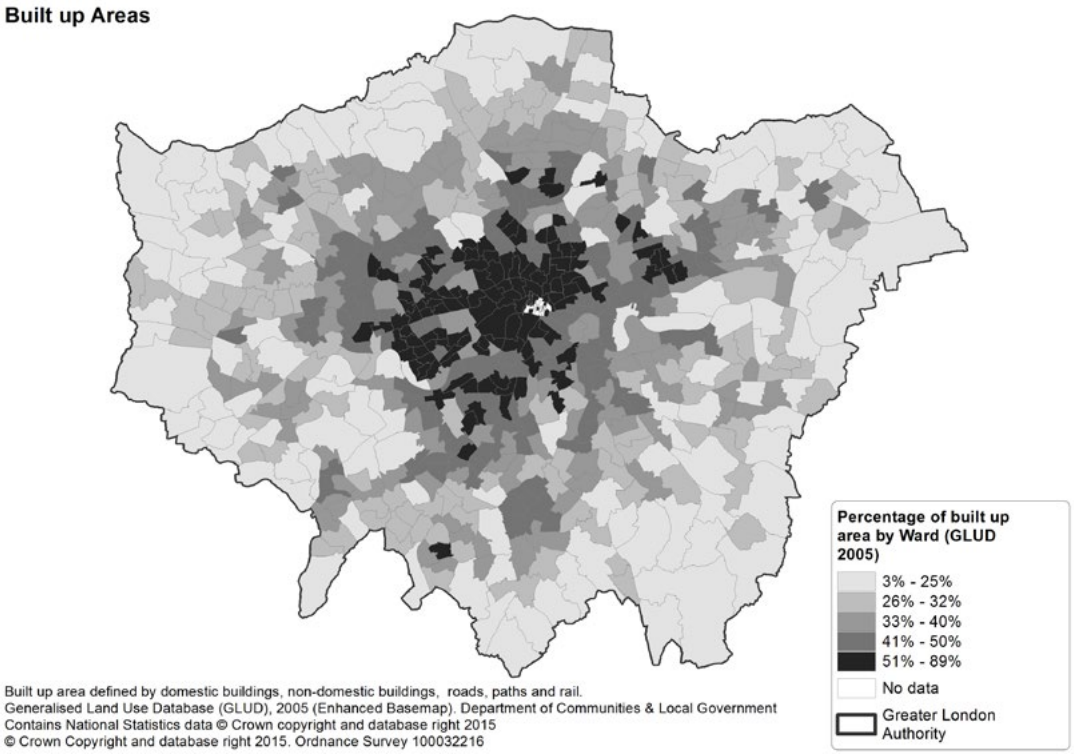
Table 2.18: Land use percentages in London, the South East and England

	London	South East	England
Domestic buildings	8.7	1.3	1.1
Other buildings	4.7	0.7	0.7
Roads and paths	13.1	2.6	2.3
Rail	1.1	0.1	0.1
All built	27.6	4.7	4.2
Domestic gardens	23.8	6.2	4.3
Green Space	38.2	84.8	87.5
Water	2.8	2.7	2.6
All 'green'	64.9	93.7	94.4
Other / unclassified	7.5	1.6	1.4
Green belt	22.1	16.6	12.4

Source: Generalised land use data 2005 and DCLG, Local Planning Authority Green Belt: England 2012/13

Within central London boroughs, where the benefits of agglomeration are highest, this figure rises to more than 50 per cent.

Map 2.47: Land use by London boroughs, 2005



Sources: Generalised land use data 2005

2.8.1.2 The economics of land use in London

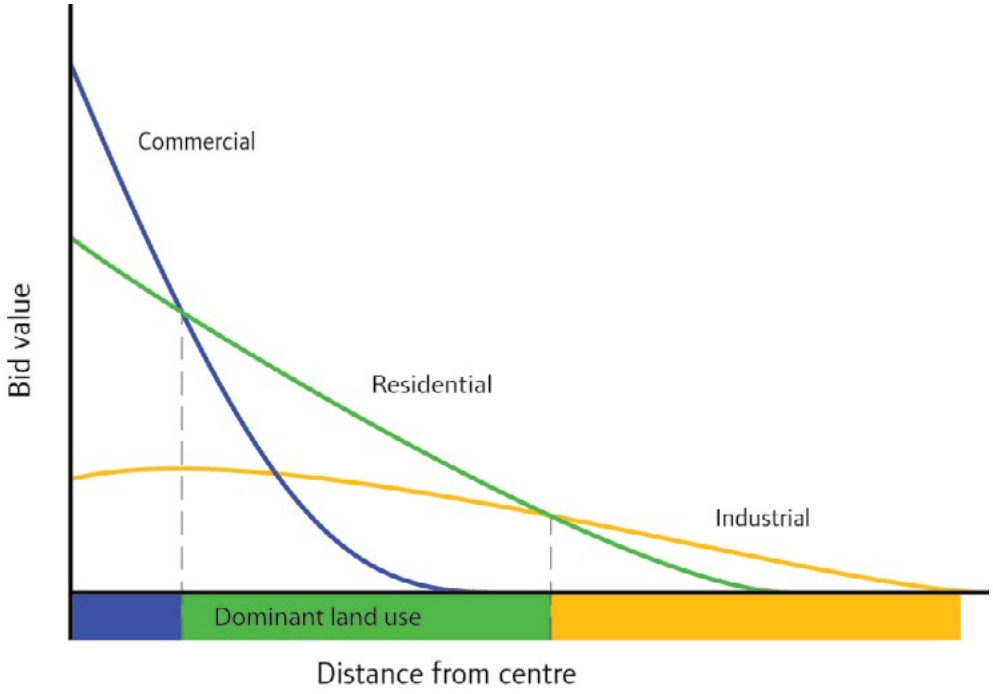
As a result of agglomeration, there is very high competition for space in Central London, by both businesses seeking shops and offices and people seeking housing. In theory, businesses can often pay more for land than people seeking land for housing, since employment land generates output and the area in which agglomeration benefits are highest is very narrow, as detailed above. As such, the highest value businesses, that benefit most from agglomeration, are most willing and able to pay for offices in Central London and outbid others for land in Central London[79].

As in most cities, land prices tend to be highest in the centre and generally decline with distance from the centre, reflecting the appeal of central locations when compared to peripheral ones. Tough competition for limited space drives up land values and acts – along with urban costs such as congestion and other diseconomies of spatial concentration, and planning controls – as a check on further concentration[80].

This phenomenon was first identified nearly 200 years ago by the economist Johann von Thünen in his work on agricultural rents, and was applied to cities in 1964 by William Alonso[81]. His model explains the price and demand for real estate in a city and is shown in Figure 2.16. It shows the distribution of land uses that occur in a simplified, competitive real estate environment and is useful in understanding how market forces shape demand for land.

Housing and commercial uses compete for land in a similar way to how different types of employment outbid one another for land. Highly productive employment tends to crowd out residential development. Agglomeration economies bring very large benefits to firms and cause great concentrations of employment in very small areas. Since businesses prefer to be clustered together and significant economic benefits derive from such concentration, other land uses like housing tend to locate further out. However, residential land, particularly that land inhabited by the most productive employees – who can earn considerable salaries – can even crowd out less productive businesses, pushing these businesses further from the centre.

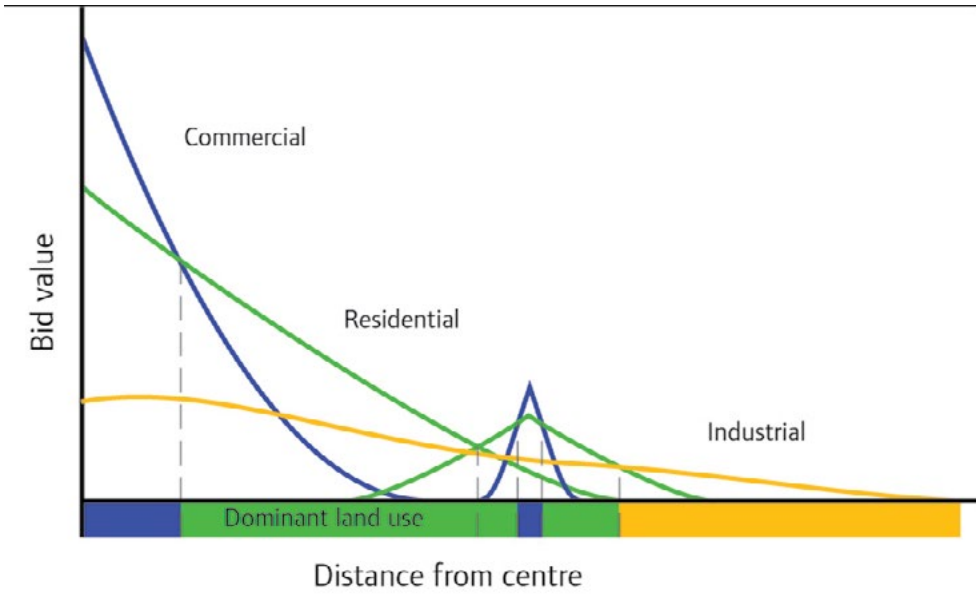
Figure 2.16: The Alonso model helps understand the distribution of land uses



Source: GLA Economics

It is possible to extend this model to also consider the role of secondary centres of employment within London (these can be seen in Map 2.8). Here, in the case of a polycentric city, the relationship between housing markets is made clear[82]. Where the two markets intersect, those desiring homes closest to the primary employment centre are prepared to pay more for space than those seeking to locate near the secondary centre. As a result, people working in peripheral employment centres tend to live further away from that centre than in the area between the peripheral centre and the regional centre.

Figure 2.17: The Alonso model applied to a polycentric city



Source: GLA Economics

Very large employment centres, in particular Central London, have very large labour pools that live across the Greater South East. As a result, there is a large reliance on high volume transport networks to accommodate flows of people in and out of London. As Map 2.30 shows, there are relatively more people commuting to Central London from the regions east of London and employment in the 'Western Wedge' draws many London residents. London's polycentric structure means that the housing market surrounding many employment centres tends to interact with others and so some degree of crowding out occurs.

The competition for land use in London thereby influences residential and commercial location decisions, which in turn impact upon travel patterns and the structure of London's economy.

2.8.1.3 The changing use and value of land in London

This section looks at the changes in the use of land in London over time, in relation to the changing values of different types of land use identified above. In particular it investigates the pressure to release land for housing given the increasing demand for and value of residential properties in London.

In theory, the value of land in different uses reflects the underlying demand for the property type built on it relative to the supply of land for that type of use. In practice, the real world can be less straightforward due to discontinuities in the market, including those introduced by topographic factors, investment and lending patterns, social housing provision, and other public policy interventions, that contribute to a 'complex and irregular mosaic of property values'[83].

2.8.1.3.1 Changes in developed and non-developed land use

In the 12 months to mid-2014, Ordnance Survey[84] assessed that 430 hectares of land had changed use in London, equivalent to just 0.3 per cent of London's total land area. Of the land area changing to a developed use, 69 per cent was previously-developed, while over half of the land use change captured was between different developed uses (51 per cent).

The main new uses of land changing to a developed use were:

- Vacant developed land at 87 hectares (29 per cent);
- Residential use at 86 hectares (29 per cent);
- Other developed use[85] at 53 hectares (18 per cent); and
- Transport and utilities at 51 hectares (17 per cent).

The area of land use change indicated by this data appears to be relatively small. However, even small changes in land use may have a significant impact on the levels of floorspace available in urbanised areas where multi-storey buildings are common.

2.8.1.3.2 The changing use of employment land

Across London there was 69.5 million square metres of business floorspace in 2012. Offices were the most common use, making up over 38 per cent of the commercial floorspace in London, up from 34 per cent in 2000. Having fallen by 7 percentage points between 2000 and 2012, industrial floorspace made up 30 per cent of the total, retail space accounted for 24 per cent (broadly similar to the 23 per cent in 2000), while 7 per cent of space was for other uses – an increase of 1 percentage point over the 12 year period.

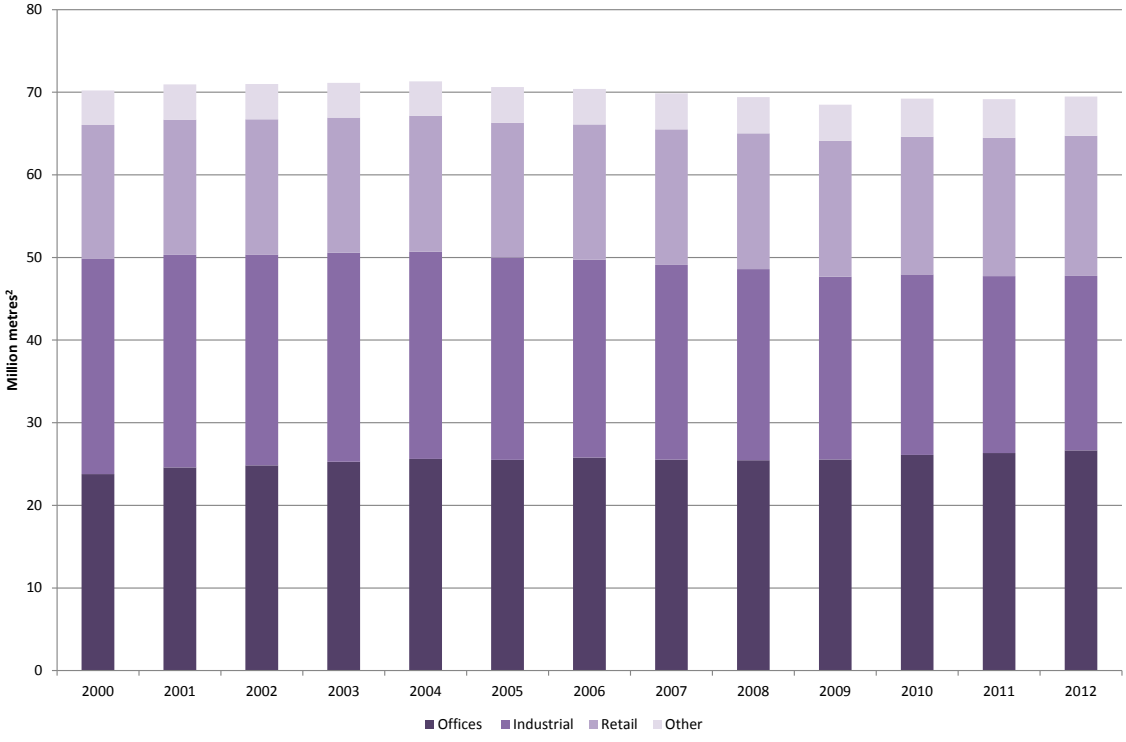
The patterns of changes in business floorspace use over this period are different across Inner London when compared to Outer London. Total business floorspace in Inner London remained broadly unchanged between 2000 and 2012, falling by 140,000 square metres (0.4 per cent) at an average of 12,000 square metres per year over this period. In Outer London between 2000 and 2012 total business floorspace fell by 1.9 per cent or around 600,000 square metres – an average of 51,000 square metres per year.

Total office floorspace took up 26.7 million square metres of floorspace in 2012, up 12 per cent from 23.8 million square metres in 2000, an average increase of around 240,000 square metres per year. Almost 80 per cent of the office space was located in Inner London, which increased by 2.9 million square metres between 2000 and 2012, an average of around 240,000 square metres per year. The change was primarily driven by increases in the City of London and Tower Hamlets, with these two boroughs accounting for almost two-thirds of the increase, adding 1.9 million square metres between them – or 160,000 square metres each year. These two boroughs, along with Westminster, account for almost half of the office floorspace across London (12.8 million square metres). In Outer London, the total stock of office space remained relatively static, declining by 67,000 square metres or 6,000 square metres per year, to 5.7 million square metres.

Retail premises take up 17 million square metres of floorspace, and are spread widely across London, with 49 per cent located in Inner London and 51 per cent in Outer London. From 2000 to 2012 the total retail floorspace remained relatively constant, increasing by 5 per cent over this period – around 800,000 square metres in total, or 67,000 per year. Within London's town centres, total occupied retail floorspace covered approximately 7.1 million square metres in 2012, up 140,000 square metres from 2007. Strong growth in convenience retail floorspace (+175,000 square metres, +14 per cent) was counterbalanced by modest reductions in comparison retail floorspace of 13,000 square metres, and service retail floorspace of 22,000 square metres)[86]. In Inner London retail space increased by around 40,000 square metres per year (460,000 square metres in total) between 2000 and 2012, while in Outer London retail floorspace increased by around 350,000 square metres in total or 29,000 each year.

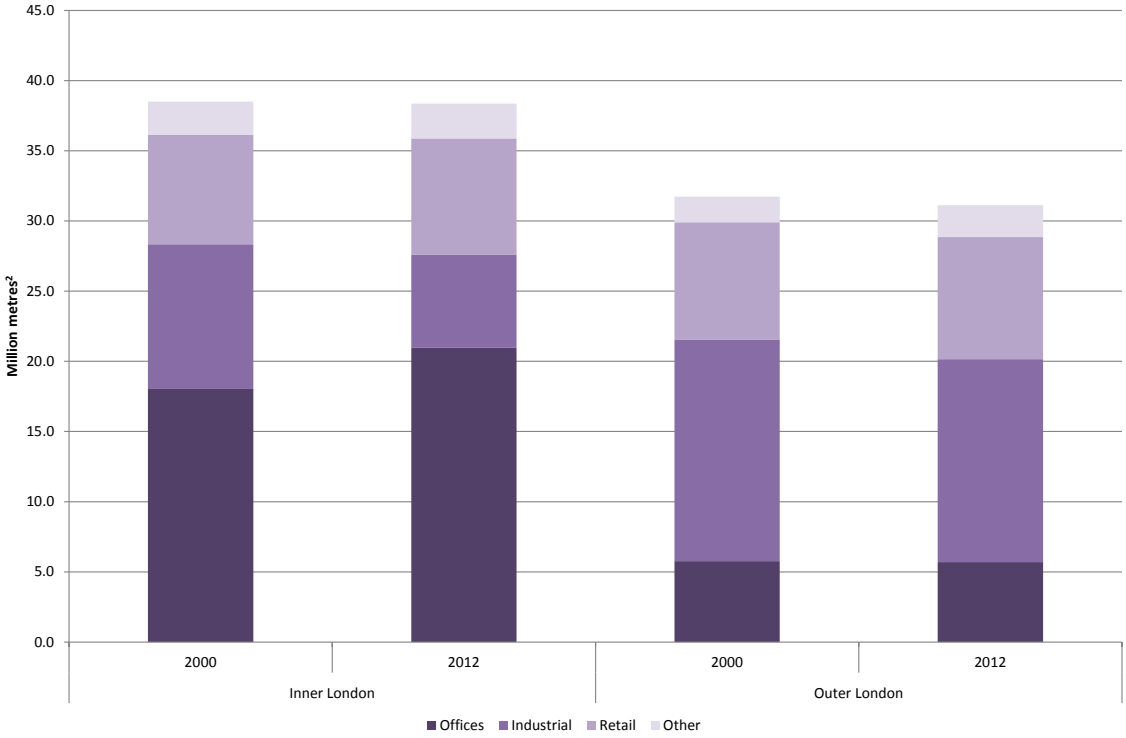
A further 21.1 million square metres are taken up by industrial uses including warehousing, reflecting an 19 per cent fall between 2000 to 2012, when industrial floorspace decreased by 5 million square metres or 415,000 square metres per year, a significant share of which may also be related to retail[87]. Industrial floorspace fell by 35 per cent in Inner London between 2000 and 2012, a 3.7 million square metre decline or an average of over 300,000 square metres per year. In Outer London the falls in industrial space were slower at around 110,000 square metres per year, falling to 14.4 million in 2012 from 15.8 million in 2000.

Figure 2.18: Business floorspace in London, 2000-2012



Source: VOA 2000-2012

Figure 2.19: Business floorspace in Inner and Outer London, 2000 and 2012



Source: VOA 2000-2012

These changes in the use of employment land reflect the competition between uses which affects the relative value of land. The value of commercial and industrial premises are calculated by the Valuation Office Agency (VOA) based on the notional annual rent that the non-domestic property could let for on the open market (the rateable value). The latest VOA data shows that, the average rateable values in London for all types of land are substantially higher than those in the rest of the country (with offices in the capital valued at more than 250 per cent more), with London alone accounting for over a quarter of total rateable values in England and Wales.

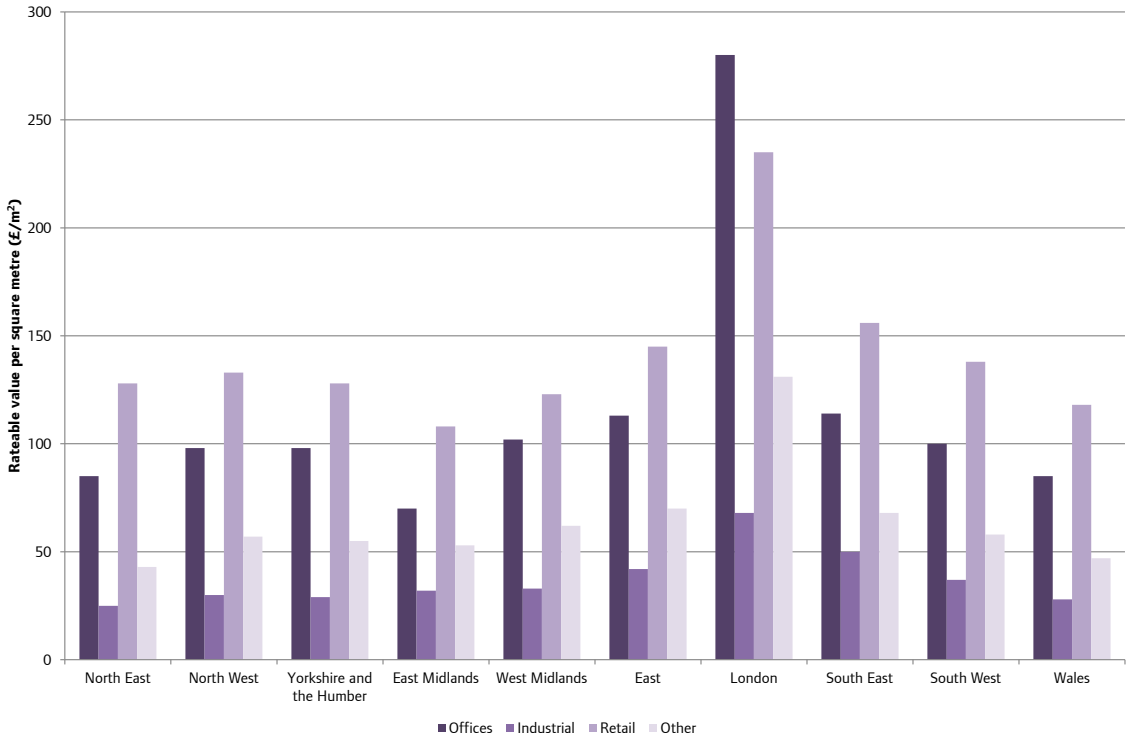
Table 2.19: Number of properties and rateable values in London, by property type

	Number of properties (000s)	Total rateable value (£ million)	Average rateable value (£)	Share of total rateable value in E&W
Shops	93	3,364	36,270	25%
Offices	87	7,322	84,190	53%
Warehouses	27	1,255	47,350	15%
Factories	23	468	20,634	9%
Other properties	77	4,054	52,860	20%
All properties	306	16,545	54,028	27%

Source: HMRC, non-domestic ratings, 2010 rateable values as at April 2013

Controlling for the different average size of these properties, Figure 2.20 shows that office and retail space in London are particularly highly valued relative to industrial and other uses.

Figure 2.20: Price differentials by commercial land use class across England and Wales (2012)



Source: VOA, 2012

As well as differences in the value of employment land by the type of use, there is also spatial variation in the rents for commercial and industrial space. Prime rents in the City were £67.50 per square foot as of September 2015 – higher than the £42.50 per square foot in the Docklands and East London – and have increased by 10 per cent over the past year. However, they still remain well below the rents in some areas of the West End, where rents were £120 per square foot in the Mayfair and St. James's areas (see Table 2.20)[88].

Table 2.20: Office Rental Values and Occupancy Costs in London[89]

Location	Prime Rents (£ per square foot)	Occupancy Costs (£ per square foot)
Mayfair	120.00	179.00
St James's	120.00	179.00
North of Oxford Street	95.00	144.50
Soho	87.50	131.00
Belgravia & Knightsbridge	85.00	138.00
Fitzrovia	82.50	117.50
Covent Garden	77.50	115.50
Marylebone, Euston & King's Cross	77.50	105.50
Victoria	75.00	114.00
Bloomsbury	72.50	107.50
City - Core	67.50	98.50
Kensington and Chelsea	65.00	105.00
City - Midtown	65.00	99.00
City - Eastern	65.00	95.50
City - Northern	65.00	95.50
City - Southern	65.00	94.50
City - Western	65.00	95.50
Paddington	62.50	93.00
Clerkenwell	62.50	86.00
Shoreditch	60.00	81.00
Waterloo	57.50	82.00
Southbank	57.50	86.00
Aldgate	55.00	80.00
Hammersmith	52.50	78.50
Camden	50.00	75.00
Battersea	45.00	69.00
Vauxhall	45.00	69.00
Docklands	42.50	80.00
Stratford	40.00	57.00

Source: JLL Research, The Central London Office Market Report Q3 2015

Industrial prime rents are much lower than office rents. As with office rents these vary across different parts of London reflecting the balance of demand and supply for space in different areas, from £15 per square foot in the Heathrow area, to £6.25 in Dagenham. This variation is also present in industrial land values which range from £450,000 - £650,000 an acre in the east compared to up to £1.8 million an acre in Park Royal and Heathrow in the west (see table 2.21).

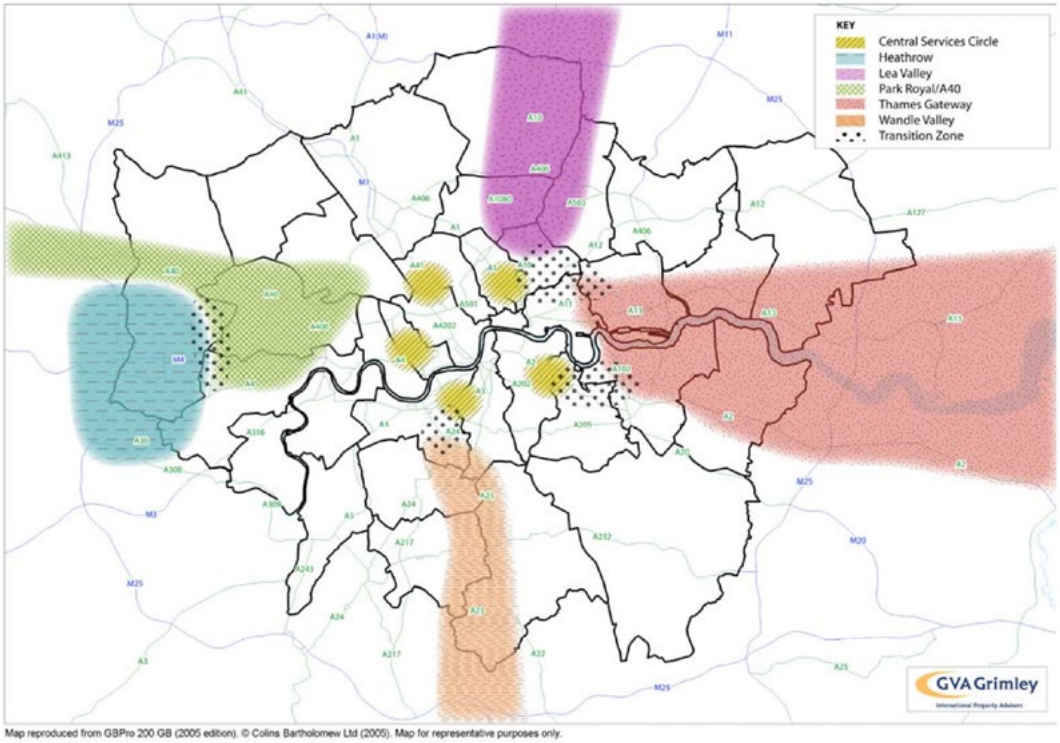
Table 2.21: Industrial rents and land values for small sheds in London, 2014[90]

Location	Prime rents (£ per square foot)	Secondary rents (£ per square foot)	Land values per acre (£ million)
Heathrow	15.00	9.50	1.80
Park Royal	13.50	9.75	1.75
Feltham	11.50	8.75	1.35
Wembley	11.00	7.50	1.40
Acton	11.00	7.00	1.35
Staples Corner	11.00	9.25	1.60
Canning Town	11.00	6.75	1.00
Uxbridge	10.50	7.25	1.10
West Drayton	10.50	8.00	1.20
Greenford	10.25	7.50	1.20
Hayes	10.00	7.00	1.20
Merton	9.50	7.00	1.25
Woolwich	9.50	7.00	1.00
Tottenham	9.00	6.50	1.00
Croydon	8.50	6.00	0.75
Enfield	8.50	6.50	1.00
Walthamstow	8.50	6.25	0.75
Barking	8.00	5.50	0.60
Romford	7.50	6.00	0.45
Dagenham	6.25	5.00	0.45

Source: Colliers International industrial rents, 2014

Unlike office and retail space which tend to cluster centrally, industrial and warehousing space in London instead tends to concentrate in particular 'wedges' or 'pockets' in order to afford easy access to markets in and out of London (Map 2.48).

Map 2.48: Principal property market areas for industrial and warehousing

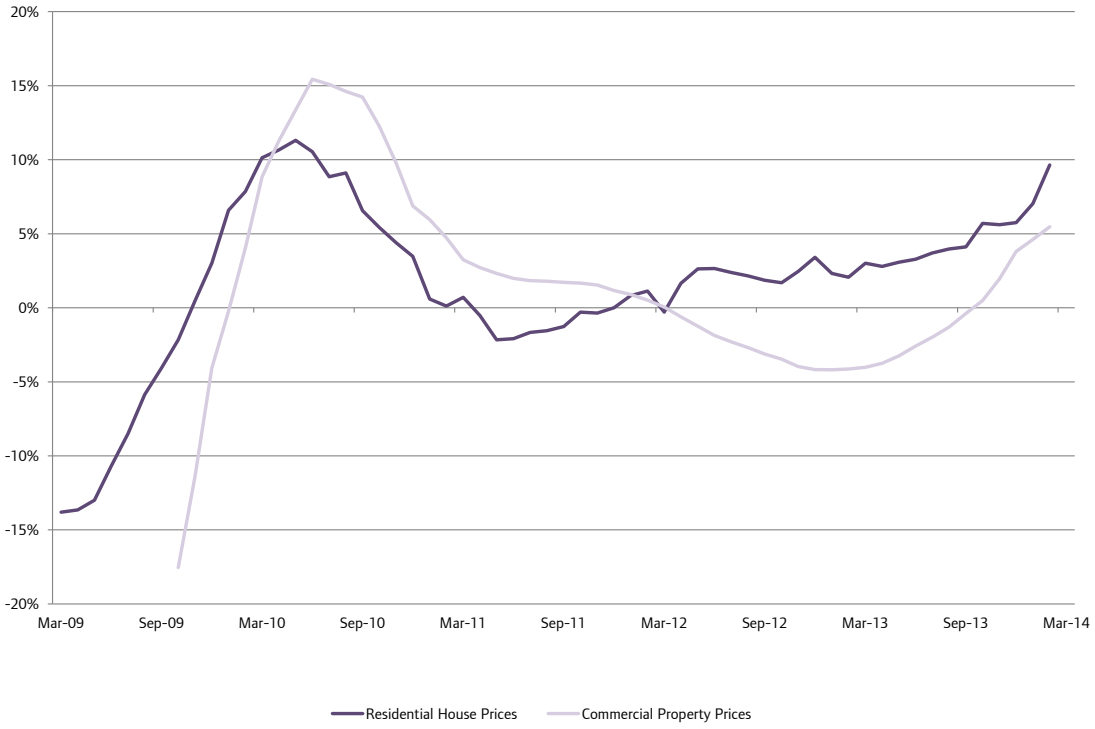


Source: URS

2.8.1.3.3 Price competition between commercial and residential space

According to spatial equilibrium theory[91], since land is substitutable on the margin between uses, commercial and residential property prices will move together if local productivity or the set of amenities change. Commercial and residential property prices are, in this sense, driven by common, or at least overlapping, fundamentals. Data for England comparing trends in the prices of commercial and residential properties provides some evidence of this correlation (Figure 2.21).

Figure 2.21: Commercial property and house prices annual growth, England



Source: ONS, IPD (DTZ Research)

Savills land development index, which mostly covers central London, shows that since 2008, the price of residential land recovered strongly compared to hotel and office development land, and now exceeds its pre-crisis peak. This may put increasing pressure on office and hotel space in central London areas as residential developments may increasingly be able to outbid other uses in the most central areas, as a result if these trends continue.

Figure 2.22: Savills land development index, prime London

Source: Savills

The latest data available from DCLG suggests that, in terms of land area, only limited amounts of land in London had switched to residential use in 2013/14[92]. Of the 86 hectares of land in London changing to residential use in 2014, 53 per cent was built on previously-developed land. It is however likely that in urbanised areas even relatively small changes in land use may have a significant impact on the levels of available floorspace.

2.8.1.3.4 Office to residential conversions

Evidence from the London Development Database suggests that changes in land use between commercial and residential are translating into relatively large losses in the availability of commercial floorspace. This shows that the introduction of permitted development rights (often referred to as 'office-to-residential') introduced in May 2013 to fast-track the conversion of offices to homes, has resulted in:

- At least 2,800 office-to-residential prior approval applications across London between May 2013 and April 2015, of which over 2,000 have been approved.
- If all of the schemes that have been approved but not superseded were developed, they would provide around 18,000 new residential dwellings. Around 5,300 of these had either been started or completed by the end of March 2015. .
- A total of 310,000 square metres of office floorspace are estimated to have been lost through schemes that have started or completed as a result of permitted development rights. This is equivalent to a loss of around 1 per cent of London's stock of office floorspace.
- If all of the approved schemes were implemented, more than 1.1 million square metres of floorspace could be lost at an average of around 650 square metres per scheme. This is equivalent to a loss of around 4 per cent of London's stock of office floorspace.

While these figures remain relatively small in the context of London's stock of office floorspace, the trends presented here provide early signs of a shift away from employment land and commercial space towards residential use. Chapter 4 considers the potential future risks to businesses if commercial space were to

be increasingly crowded out by the demand for housing and/or if current exemptions from the permitted development rights in the CAZ and NIOD were lifted.

2.8.2 House prices in London

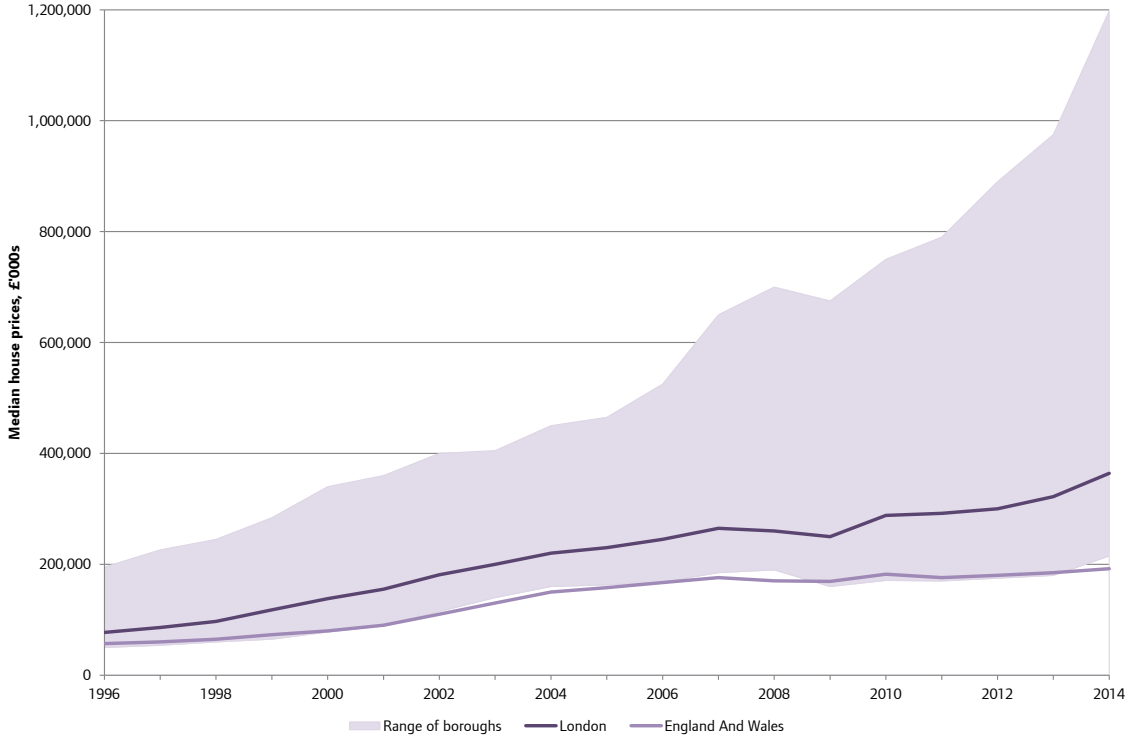
As noted above, the value of residential property in London has been increasing in recent years. London's house prices are considerably higher, and have been rising at a faster rate, than the country as a whole.

In each year since Land Registry records began in 1996, the average (median) house price in London[93] has exceeded the average for every other region in England and Wales. This gap in average house prices between London and the country as a whole has also grown larger in each year, with the exception of 2009 when year-on-year average prices in London fell by £10,000, which was greater than the £1,000 fall in average prices in England and Wales (see Figure 2.23).

In the period from 1996 – 2014 the gap between the average prices paid for housing across the different London boroughs has also grown markedly bigger. This reflects the rapid increase in house prices in central areas, where house prices were relatively high at the start of the period. This is particularly true in desirable central London boroughs with median house prices in 2014 as high as £860,000 in Westminster (up 11.4 per cent annually in the five years since 2009) and £1.2 million in Kensington and Chelsea (up 12.2 per cent annually in the five years since 2009) based on Land Registry data.

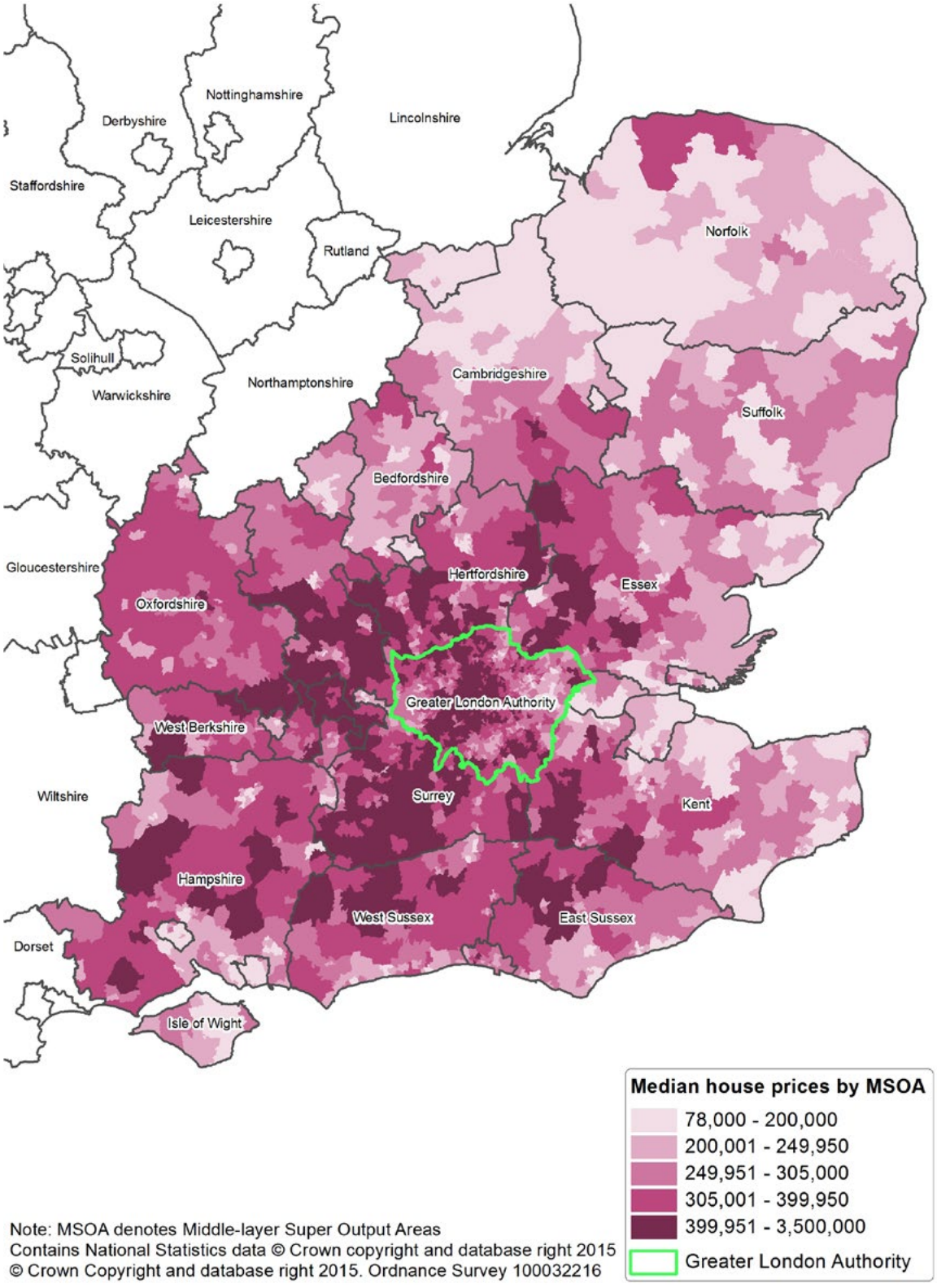
This compares to a London borough low median house price of £215,000 in Barking and Dagenham (up 6.1 per cent annually in the five years since 2009), which is still higher than the national average for England and Wales of £192,000 (up 2.6 per cent annually in the five years since 2009). High house prices have also spread beyond London's boarders, as people live outside of the capital and commute in for work. Counties such as Surrey, Essex, Kent and Hertfordshire have areas where the median house price exceeds £400,000.

Figure 2.23: House prices in London in England and Wales, 1996-2014



Source: Land Registry

Map 2.49: Maps of median house prices in London and the GSE, 2014

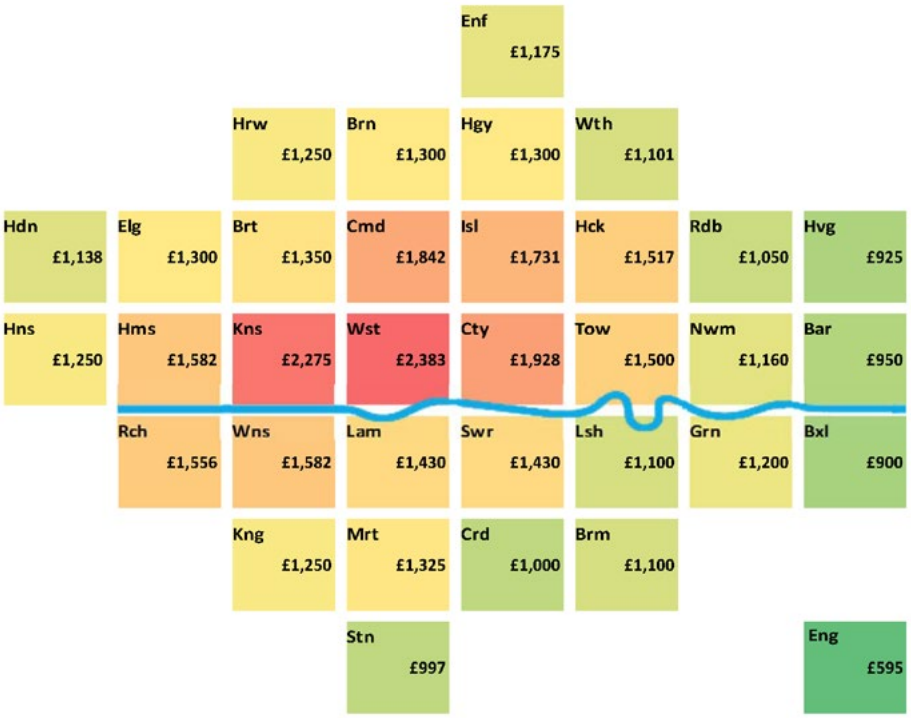


Source: Land Registry

As with the price of buying a home, the median price of private monthly rents in London is also considerably higher than in England as a whole. Based on data on private monthly rents from the VOA, median rents in London in 2013/14 were £1,350 per month, more than twice as high as median rents in England as a whole (£595 per month). The VOA data provides a 'snapshot' on the median value of private monthly rents, and although it cannot enable robust comparisons over time, it can be used to illustrate the differences in average rents across London[94].

Map 2.50 shows that in the 12 months to March 2014, the median monthly private rent was highest in Westminster (£2,383) and Kensington and Chelsea (£2,275). These were the only two local authorities in England to have a median monthly private rent of more than £2,000 in 2013/14. While considerably lower, median rents recorded in the London Boroughs of Havering, Barking, and Bexley were between 50-60 per cent above the national average.

Map 2.50: Map of median monthly rents by Borough (2013/14)

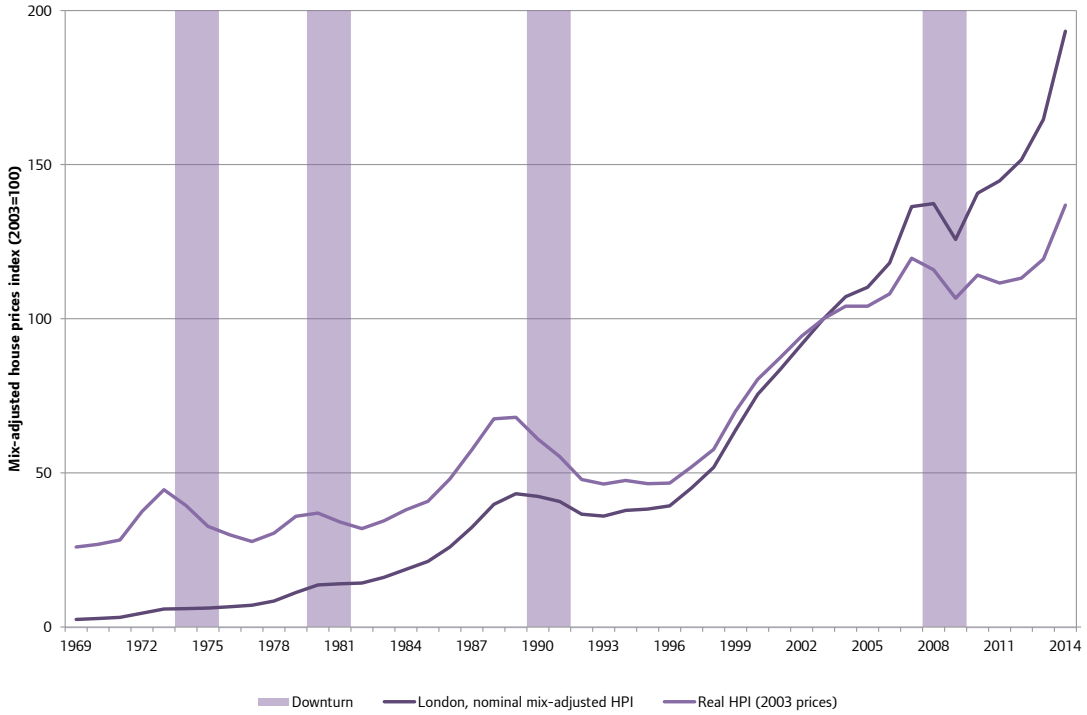


Source: VOA

2.8.2.1 House prices and the business cycle

Over a longer-time horizon, housing markets in London have witnessed a number of ups and downs, with volatile house prices in London tending to amplify changes in national house prices. Although falls in the actual (nominal) value of the average home are relatively rare, London has experienced several episodes of real house price deflation since the ONS data series began in 1969. From the patterns of previous cycles, no clear trends can be observed from price data alone that suggest whether London house prices are approaching a new peak, and whether this will entail a levelling off, or a more exceptional downward adjustment.

Figure 2.24: Nominal and real house price levels in London and the business cycle, 1969-2014



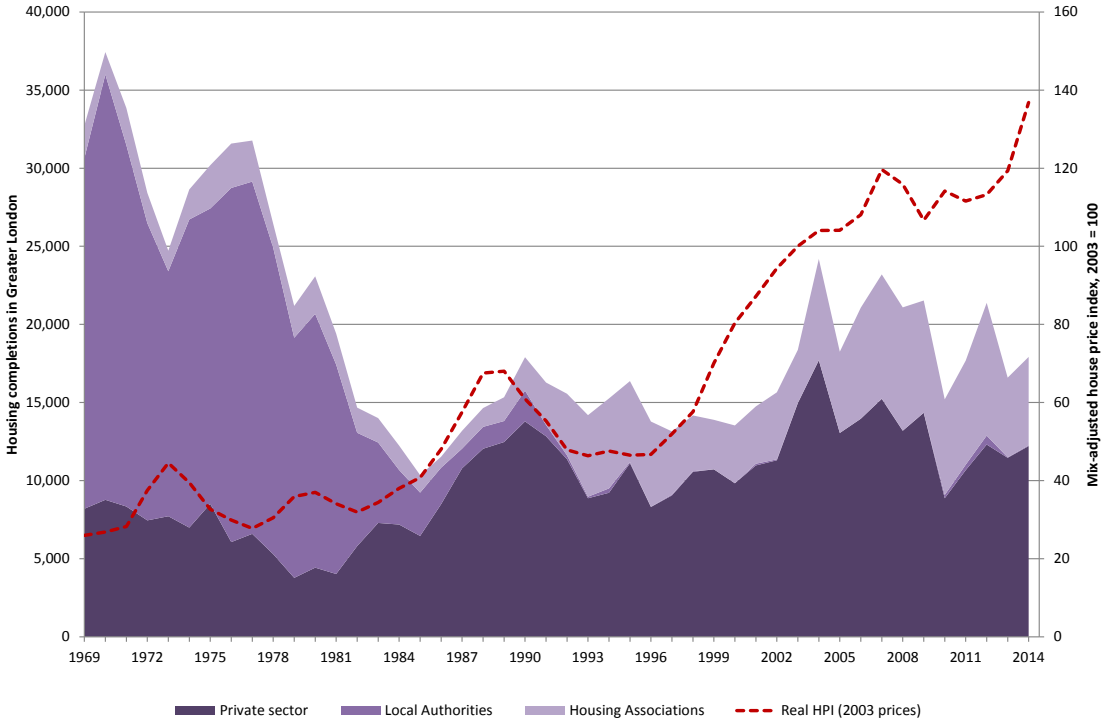
Source: ONS House Price Index reference table 33

2.8.3 Responsiveness of housing supply

While housing building has tended to fall following a drop in house prices, there is not always a corresponding increase during periods of rising prices. Although modest increases in the supply of private completed houses did however take place at the time of the previous two house price booms in the late 1980s and early 2000s, the levels of house-building in London have not kept pace with changes in house prices or the population.

As a result, gross house building levels in London have remained stubbornly below the levels seen in the 1970s, at which time the majority of new builds were developed by the public sector (see Figure 2.25). Furthermore, latest estimates indicate that 49,000 homes per year until 2035 need to be built in London to meet demand[95] - levels of building that have not been reached since prior to World War II, and well below the current rate of house building which saw less than 18,000 new homes built in 2014.

Figure 2.25: New house building and house prices in London, 1969-2014



Sources: 1969 to 1989 data provided to GLA by DCLG; 1990-2014: DCLG house building statistics tables 217 and 255a. ONS mix-adjusted house price index reference table 33.

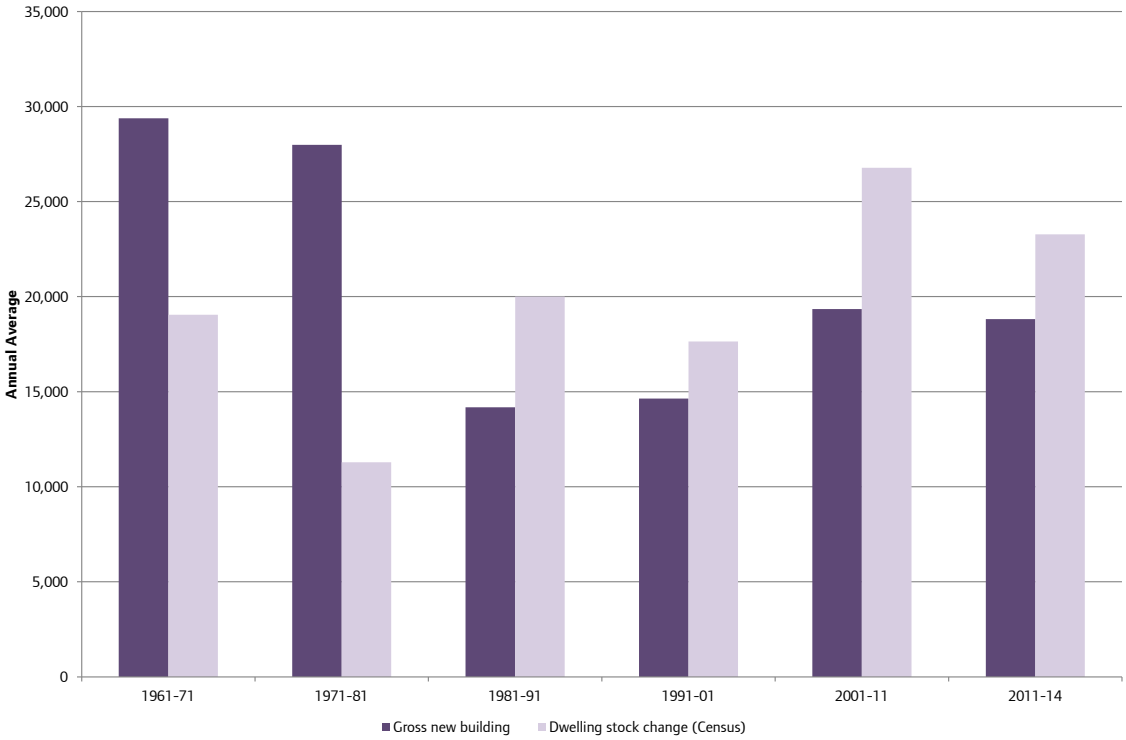
These construction data however only applies to new buildings (in effect, a gross measure) and does not take account of other possible changes to the dwelling stock as a result of conversions, changes of use and/or demolitions.

In each of the last five years for which data are available, overall net changes were 6 to 11 per cent higher than the number of new builds in London alone, adding almost 10,000 additional dwellings to the overall housing stock[96].

This notwithstanding, new build remains the primary driver of an increasing housing stock and the additional 10 per cent increase realised from conversions and other changes is still far from being responsive to the levels that recent trends in house prices would suggest are necessary to meet demand.

Looking back over a longer time period, Census estimates on the number of dwellings allow us to infer the net change across each decade. Figure 2.26 suggests that in contrast to recent trends, net additions to the housing stock were considerably less than gross levels of new building in the 1960s and 1970s. This is consistent with many of the new buildings at the time simply replacing existing stock following slum clearances and other demolitions. On an annual average basis, gross new builds and net additions to the housing stock have been slightly lower in the three years between 2011 and 2014 than in the previous decade, at a time of rising house prices.

Figure 2.26: Gross new house building and change in dwelling stock in London, annual averages



Sources: DCLG house building statistics, and Census data from 1961 to 2011

While the net supply of homes in London has increased since the turn of the century, this has been accompanied by strong rates of population growth, which has not always been the case. Between 1961 and 1991 London's population decreased by over 1.6 million people, while over the same period the dwelling stock increased by over half a million homes.

More recently, between 1991 and 1998 the housing stock increased by 4.4 per cent, compared to a 3.5 per cent increase in population, adding over 18,000 homes per year while the population increased annually by almost 34,000. This was a period when real house prices were stable, rising on average by 1 per cent per annum. However, between 1998 and 2014 real house prices grew by 9 per cent per annum. This was a period when increases in population exceeded that of housing supply, with London's population rising by 21.1 per cent at an average of over 93,000 people each year. The rise in the dwelling stock was much lower, increasing at an average of just over 24,000 homes a year, a total increase of 12.7 per cent over the period.

For growth of the dwelling stock to have kept pace with population growth over this period, over 250,000 extra homes needed to be added to the housing stock – an average of almost 16,000 each year – on top of the 24,000 per year that were added during this period. As the supply of additional homes did not keep pace with demand, the number of people per dwelling has increased from 2.32 in 1998 to 2.50 in 2014.

As the average household size has increased, so has the incidence of overcrowding[97], which was up by 65 per cent in London between 1997/98 and 2012/13. Around three-quarters of this increase was in the private rented sector, with the rate of overcrowding in the sector doubling over this period from 6.1 to 12.8 per cent, and exceeding over 100,000 households in total in 2012/13[98]. This is consistent with the expected behavioural response to the undersupply of homes and increased cost of housing over this period, alongside the increase in international migrants from poorer countries between 2001 and 2011 who tend to live at much higher densities, in terms of people per room[99].

Looking forward, the most recent population projections show that between 2014 and 2041 London's population is projected to increase by between 65,000 (long-term migration assumptions) and 83,000 people per year (short-term migration assumptions). The total rise in population projected is between 20.6 per cent and 26.4 per cent– an aggregate increase of between 1.61 million and 2.06 million people[100]. While the latest assessment projections for housing need in London found that 49,000 new homes per year are needed between 2015 and 2035[101], less than 18,000 new homes were delivered in the capital in 2014. These estimates reflect an expectation that household formation rates will fall to levels similar to the 1990s, with an average household size of 2.34 projected by 2035. This change is driven by a population that is expected to become older, which will result in the formation of smaller households.

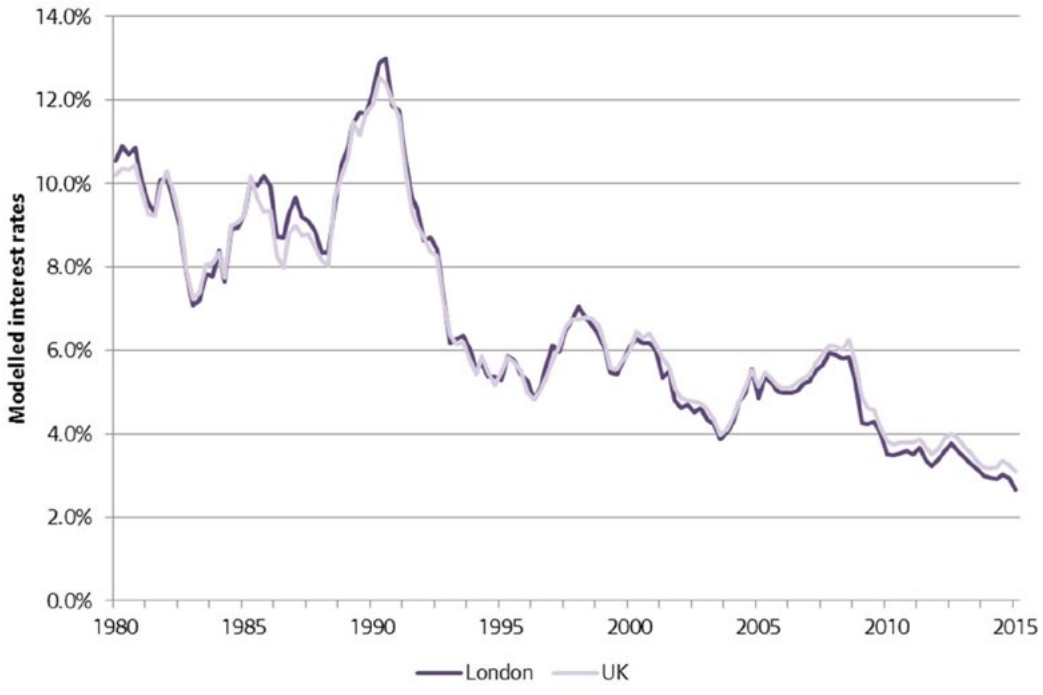
2.8.3.1 Other drivers of demand for housing

As well as increases in population, other types of demand for housing can also influence the market, particularly for house prices. Important factors include changes in incomes, the cost of mortgages, and demand for housing as an investment vehicle by investors.

In terms of income, evidence suggests that the 'income elasticity of demand' for housing in the UK is positive, meaning that market demand for housing does indeed grow as people become better off. In certain highly desirable London sub-markets and for specific types of home, it is possible that demand for housing is particularly sensitive to changes in incomes. Research by Cheshire and Sheppard[102], for example, finds evidence that the demand for housing space (both the internal space and garden space) increases at around twice the rate of increases in household incomes.

Borrowing costs for home buyers are also important – and these costs are at historically low levels. Figure 2.27 shows that interest rates on regulated mortgages secured on properties in London were 2.7 per cent in the first quarter of 2015, down from an estimated high of 13 per cent in 1990. Such historically low mortgage interest rates have reduced the nominal debt repayment burden and increased household's borrowing power. It is also notable that while Bank of England base rates have been set at 0.5 per cent since March 2009, the mortgage interest rates faced by homebuyers has fallen by 1.6 percentage points in the past five years.

Figure 2.27: Mortgage interest rates in London and the UK, 1980-2015



Source: Greater London Authority, An Economic Analysis of London's Housing Market (November 2015)

Further, a 2005 OECD paper[103] suggested that financial deregulation since the 1980s, and more recent lending innovations such as offset mortgages which allow borrowers to offset their savings against the mortgage balance, have significantly reduced household costs of borrowing[104]. The relaxation of borrowing constraints, and the reduced cost of mortgages, in turn may have positively fed back to house prices.

It has also been argued that two other changes in London's housing markets, related to the use of property as an investment, have fed into overall increases in house prices: increasing foreign ownership of housing, and growth in the buy-to-let market.

There is limited available evidence that either of these have had a profound impact on house prices. Indeed, although increasingly supported by buy-to-let mortgages, the share of the private rental market in London remains lower than it was in the 1960s and 1970s. However, it is arguable that the strong long-run performance of London housing relative to alternative investments may have contributed to London's housing stock being increasingly seen as a vehicle in which to hold money, acting as a possible further incentive towards owner-occupation.

With regard to foreign ownership, the evidence is also mixed, and on balance suggests that it is responsible for only a small share of transactions and likely to have had only modest effects on house prices in London. There is also some evidence to suggest that following the economic crisis, the additional demand for new build properties may have to some extent lessened the negative impact of credit constraints on construction activity[105].

2.8.3.2 Market frictions and physical constraints on housing supply

A number of factors may explain why housing supply in London has been relatively unresponsive to price signals to date. A number of possible market frictions and inefficiencies have been put forward by the literature to explain why housing is slow to respond to market signals[106]. These include: difficulties for house-builders to access commercial finance; risk aversion or perverse incentives that lead to stock-piling of land; barriers to overcoming construction materials and skills shortages; as well as imperfect competition in the market for residential development (relative to other land uses). In a 2012 report, Molior[107] highlighted that 45 per cent of schemes of 20 or more private homes in the Greater London area were in the control of firms that were not builders, although a 2014 update showed that this had since been reduced to around 30 per cent[108].

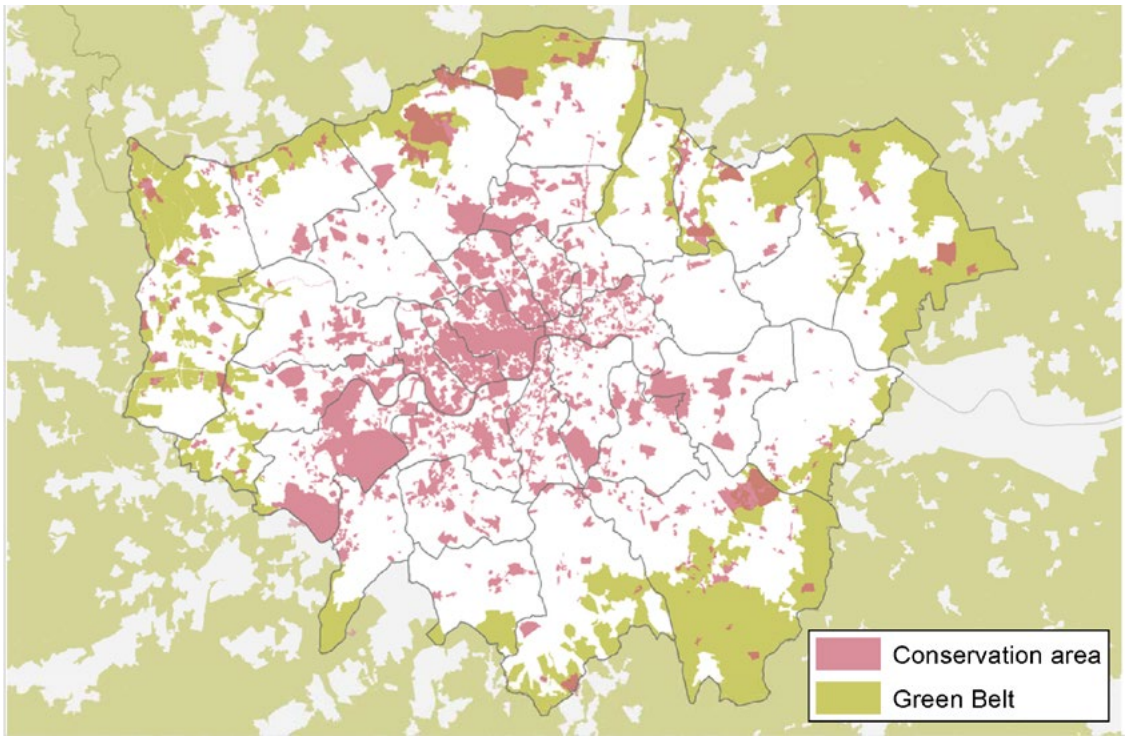
However the most cited constraint is the planning system and the local scarcity of developable land associated with it. New building in London, and particularly house building, is subject to a number of constraints; notably the land covered by Green Belt and other designated conservation areas[109]. The first conservation areas in London were designated in 1967 and there are now over a thousand in total. An estimated 15 per cent of the land in London is within a designated conservation area, a proportion which ranges from 1 per cent in Barking and Dagenham to 72 per cent in Kensington and Chelsea and 77 per cent in Westminster.

- 22 per cent of London's land (341 km^2) lies within the metropolitan Green Belt, only a small amount of which overlaps conservation areas. While 14 boroughs have no Green Belt land, in Havering and Bromley the Green Belt comprises just over half of the total land area.

- 94 per cent of the metropolitan Green Belt lies outside of London.

- 4 per cent of new residential addresses were created within the Green Belt and 5 per cent of land changing to residential use was within the designated Green Belt.

Map 2.51: London conservation areas and Green Belt



Source: English Heritage, Conservation area boundaries provided to GLA

It is necessary to weigh up the costs and benefits of any such restrictions in order to assess whether the (often intangible) value of protections in terms of amenity benefits (and the offsetting dis-amenities) are worth the additional monetary costs that results from the upward pressure that this places on the price of land. In the case of protected green areas, in line with the 'theory of the commons'[110], Helm argues that it may be necessary to consider the system benefits and the value of the natural capital endowments as a whole, as well as consider the potential benefits that could be derived if greater efforts were made to maximise the value of green space by, for example, increasing their amenity value by improving public access[111].

A range of evidence exists which looks into the role of planning constraints on land prices. In the case of commercial property, analysis by academics at the London School of Economics[112] finds that regulatory limits on the height and density of buildings in the West End inflate the price of office space by an estimated 800 per cent, compared to a comparable price effect of around 300 per cent in Paris and Milan.

Similarly, in an assessment of the determinants of house prices in England, Hilber and Vermeulen[113] estimated that around 35 per cent of the price of a house in England is directly attributable to the regulatory restrictiveness of land use planning in that area. This was measured by the average refusal rate of major residential projects which the authors find to be highest in London and the South East.

In a separate paper on the relationship between planning and housing, Hilber (2012) however notes that house prices in London would still be fairly high by world standards even 'if the planning system was reformed and various regulatory constraints relaxed. Moreover, such reforms would be likely only to lower price pressures gradually and over longer time periods'. This is because the supply (or flow) of new homes in any period will only have a marginal effect on the overall supply (or stock) of homes available.

Data on planning permission approvals also shows that the slow pace of house building is not only a question of planning restrictions. Typically, planning approvals are given for roughly 1.5 to 2 times the actual number of homes finally built, and this gap has been broadly consistent over the past 10 years – so although the level of approvals indicate a capacity for more homes, something else is preventing these from actually being built.

While it remains possible that conditions after consent is granted may act as a barrier to completions in some cases, the persistence of this gap suggests that other factors are acting as a brake on house building. In interviews with the firms behind London planning permissions in 2014, Molior finds that whilst funding is no longer a widespread issue, shortages of staff and materials may be delaying activity[114]. The Outer London Commission (OLC) also highlights concern of 'a tendency for developers to manage the delivery of private sale units to maintain sales values' across larger sites[115].

2.9 The population density of London

With the constraints on land that exist in London, how efficiently this land is used to meet the demands of a growing population is an issue that currently faces the capital. Increasing the population density is necessary to allow London to house its growing population within its current boundaries. Whilst population density in Inner London is significantly higher than Outer London, Central London's population density is much lower when compared to other global cities. This suggests that there is scope for London to increase its population density centrally towards that of other major cities, but also in the outer areas of the city by increasing densities towards those of areas in Inner London.

2.9.1 The impacts of higher population density

The findings of research into the impact of higher population densities are mixed. A key challenge when identifying the advantages and disadvantages of higher density living is that different people experience the impacts of density in different ways, which results in the findings of the research being very much open to debate. The concentration of population density can have economic, environmental, health and social impacts amongst others, which have been summarised by Boyko and Cooper[116].

Economic advantages from higher density development include improving a city's economic efficiency and employment opportunities through agglomeration, increasing productivity levels - with a doubling of employment density increasing average productivity by around six per cent[117], promoting the critical mass necessary to support local retail and service areas, whilst transit also becomes more viable and efficient, and existing infrastructure is used more efficiently. This is broadly reflected in cities that have higher levels of agglomeration also tend to have higher GDP per capita and higher productivity levels[118].

Disadvantages attributed to higher density include greater costs to build and maintain higher density projects, increasing the relative price of dwellings; restricting access to undeveloped land, and negatively impacting the economic development of surrounding rural areas. Increases in traffic congestion were also cited as a disadvantage, whilst some studies have found that the returns from higher density diminish beyond a certain point. The costs of higher densities can exceed the benefits of agglomeration under certain conditions, where there is an under-investment in transport and infrastructure, and insufficient planning, which results in increases in congestion, crowding and pollution[119].

Benefits for the environment attributed to higher densities can include reducing carbon emissions and pollution due to lower rates of vehicle use, and making better use of natural resources. For example, there is a 10-fold difference in transport related carbon emissions between energy-intensive sprawling cities and compact cities that are more energy efficient[120]. The densest areas of London have greater shares of trips made by public transport, walking and cycling, with evidence of a shift away from cars as the means of travel to work in areas experiencing an increase in population density[121]. However, other studies suggest emissions in high density cities are higher overall. One study finds that individuals desire to travel to distant locations, which alongside increased congestion and travel time associated with higher densities, mean that overall emissions are higher[122]. Other disadvantages identified in research include exacerbating pollution due to reduced space for trees and shrubs; reducing the capacity to cope with domestic waste and to recycle; and using more energy during the construction of high density buildings.

Boyko and Cooper also found in the research that the health benefits from density include increasing exercise by enabling more walkable and bicycle friendly neighbourhoods that offer more opportunities to walk or cycle, whilst other research has revealed that higher density living can result in mental health issues. Findings on the social impacts of higher density are also mixed, with research finding that it can significantly

improve housing choice, and create a more liveable and sustainable urban environment. However other studies revealed higher densities can lead to cramped living environments, a loss of privacy, increases in noise and nuisance, and contribute to a lower overall sense of community. Some of the research findings on social impacts is mixed, suggesting higher densities can both increase and reduce social inequality and segregation, and also have positive and negative impacts on crime.

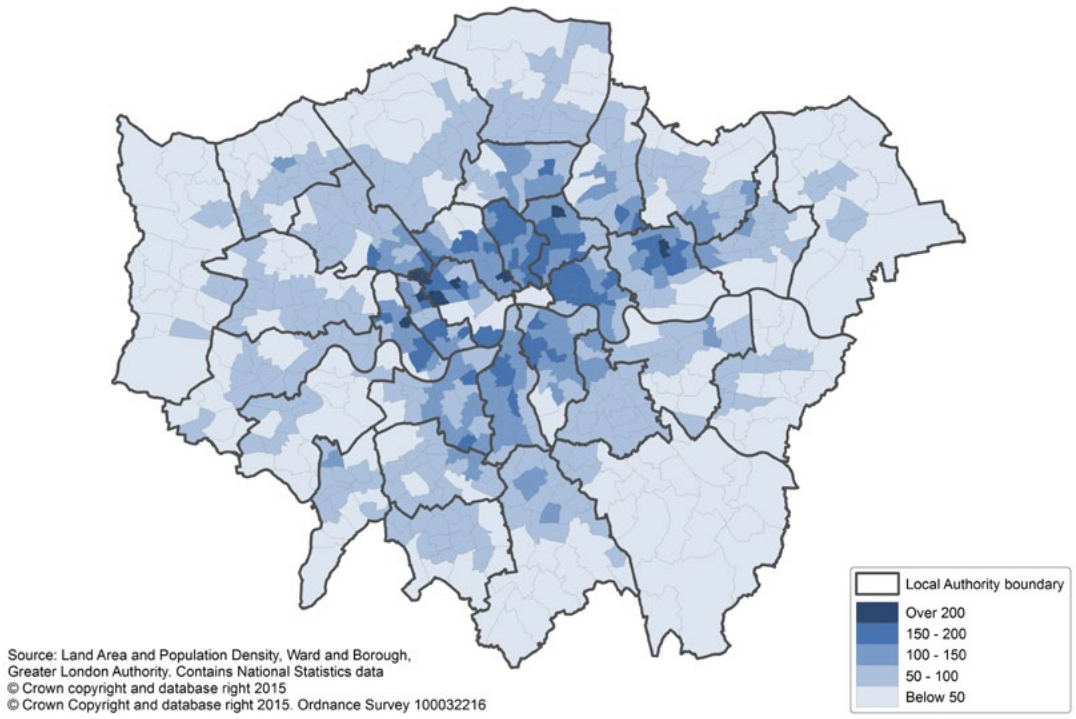
Overall, there is no clear consensus on the costs and benefits that arise from higher densities. This underlines the importance of planning and design when increasing population density. Increases of development density that are well planned and designed can ensure that the benefits from population density are maximised, whilst minimising the costs that can be associated with it.

2.9.2 Current levels of density in London

Overall in the capital there are 5,510 people per square kilometre, with Inner London boroughs more concentrated at 10,773 people per square kilometre, and density increasing to 11,565 in the Central London boroughs[123]. There are some small areas in London which have particularly high population densities. Islington is the borough with the highest population density of 15,118 people per square kilometre, whilst there are five wards in Westminster, and single wards in Newham, Hackney, Kensington and Chelsea, Camden, and Hammersmith and Fulham, that have population densities of over 20,000 people per square kilometre.

In Outer London density is much lower with 4,165 people per square kilometre, with the lowest density in Bromley at 2,162 people per square kilometre[124]. Higher population densities in Inner London can be attributed to its proximity to higher concentrations of employment, and the historical development of the city when transport was more costly.

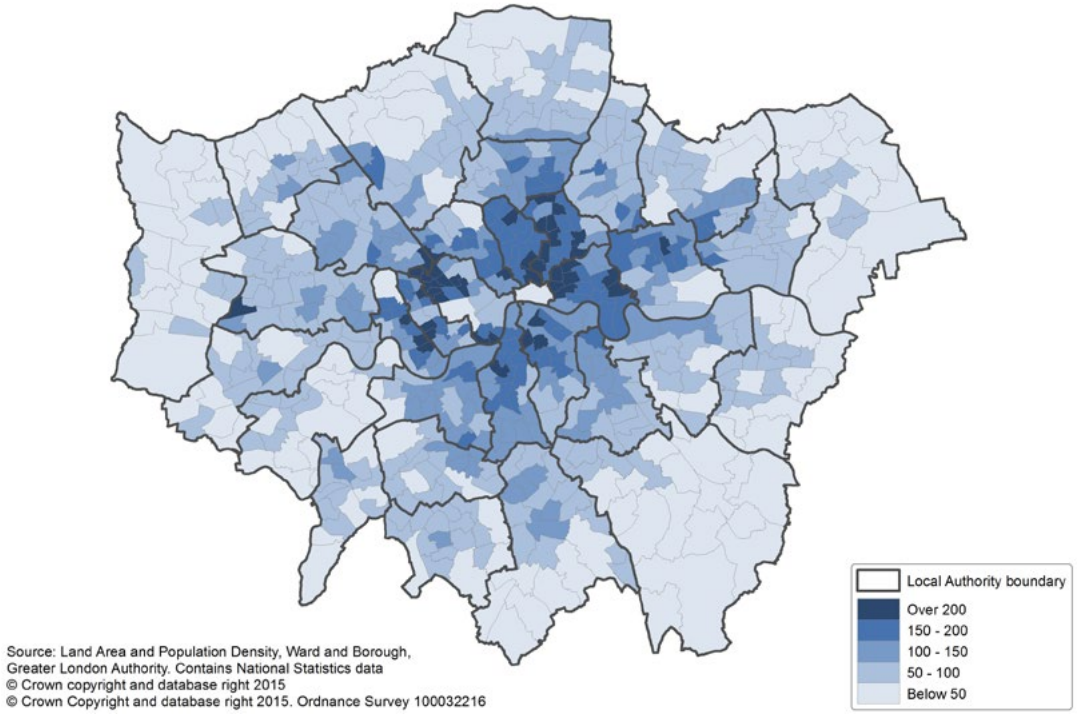
Map 2.52: Population density in London, 2015



Source: Greater London Authority

Current population projections estimate that the total population density of the city will increase to 6,586 people per square kilometre by 2041, a rise of 19.5 per cent. Inner London boroughs are expected to increase in density by 23 per cent, whilst Outer London boroughs are projected to increase their density by 17.2 per cent over the next 25 years.

Map 2.53: Projected population density in London, 2041



Source: Greater London Authority

Box 2.1: More Residents/More Jobs?

It often makes sense to think about demographic and employment trends separately. Population increase is affected by birth and death rates and by migration patterns, all of which are only indirectly the result of economic pressures. Jobs, however, are the result of business investment, public spending and economic opportunities which do not appear to have much to do with population trends.

However, some important dynamics are missing from this brief summary. It is obvious that where there are more residents there will be more employment opportunities, to cover greater demand for health centres to gyms to schools to estate agents etc.; so more economic activity is associated with areas with more people. Moreover, local residents setting up in business may prefer to establish their business near their home, even if their customers are in a different part of the country (or abroad).

Identifying the job-population association is a complicated task. A prescriptive approach (e.g. how many estate agents a residential development will require) should be avoided. Furthermore, the approach needs to capture investments by residents that are not for local consumption.

Impact assessment studies for residential and commercial developments can often be used to estimate changes to employment and population levels in the local area. This will typically be based on the ratio of employment to population in the surrounding region, a method that works better for discrete and well defined smaller urban areas, than for London.

Therefore, due to the size and nature of London, levels of both public transport and highway accessibility influence the location of employment and population. Most London workers expect to commute to work; principally by either car or public transport[125].

Recent research by GLA Economics[126] has examined this issue in detail and discovered that:

Areas within London with low levels of accessibility exhibit a strong relationship between employment and population density. These predominantly Outer London areas have a higher proportion of employment that serves the local population.

For areas of high public transport accessibility, above 0.7 million people, the relationship between population density and employment density breaks down. Here instead, accessibility itself becomes a stronger determinant of employment density. In these areas of high accessibility, a lower proportion of employment exists to serve the local population. In its place, more specialised and higher paid employment is found, access for which is predominantly gained by public transport.

Despite finding a significant relationship for areas of London with low public transport accessibility, there is still a large margin of variation around the employment to population density ratio.

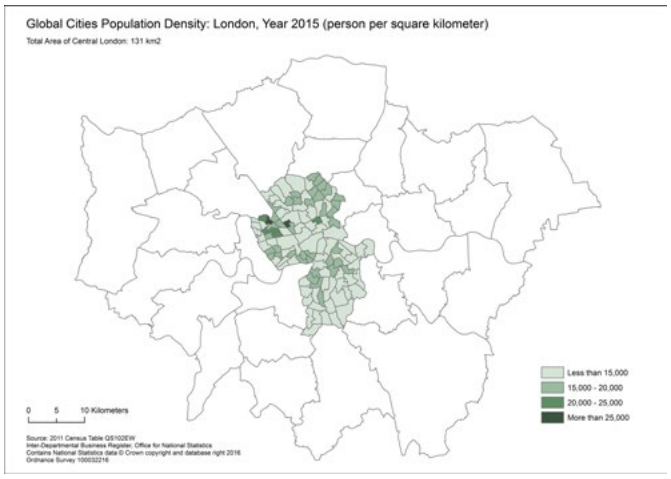
Nevertheless, there is reasonable evidence to suggest that land turned over for housing in areas of low transport accessibility could be associated with employment growth in the local economy. Taking the coefficient of employment density regressed alone on population density in areas of low accessibility, it can be deduced that an increase to the resident population of 1,000 will on average have the potential to give rise to a further 171 jobs in the locality.

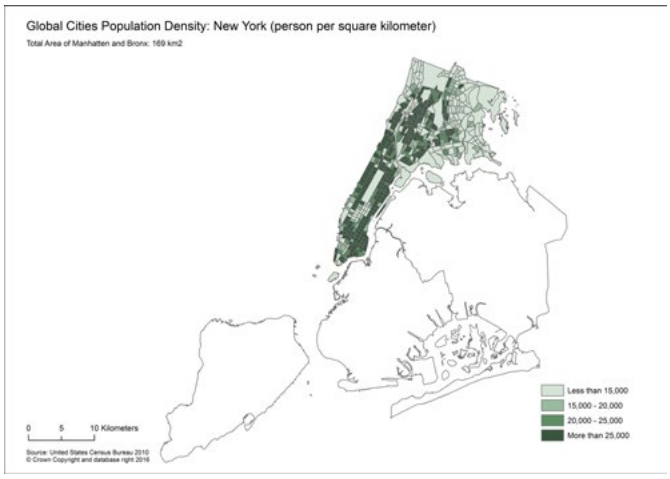
2.9.2.1 Density of London compared to other cities

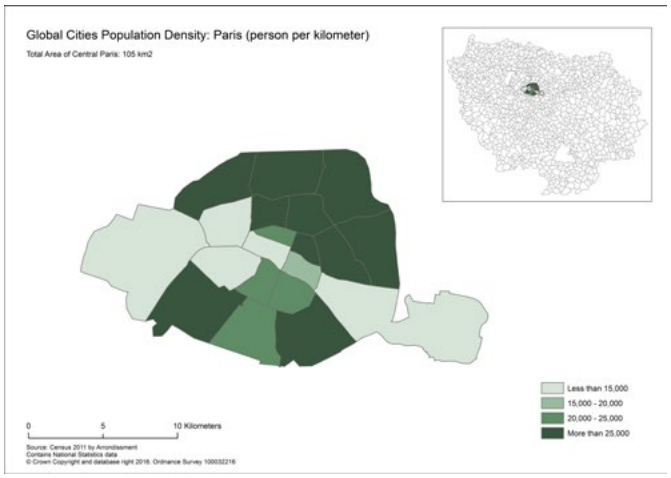
Given the projections in increased density of London, it is useful to analyse how it compares to other cities. Four other 'global' cities – Paris, New York, and Tokyo - have been chosen for this comparison.

Overall, Tokyo has the highest population density of the four cities with over 6,000 people per square kilometre. London is second, followed by Paris and then New York based on the wider definitions of these city boundaries. Looking at the central areas of these cities however, the population density of central Paris is 1.8 times that of Central London. In New York, Manhattan and the Bronx are 1.6 times the density, while the central wards of Tokyo are 1.4 times dense, with London having the lowest population density in the central area of all these cities.

Maps 2.54-2.57: Population densities of central areas in 'global cities'







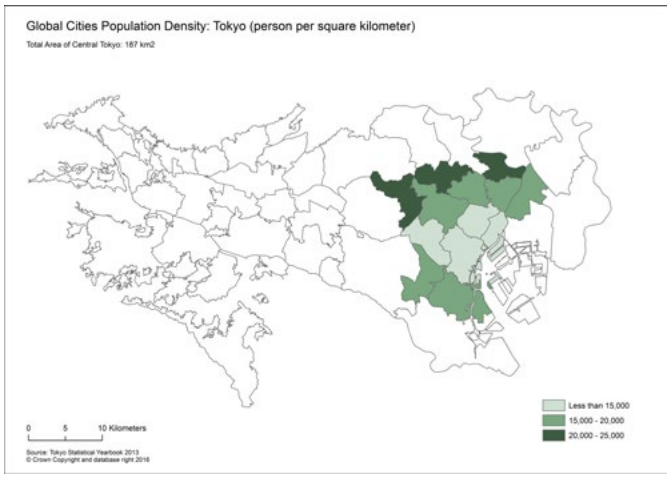


Table 2.22: Density of 'global cities'

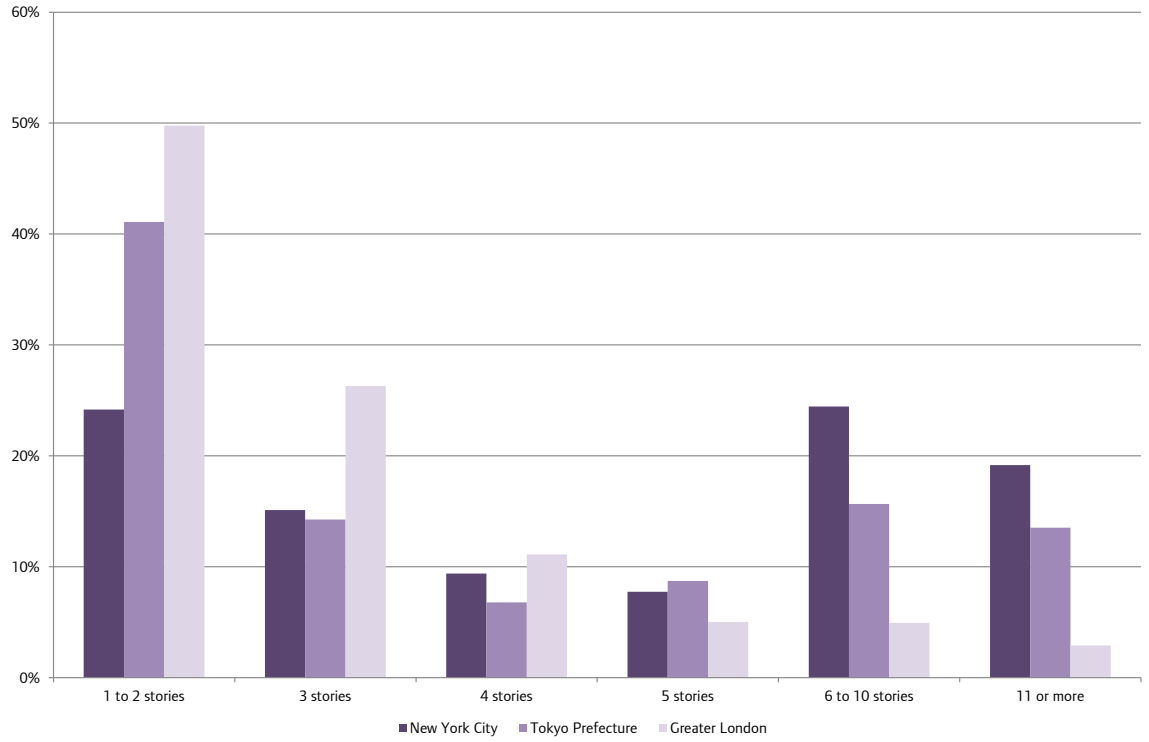
City	Population (millions)	Density (per km2)	Area (km2)
London	8.66	5,510	1,572
Central London	*1.49*	*11,565*	*129*
Paris[127]	12.01	997	11,986
Central Paris	*2.24*	*21,264*	*105*
Tokyo	13.29	6,038	2,189
Central Tokyo[128]	*3.09*	*16,533*	*187*
New York City	8.49	10,756	786
Manhattan and The Bronx	*3.07*	*18,300*	*168*

Source: GLA Estimates, Eurostat, US Census, citypopulation.de

Furthermore, particular areas within the centre of these cities have even higher densities. Manhattan alone has a population density of over 27,000 people per square kilometre, while the Toshima ward in Tokyo has a density of almost 23,000 people per square kilometre. These densities are much higher than the 15,000 people per square kilometre in Islington, suggesting that, by international standards, London has the scope to further increase its population density in the central part of the city.

The relatively low density in central London is reflected in the lower number of tall buildings compared to Tokyo and New York City. In London, three quarters of tall buildings are three stories or less, compared to 55 per cent in Tokyo and 39 per cent in New York City. While buildings of eleven stories or more are much less common in London, at just 3 per cent, compared to 14 per cent in Tokyo, and 19 per cent in New York City.

Figure 2.28: Building height in selected cities



Sources: English Housing Survey, Japan Housing and Land Survey, New York Housing and Vacancy Survey

Whether these tall buildings in London are predominantly residential or not also has an impact on population density. Whilst London has 15 towers taller than 150 metres, only one of these towers is residential. By contrast, New York has 188 towers of which 66 are residential, and Tokyo has 118 towers of which 46 are residential. However, if all the currently planned towers in London are built, by 2025 it is estimated that London could have 44 towers, of which 25 would be residential[129].

Moving further out from the centre, New York City has the highest density of the four cities at 8,765 people per square kilometre, followed by London with a density of 4,165. This is higher than the Tama area in Tokyo by around 15 per cent, but around 8 times the density of outer Paris. However, geographically, London is larger than New York City, but smaller than Tokyo and significantly smaller than Paris. London covers an area of 1,572 square kilometres; Tokyo is 1.4 times this size, Paris over seven times the size. New York City is just half the size of London, but the wider New York Metropolitan area, which expands beyond New York City, is much larger covering over 30,000 square kilometres and is home to over 22 million people, at a much lower overall population density than New York City itself.

Comparing the density of London to other major European cities shows a similar trend. London is a higher density city than other major cities in the European Union (Table 2.23), but most other major European cities cover a wider geographic area compared to London, despite their lower populations. Madrid is five times bigger than London, Rome is three times the size geographically, while Bucharest is 12 per cent bigger than London but is home to around one quarter of the people. In terms of geographic size, only Berlin is smaller than London at just over half the size, and is home to around 40 per cent of London's population; it has the second highest population density of the major European cities behind London.

Table 2.23: Population density of large cities in the European Union[130]

City	Population (millions)	Density (per km2)	Area (km2)
London	8.66	5,510	1,572
Berlin	3.42	4,001	886
Bucharest	2.28	1,298	1,759
Paris	12.01	997	11,986
Madrid	6.38	804	7,983
Rome	4.32	780	5,183

Source: GLA Estimates, Eurostat (Macrobond)

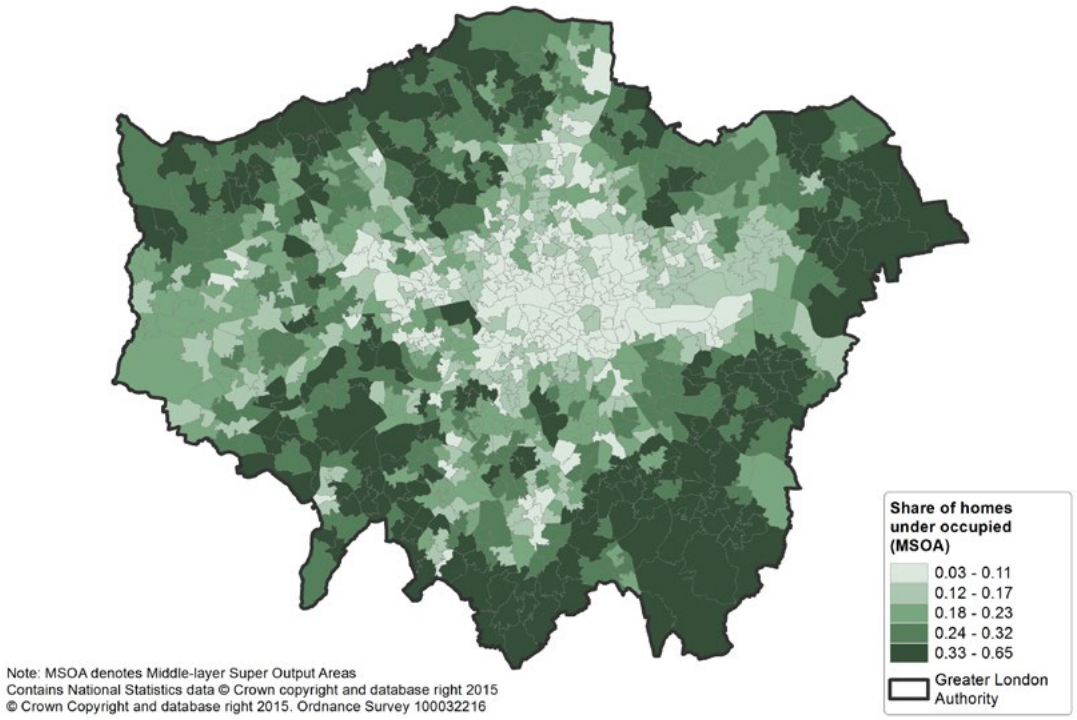
Another manner in which to consider the density of the city is by measuring its population weighted density. This attempts to measure the density at which the average resident lives, rather than dividing the total population by the entire city area, by using a weighted average of parcels of land based on their population. Based on this measure London has a population density of around 80 people per hectare, similar to that of Berlin with 83 people per hectare, and lower than Madrid (186 people per hectare), Paris (133 people per hectare) and Rome (89 people per hectare). Of the cities measured in Europe, Barcelona had the highest density of 246 people per hectare[131].

Whilst these comparisons have focused mainly on the central areas of these cities, further analysis of population density in Outer London will be included in the final version of this report.

2.9.2.2 Capacity of existing stock

Another way to house the growing population of London would be to increase the use of the existing housing stock, as much of it is currently under-utilised. There are around 730,000 under-occupying households in London[132], 23 per cent of all households in the capital[133]. Generally, under-occupation is more common in Outer London areas than it is in Inner London, with the outer south-eastern part of the city being where rates of under-occupation are highest. Closer to the city centre, under-occupation appears to be more common in the southern and western parts of the city, compared to the northern and eastern areas which make better utilisation of the existing housing stock. In terms of density, this is important as those areas with lower population densities tend to also underutilise the current housing stock to a greater extent.

Map 2.58: Share of homes under occupied in London



Source: Census 2011

Whilst there are a number of factors that influence how the housing stock is consumed, one consideration is the cost of moving home. Various studies have found that taxes such as Stamp Duty Land Tax can reduce household mobility[134]. Furthermore, characteristics of the current tax system have been found to encourage inefficient use of the housing stock, for example, discounts on council tax that are offered for single occupants, as well as second and empty homes that encourage under-occupation[135]. Well-designed taxes could influence the incentives of under-occupation and encourage a more efficient use of the housing stock.

Chapter 2 endnotes

1 London First, January 2015, 'London 2036: An agenda for jobs and growth'.
2 More detail on Functional Urban Areas is available from Eurostat here: Eurostat, 'European cities – the EU-OECD functional urban area definition'.
3 ONS, 'Travel to Work Areas'.
4 For an example see: Cushman & Wakefield, 2011, 'European Cities Monitor'.
5 GLA Economics, September 2014, 'Growing Together II: London and the UK economy'.
6 Graham, D. (2007) "Agglomeration, productivity and transport investment" Journal of Transport Economics and Policy, 41(3)
7 An area that contains Canary Wharf.
8 For a more in depth analysis of the CAZ, NIOD and their fringes please see: Douglass, G., August 2015, 'Working Paper 68: Work and life in the Central Activities Zone, northern part of the Isle of Dogs and their fringes'. GLA Economics.
9 NUTS stands for Nomenclature of Units for Territorial Statistics. It is a European classification for areas based on their size to ensure data across countries at different geographical levels are comparable.
10 After January 2015 a more detailed NUTS3 geography for London was introduced; details of this change can be found at: ONS, 'Bulletin 2014/11: Changes to Nomenclature of Territorial Units for Statistics (NUTS) areas in January 2015'.
11 The difference in BRES between 'employees' and 'employment' is 'working owners', defined as those self-employed who are registered for VAT or PAYE.
12 Note this is comparing employment in 2014 with GVA in 2012 and slight care should therefore be given when comparing the two numbers.
13 Note, both these maps are drawn from a north facing perspective and given the concentration of employees in the centre of the CAZ and NIOD may hide details to the north of these concentrations.
14 The area around Old Street Roundabout where a number of tech firms have congregated.
15 The clustering was carried out using GIS Hot Spot Analysis. Given a set of weighted features, it identifies statistically significant hot spots and cold spots using the Getis-Ord Gi* statistic. This is based on the value of a cell and the value of the cells immediately around it. A high value cell with high value cells around it will get the highest score.
In detail the Getis-Ord Gi* statistic is used to identify statistically significant hot spots and cold spots, with the 'Fixed Distance Band' parameter being used to reflect spatial relationships; the default distance calculated by the tool was used (2771m), which ensures each feature (geographical area) has at least one neighbour. ArcGIS describes this as:
"Each feature is analyzed within the context of neighbouring features. Neighbouring features inside the specified critical distance receive a weight of 1 and exert influence on computations for the target feature. Neighbouring features outside the critical distance receive a weight of zero and have no influence on a target feature's computations".
For more details on the employment clustering in the CAZ please see: Douglass, G., August 2015, 'Working Paper 68: Work and life in the Central Activities Zone, the northern part of the Isle of Dogs and their fringes'. GLA Economics.
16 External benefits that arise when economic activity takes place in a concentrated space.
17 ABI data was used for this map as BRES data does not go back to 2003.
18 Appendix C of: Douglass, G., August 2015, 'Working Paper 68: Work and life in the Central Activities Zone, the northern part of the Isle of Dogs and their fringes'. GLA Economics, provides more detail on the methodology used in the clustering analysis here and elsewhere in this chapter.
19 Census data are adapted from data from the Office for National Statistics licenced under the Open Government Licence v.3.0.
20 Middle-layer Super Output Areas.
21 Douglass, G. & Hoffman, J., March 2015, 'Working Paper 64: The science and technology category in London'. GLA Economics.
22 Togni, L., October 2015, 'Working Paper 70: The creative industries in London'. GLA Economics.
23 It should be noted that due to the different geographic sizes used in these maps compared to Map 2.6 the clustering in these maps is shown in somewhat more broad strokes. More detail on the clustering methodology used here can be found in: Douglass, G., August 2015, 'Working Paper 68: Work and life in the Central Activities Zone, the northern part of the Isle of Dogs and their fringes'. GLA Economics.
24 Includes international organisations such as the IMF, UN, EU etc. as well as diplomatic and consular missions.
25 TfL, 2014, 'Travel in London 7'.
26 Ibid.
27 TfL: London connections map.
28 MaccreanorLavington, Peter Brett Associates, Graham Harrington, July 2014, 'Accommodating Growth in Town Centres: Achieving successful Housing Intensification and High Street diversification'. Greater London Authority.
29 Accent, June 2013, 'Town Centres 2013'. TfL.
30 Refers to trips to work only.
31 Urban Age Cities Compared: Where People Live.
32 TfL, March 2015, 'Building our Capital: five years of delivery by London Underground'.
33 Ibid.
34 Crossrail, 'Delivering substantial economic benefits in London, the South-East and across the UK'.
35 Department for Transport, 9 September 2015, 'Rail passenger numbers and crowding on weekdays in major cities in England and Wales: 2014'.
36 For more information see: Department for Transport, 9 September 2015, 'Rail passenger numbers and crowding statistics: infographic'.

37 Rail Executive, 15 October 2014, 'Rail Trends, Great Britain 2013/14'.
38 Figures are based on only one manual count per service. Includes services that terminate at Stratford (AM) and services that start at Stratford (PM).
39 Services to and from Charing Cross and Cannon Street are included in the London Bridge figures.
40 Figures are based on only one manual count per service.
41 Includes Heathrow Connect services.
42 Includes Gatwick Express services.
43 Southeastern services calling at Waterloo East are not included in the Waterloo figures as they are included in the figures at London Bridge.
44 The 3 hour AM peak is between 07:00 and 09:59. The 1 hour AM peak is the high peak hour between 08:00 and 08:59.
45 As a percentage of standard class critical load.
46 As above.
47 As a percentage of total number of services.
48 As above.
49 For Thameslink services travelling through London, arrivals are included in the figures for the first terminal a service calls at and departures in the figures for the last terminal called at.
50 Figures are based on only one manual count per service. Includes services that terminate at Stratford (AM) and services that start at Stratford (PM).
51 For Thameslink services travelling through London, arrivals are included in the figures for the first terminal a service calls at and departures in the figures for the last terminal called at. Services to and from Charing Cross and Cannon Street are included in the London Bridge figures.
52 Figures are based on only one manual count per service.
53 Includes Heathrow Connect services.
54 For Thameslink services travelling through London, arrivals are included in the figures for the first terminal a service calls at and departures in the figures for the last terminal called at.
55 Includes Gatwick Express services.
56 Southeastern services calling at Waterloo East are not included in the Waterloo figures as they are included in the figures at London Bridge.
57 The 3 hour PM peak is between 16:00 and 18:59. The 1 hour PM peak is the high peak hour between 17:00 and 17:59.
58 Figures are based on only one manual count per service.
59 Includes Heathrow Connect services.
60 Figures are based on only one manual count per service.
61 Includes services to and from London Euston (Watford DC line services) only and excludes services on other London Overground lines.
62 London Overground, South West Trains and Southeastern use a different standing allowance per passenger to other operators on some or all of their rolling stock.
63 Arrivals and departures at the city centre station. For cities with more than one station in the city centre, arrivals are counted at the first station a service calls at and departures on departure from the last station called at.
64 Moor Street, New Street and Snow Hill.
65 Temple Meads.
66 Cardiff Central and Queen Street.
67 Liverpool Central, Lime Street, Moorfields and James Street.
68 All stations in Zone 1 of the Transport for London (TfL) travelcard area on routes into major terminals.
69 Oxford Road, Piccadilly and Victoria.
70 Central London is defined as all stations in Zone 1 of the Transport for London (TfL) travelcard area on routes into major terminals. The stations listed are the first station on each route within Zone 1. Where this is not a terminal, the terminal on that route is listed in brackets.
71 Figures are based on only one manual count per service.
72 Services to and from Charing Cross and Cannon Street are included in the London Bridge figures.
73 Figures are based on only one manual count per service.
74 Includes Heathrow Connect services.
75 Includes Gatwick Express services.
76 Oxford Economics, September 2015, 'Adding Value: The River Thames Public Amenity'. Port of London Authority.
77 SQW Limited, September 2015, 'River Thames Economic Prosperity'. Port of London Authority.
78 Fujita and Thisse (2002): fundamental trade off Tiebout (1956)
79 Henderson, J. 2009, "Cities and Development", *Journal of Regional Science*, 50th Anniversary issue.
80 Cavailhes, J; Gaigne, C; Tabuchi, T; & Thisse,J. 2007. "Trade and the Structure of Cities", Journal of Urban Economics, Volume 62(3) p. 383-404
81 Alonso, W.A., 1964, 'Location and land use: toward a general theory of land rent', Harvard University Press, Cambridge.
82 The housing market is considered in further detail in the next section.
83 Jones, C. and Watkins, C. (2009), 'Housing Markets and Planning Policy', Oxford: Wiley-Blackwell.
84 Land use change data provided by DCLG is derived from Ordnance Survey products, based on rolling assessments, rather than directly observed so may not yet capture the full picture of land use change in London. An additional year of data for 2014/15 will be available from early 2016, and will be added to the analysis in the final version of this report. Additional analysis of

changes in land use from the London Development Database, which may provide a more reliable indicator, will also be included in the final version of this report.

85 This category includes buildings where no other category was suitable, as well as hard standing areas such as car parks, paved areas and tarmac.

86 GLA, London town centre health check analysis report 2013

87 Valuation Office Agency (VOA), commercial and industrial floorspace

88 JLL Research, The Central London Market Report Q3 2015

89 Prime rents reflect the rents paid at the high end of the market, whilst the occupancy costs include the other costs entailed with renting office space

90 Rents apply to small sheds, defined as units between 10,000 to 30,000 square feet in size. Prime rents apply to new units whilst secondary rents reflect second-hand units built during the 1990's. Land values are based on prime locations only.

91 Rosen, 1979 and Rabuck,1982.

92 Land use change data provided by DCLG is derived from Ordnance Survey products, based on rolling assessments, rather than directly observed so may not yet capture the full picture of land use change in London. An additional year of data for 2014/15 will be available from early 2016, and will be added to the analysis in the final version of this report. Additional analysis of changes in land use from the London Development Database, which may provide a more reliable indicator, will also be included in the final version of this report.

93 In presenting the 'average' price, the median is typically used as it avoids over-estimates associated with mean values that result from a positive skew in the distribution of house prices.

94 Further information on the VOA methodology for calculating private rents can be found at: https://www.gov.uk/government/publications/private-rental-market-statistics-england-only/release-notes-10-june-2014#methodology , accessed on: 02/10/15.

95 Greater London Authority, The London Strategic Housing Market Assessment (2013)

96 Source: London development database, extracted on 06/08/15.

97 A household is deemed to be overcrowded it has less bedrooms than required according to the bedroom standard (a formula to determine housing need), based on the composition of the household

98 2013/14 English Housing Survey

99 Gordon, Ian (2014) Fitting a quart in a pint pot?: Development, displacement and/or densification in the London region

100 GLA Intelligence, June 2015, 'GLA 2014 round of trend-based population projections - Results'.

101 Greater London Authority, The London Strategic Housing Market Assessment (2013)

102 Cheshire, P and S. Sheppard (1998) 'Estimating the demand for housing, land and neighbourhood characteristics', Oxford Bulletin of Economics and Statistics, 60, 3, 357-82.

103 OECD, 'Recent house price developments: the role of fundamentals', OECD Economic Outlook, 78, pp. 123-154.

104 Based on its analysis of the demand and supply of housing finance, the Office for Budget Responsibility (OBR) also finds evidence on much higher levels of credit rationing prior to 1981. Source: Auterson, T., 'Forecasting house prices', OBR Working paper 6, July 2014.

105 GLA Economics, 'House prices in London: an economic analysis of London's housing market', November 2015

106 For a discussion, see HM Government (2006), 'Barker Review of Land Use Planning', December 2006.

107 GLA, December 2012, 'Barriers to housing delivery: what are the market-perceived barriers to residential development in London?' Report by Molior London for the GLA.

108 GLA, 'Barriers to Housing Delivery Update: Private sector housing development on large sites in London', July 2014. Report by Molior London for the GLA.

109 While there is a constant review of Green Belt land in England, land can only be removed from the Green Belt through local authorities adopting new local plans which must satisfy tests for protecting Green Belt land set out in the National Planning Policy Framework. Green Belt land is a mix of previously developed and non-previously developed land. It can cover villages comprising a mixture of residential, retail, industrial and recreational land, as well as fields and forests. In this context, it may be helpful to make a distinction between land *use* and *designation*. Land *use* describes the main activity taking place on an area of land, for example residential or agriculture, whereas the land *designation* describes an area of land (with perhaps many land uses) with a special characteristic such as National Parks, Urban Areas, Areas of Outstanding Natural Beauty and Green Belt.

110 Hardin, G. 'The Tragedy of the Commons', 1968, Science vol 162, no. 3859, pp. 1243-1248.

111 For further evidence on the costs and benefits of the Green Belt and London's green spaces, see chapter 5.

112 Cheshire and Hilber, 2008, 'Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge' Economic Journal, Royal Economic Society, vol. 118(529).

113 Hilber, C. and Vermeulen, W. 'The impacts of restricting housing supply on house prices and affordability', November 2010

114 GLA, 'Barriers to Housing Delivery Update: Private sector housing development on large sites in London', July 2014. Report by Molior London for the GLA.

115 OLC, 'Removing barriers to housing delivery', Background paper issue 3, June 2015. The OLC is due to issue its final report on the barriers to housing delivery in March 2016, as part of a full review of the London Plan.

116 Boyko and Cooper (2011).

117 Ciccone and Hall (1996).

118 Urban Land Institute (2015).

119 Pichardo-Muniz and Chavarria (2012).

120 NCE Cities Paper 3: Accessibility in cities – transport and urban form.
121 TfL, Travel in London Report 8, Transport for London (2015)
122 Gleeson (2011) 'Make No Little Plans': Anatomy of Planning Ambition and Prospect. Geographical Research.
123 For the rest of this section, 'Central London' includes Camden, City of London, Islington, Kensington and Chelsea, Lambeth, Southwark and Westminster. This is consistent with the Central London sub-region as defined in the London Plan (March 2015)
124 Greater London Authority, 'Land Area and Population Density, Ward and Borough'.
125 According to GLA Intelligence, based on an analysis of the Census 2011, people living in London tend to have shorter distances to commute than those living in England and Wales, and are more likely than others to travel to work by using public transport, and less likely than others to travel by either driving or being a passenger in a car or van. More detailed analysis and figures are reported in the following reports:
GLA Intelligence (2014). "2011 Census Snapshot: Method of Travel to work in London", CIS 2014-06 Census Information Scheme.
GLA Intelligence (2014). "2011 Census Snapshot: Distance Travelled to work in London", CIS 2014-07 Census Information Scheme.
126 For more information on this topic please see: Togni, L., October 2015, 'Working Paper 71: More residents, more jobs? 2015 update - The relationship between population, employment and accessibility in London'. GLA economics.
127 The Paris region is classified as Île-de-France, is the NUTS 1 level region used to cover Paris. This is consistent for comparison with the NUTS1 classification of London
128 Central area identified containing 13 of the 23 special wards in central Tokyo
129 JLL Raising the Roof, September 2015
130 All European Union cities with a population of greater than 2 million people
131 Charting Transport, 'Comparing the densities of Australian and European cities', 26 November 2015
132 Under-occupied households are those with two or more bedrooms more than they require based on household composition according to the bedroom standard, a formula to determine housing need
133 English Housing Survey 2010/11 – 2012/13
134 Hilber, C. 2015, 'UK Housing and planning policies: the evidence from the economic research', LSE Centre for Economic Performance.
135 Mirrlees Review (2010)