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SETTLEMENT PATTERNS, URBAN FORM & SUSTAINABILITY

An evidence review

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The Royal Town Planning Institute (RTPI)

RTPI champions the power of planning in creating prosperous places and vibrant communities. We have over 25,000 members in the private, public, academic and voluntary sectors. Using our expertise and research we bring evidence and thought leadership to shape planning policies and thinking, putting the profession at the heart of society's big debates. We set the standards of planning education and professional behaviour that give our members, wherever they work in the world, a unique ability to meet complex economic, social and environmental challenges. We are the only body in the United Kingdom that confers Chartered status to planners, the highest professional qualification sought after by employers in both private and public sectors.

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Contents

Executive summary

The country faces a number of long-term challenges. Many of our towns and cities lag behind their European counterparts in terms of economic productivity, while the benefits of growth are spread unevenly across society. An ageing population is placing an increasing strain on healthcare systems, while problems like obesity and air pollution are on the rise. Climate change is creating new environmental risks, and making radical emissions reductions and adaptation measures ever more necessary.

Meanwhile, much of the country is in the grip of a housing crisis. While its causes are complex, a contributing factor has been the consistent undersupply of new houses over several decades. Successive governments have responded to this crisis with planning reform - attempts to streamline the planning process and increase the volume of permissions granted for new homes. In 2015, the UK government set a target to deliver one million new homes by 2020.

The national debate around planning and housing tends to focus on three criteria: the number of houses that are granted permission, the speed at which they are built, and the affordability of the finished product. There is a wealth of data on each of these metrics, much of it published by the government, which receives considerable attention in the media. Over time, these have become used to measure the effectiveness of the planning system.

But while these are important criteria, they form just part of the picture. Planning is about delivering sustainable development, not just housing numbers. The National Planning Policy Framework (NPPF) sets out a wide range of economic, social and environmental objectives which include:

- Building a strong and competitive economy
- Supporting radical reductions in greenhouse gas emissions
- Reducing vulnerability and providing resilience to climate change
- Promoting healthy and safe communities
- Planning for current and future demographic change

Planning can help to deliver these objectives by shaping urban form: the size, location, density, land use mix, connectivity and accessibility of developments. This influences patterns of settlement growth over time. But when it comes to measuring progress against these wider objectives, the data is lacking. While local authorities create maps of sites which are allocated for housing, and developers keep records of completed schemes, this information exists largely at the local level or in commercial datasets. As a result, there is little spatial analysis to show where new houses are located, their physical characteristics, and the impact on the shape of villages, towns and cities.

Without this data, is it hard to understand whether changes to planning policy are helping to deliver wider sustainability objectives. Are they encouraging development within existing settlements and compact urban extensions? Are homes being built at densities which support walking, cycling and public transport, and in places where residents can easily access jobs, services and leisure opportunities? Or are they resulting in more car-dependent developments in remote locations, increasing infrastructure costs and the risk of congestion, air pollution and inactive travel?

This paper shows that these questions have far-reaching implications for other policy objectives. The evidence presented here describes how:

- Large and compact settlement patterns support economic productivity by reducing the distances between homes and jobs and making efficient use of infrastructure networks
- Settlement patterns and urban forms that promote sustainable mobility play a critical role in reducing transport emissions, with larger settlements, higher densities and mixed land uses reducing the need to travel by car
- Larger settlements with higher densities and mixed land use improves public health by increasing physical activity, which helps to address the prevalence, severity and cost of chronic lifestyle-related diseases
- Compact, medium density, mixed use and public-transport friendly settlements can encourage continued physical activity, economic participation and social interaction for an ageing population

Given the significance of these relationships, the RTPI commissioned research to gain a better understanding of changing settlement patterns and urban form in twelve English city-regions. The 'Location of Development' study mapped planning permissions for over 226,000 new homes granted between 2012 and 2017. It measured the size of each scheme and its relationship to the existing built-up area, and analysed proximity to major employment clusters and key public transport nodes. We then held roundtable discussions with our members across the country, to understand how these patterns of growth were impacting the sustainability of these city-regions.

Our initial findings were mixed. In some city-regions, it appeared that the majority of houses where following a compact settlement pattern, with larger developments located in close proximity to jobs, and supported by good public transport connectivity. In others it appeared that development was following a more dispersed pattern, with a higher proportion of small housing schemes in remote locations. Our members warned that this could have adverse impacts on congestion, health and the funding of infrastructure.

While this was the largest study of its kind, it focused on just some of the spatial characteristics of sustainable development. This research paper draws from much wider evidence on the relationship between settlement patterns, urban form and sustainability. The RTPI believes that this evidence helps to demonstrate the positive contribution of planning to national challenges relating to economic productivity, climate change, public health and our ageing population.

Key terms

Settlement patterns

These can be broadly categorised into the following types:

- **Compact and contained established towns and cities**, surrounded by protected green belts or other open land.
- **Edge and out-of-town developments**, often mixed landscapes of largely retail and commercial buildings
- **Peripheral housing estates** and **urban extensions** to existing settlements
- Free standing **new settlements**
- **Dispersed developments** in rural areas and smaller settlements

Urban form

This refers to the physical characteristics of a built-up areas, and can be described using the following key metrics:

- **Location:** The location of development according to the settlement patterns listed above
- **Density:** The measure of a unit of interest per area unit, such as population density, built-up area density and employment density
- **Land use mix:** The diversity and integration of land uses at a given scale. An area of high land use mix would contain a range of residential, commercial and industrial uses
- **Connectivity and permeability:** These related terms refer to different scales. Connectivity describes how well places are connected by different modes of transport. Permeability describes the ease of movement within a given area, using measurements of street density and neighbourhood design, as well as the number of intersections and block size
- **Accessibility:** This is shaped by the above characteristics, describing the ease by which people can access jobs, housing, services and shopping, or more generally other people and places. It is often described using a combination of proximity and travel time

Scale: Urban form can be considered at a range of scales, from the street, block and neighbourhood level to the town, city, region or nation.

Sprawl: An urban form characterised by the physical expansion of low-density development into surrounding agricultural or natural land, creating patchy or dispersed settlement patterns with buildings separated by empty or underutilised space.

Intensification: Increasing the density of dwellings within existing built up areas

Active transport: Walking and cycling, either for the whole trip or as part of a longer journey

1. The Location of Development study

This study mapped the size and location of planning permissions for housing in twelve fast-growing city-regions: **Blackburn, Bournemouth, Brighton, Bristol, Cambridge, Coventry, Leeds, Newcastle, Nottingham, Oxford, Plymouth** and **Warrington**. These city-regions had a combined population of 11.4 million in 2016, up by 5% since 2012, and contained over 5.25 million jobs, an increase of 11% since 2011.

Between 2012 and 2017, planning permission was granted for over 300,000 new houses in these city-regions. 73% of these permissions were on major schemes of 50 or more houses, which were the focus of the study.

The first round of the study ran from January 2012 (when the NPPF came into force) to September 2015. During this period permission was granted for 704 major schemes, representing 165,000 new houses. The second round ran from October 2015 to September 2017, when permission was granted for an additional 336 major schemes, representing 61,000 houses.

The study analysed the scale and location of major schemes, looking at their relationship to the existing built-up area and proximity to major employment clusters and railway stations. These are just some of the spatial factors that influence sustainability, which help to demonstrate how development locations and settlement patterns are changing over time.

The first study found that, across the twelve city-regions, 73% of permissions were located within 10km of a major employment cluster with 10,000 or more jobs. 22% of permissions were located between 10 and 20km from employment, and only 5% over 20km away. This suggested that patterns of housing growth were helping to limit commuting distances.

The first study also found that only 14% of permissions were located within easy walking or cycling distance of a railway, light rail or metro station, defined as 800 metres or less, while 53% were located over 2km away. In the context of declining local bus coverage, this suggested that patterns of housing growth may result in higher levels of car use. 46% of permissions were located in an existing built-up area, with 54% located on edge of settlements and more rural locations. In city-regions with a high proportion of small schemes this suggested patterns of dispersed development.

The second study saw a slight improvement in these trends, with most permissions remaining in close proximity to employment, and more located close to railway stations and within the existing built-up area. Meanwhile, a greater proportion of permissions were granted for smaller schemes of under 450 houses.

The following pages provide a sample of the data, analysis and mapping from this study. The methodology and findings for each city-region can be found at:
rtpi.org.uk/locationofdevelopment

The study was carried out by Hatch consultancy, using data from EGi.

Figure 1.1: The average number of houses permitted per month in each city-region

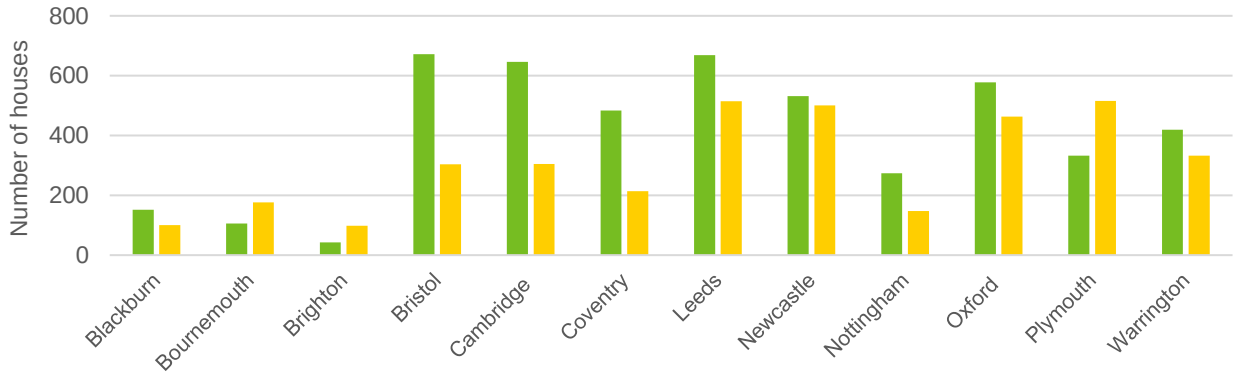


Figure 1.2: The percentage of houses permitted by scheme size across all city-regions

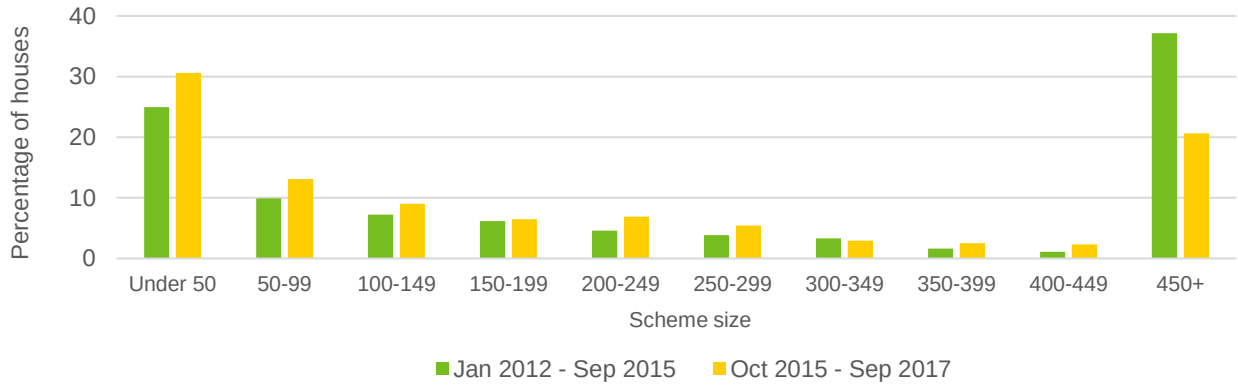


Figure 1.3: Spatial analysis on permissions for 50 or more houses showing the proportion of new housing by:

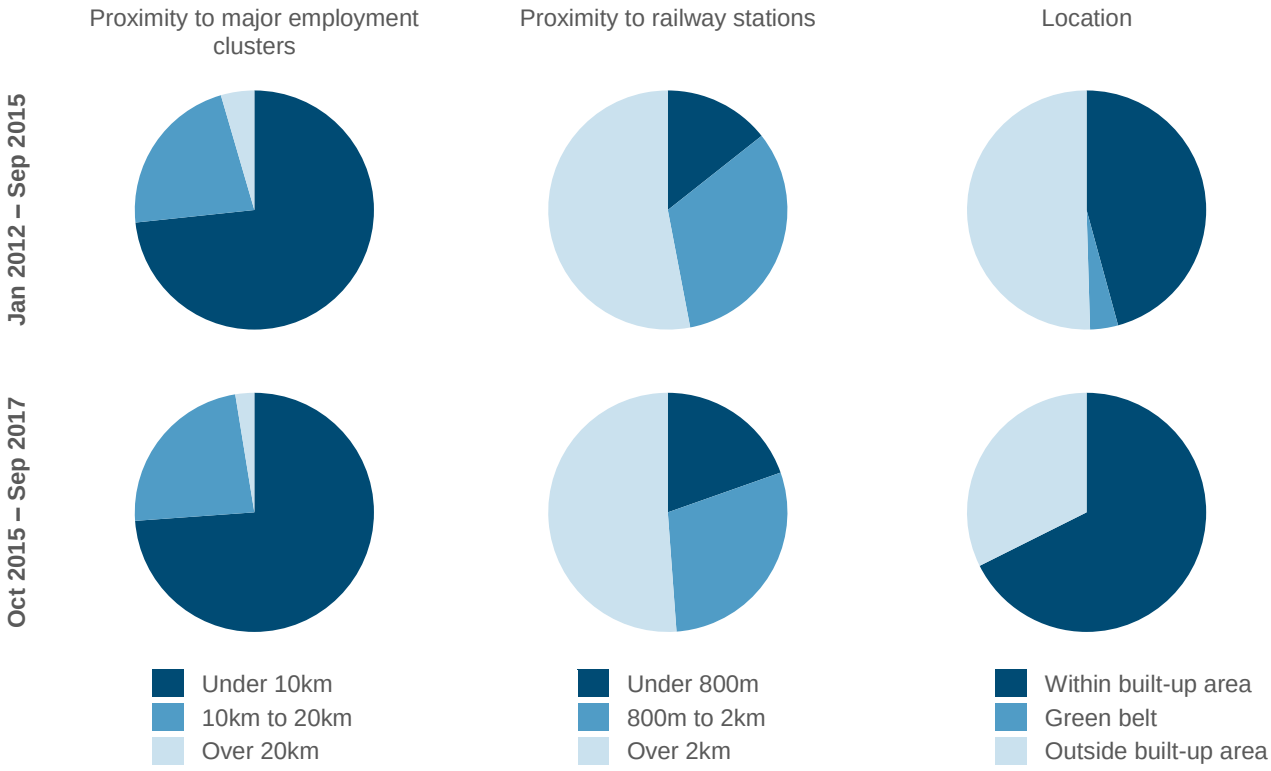
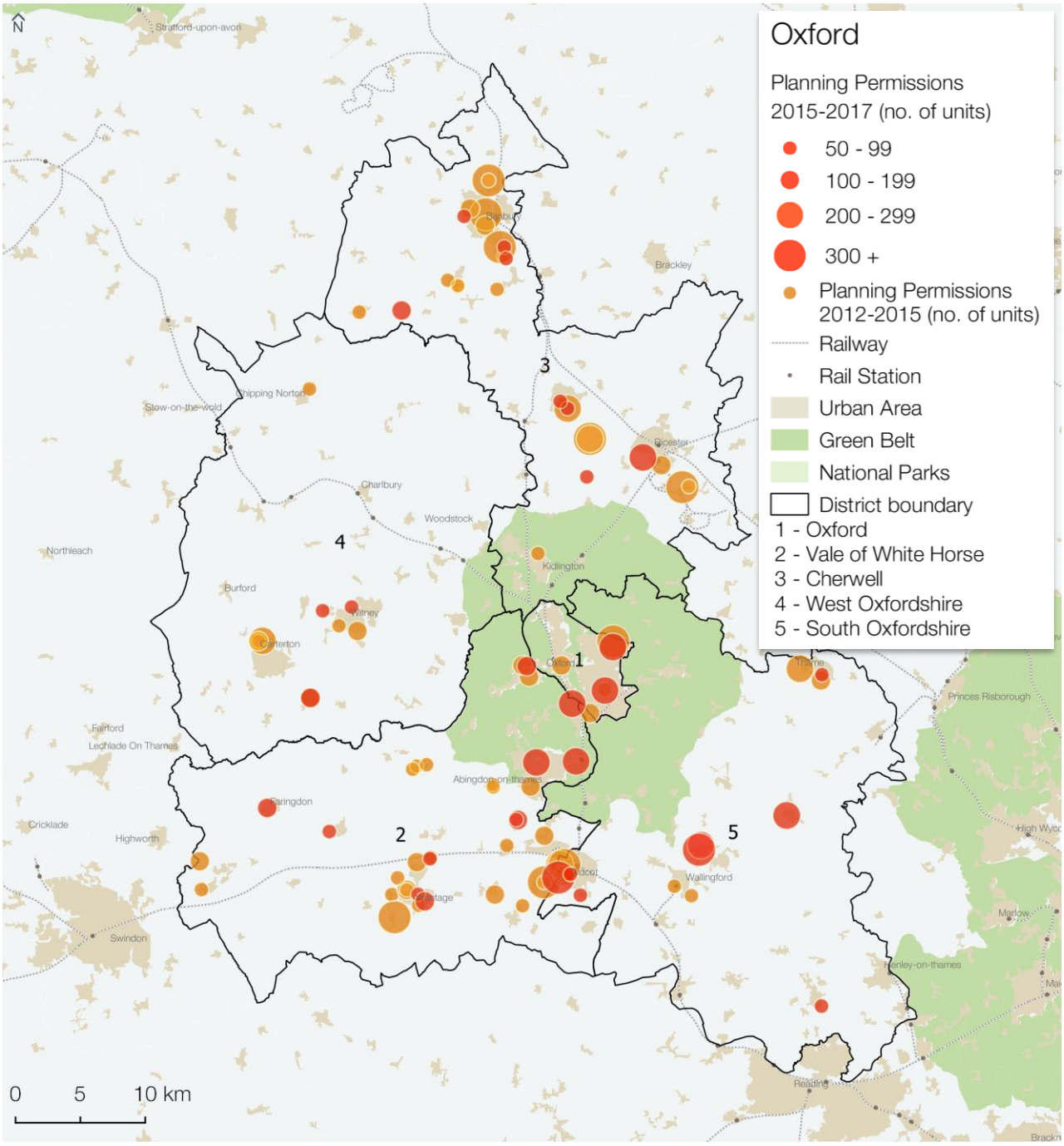


Figure 1.4: A map of planning permissions granted for housing schemes of 50+ units in the Oxford city-region between January 2012 and September 2017



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2. A brief history of settlement patterns and urban form in England

2.1. Introduction

Planning plays a key role in delivering sustainable development. Policies generally seek to accommodate housing growth within a form of settlement hierarchy, which aims to first locate new development at higher densities within and around larger cities and towns before expanding smaller towns and villages.[1] But while planning plays an important role in shaping settlement patterns and urban form, it operates within a broader economic, political and cultural context.

A wide range of factors have influenced how urban areas expand over time, including the rise of private vehicles, major road-building programmes, the closure of railway stations, changing consumer preferences, the availability of mortgage finance, and fluctuations in land and property markets. Over the past sixty years, successive governments have also reformed the planning system in pursuit of specific policy objectives, such as to increase housing supply. This stems in part from the greater degree of control that governments can exert over planning policy when compared to wider market forces or cultural preferences.[2]

Instead of directly expanding outwards from an urban core, many English settlements are surrounded by a patchwork of smaller towns, villages and hamlets separated by open land.[3] This pattern has been attributed to a longstanding cultural preference for nature conservation, which has been reflected in green belt policy and local opposition to development in the countryside.[4] As a result, England has avoided much of the large-scale urban sprawl which characterises parts of North America and Europe. However, the particular settlement patterns and urban forms of England present their own set of challenges.[5]

This chapter provides a brief overview of some of the forces which have shaped settlement patterns and urban form from the mid-twentieth century onwards, as the population increased and new technologies emerged.

2.2. Post-war expansion

The decades following the end of World War Two saw a marked increase in new housing development in England. This began with the regeneration of urban areas damaged by bombing, major investment in infrastructure, and the movement of populations out of crowded inner cities. Some were rehoused in newly built social housing estates on the edge of compact town and city centres, while others moved into large-scale and relatively self-contained settlements, which were built across the country under the 1946 New Town Act. These settlements were delivered by Development Corporations, organisations set up by central government with the powers to assemble land, coordinate the provision of purpose-built infrastructure, and specify residential, commercial and industrial land uses.

In 1947, the Town and Country Planning Act established a comprehensive planning system as part of a broader package of social reform. Development rights were nationalised and control over land use passed to local authorities who were required to produce a land use plan. Locally elected

politicians gained control over decision making, supported by the advice of professional planners.[6] From the 1950s onwards, green belts were designated around some towns and cities to preserve the distinction between urban and rural areas.[7]

The following decades were marked by mass car ownership and major road building. By the end of the 1960's these trends were shaping urban form, as private-sector house builders started to develop speculative large-scale housing estates located at the edge of compact towns and cities. These new suburbs catered for a more mobile and affluent middle-class who could afford to live in larger houses outside traditional urban centres. Road building and increased mobility also allowed business and shops to relocate into more peripheral areas where land was cheaper and access to motorways, ports and airports made logistical operations more straightforward. This decentralisation of residents and economic activity contributed to the decline of urban areas which were already struggling with the loss of traditional manufacturing industries.[8]

In the 1970s, concerns about the location of development and uncoordinated infrastructure led to changes in planning legislation, giving county councils the responsibility to develop Structure Plans which dealt with issues that crossed local authority borders.[9] However, decentralisation continued throughout the 1970s and 1980s, as car-dependent housing, retail and businesses developments spreading out along road networks into peripheral, greenfield locations. As settlement patterns spread out and travel patterns became more complex, roads became increasingly congested. Planning sought to accommodate the growing volume of traffic through the restructuring of inner city areas, with segregated roads and additional parking spaces, and through new ring roads and motorways.[10]

2.3. Encouraging urban regeneration

In the late 1980s, regional assemblies were formed for each of the English regions outside London, embodied with new planning powers. They set targets for the quantity and distribution of new housing at the regional level, while specific sites continued to be identified at the local level. In 1995, debate over location of future development intensified with the publication of government housing projections which set out a need for 4.4 million new homes by 2015.[11] With pressures mounting, the political climate shifted back towards supporting development in existing urban areas. The 1999 Urban Renaissance Agenda report set out the benefits of promoting higher densities in brownfield sites in order to drive urban regeneration. At the national level, planning policy adopted sustainability principles which followed the 'compact city' model, including prioritising development on previously developed (brownfield) land, setting minimum density standards, and promoting urban forms that favoured movement by public and active transport.[12]

The turn of the century saw significant population growth across the country, and higher volumes of development.[13] The success of regeneration initiatives was now starting to reverse previous decades of urban decline, and knowledge-based industries were realising the benefits of locating in established, higher-density urban areas. This attracted inward migration back into city centres, most especially into London. However, development was still occurring in more rural areas, with 25% of new housing between 2000 and 2004 located in settlements of fewer than 10,000 people. An increasing proportion of the rural population were now wealthier residents who commuted to work in nearby towns and cities, which started to price out existing residents. Retail and businesses continued to favour peripheral sites with access to transport, although the distribution of commercial growth became more evenly balanced with urban areas.[14]

By 2006, issues of housing supply and affordability were moving up the political agenda, driven in part by influential reviews led by the economist Kate Barker.[15] In 2007, the government set out plans for two million new homes in England by 2016, rising to three million by 2020. Some 'eco-towns' were planned to help meet this need, but only two were pursued.[16]

2.4. Boosting housing supply through the market

From the early 2000s onwards, the planning system went through further changes, driven by a desire to speed up development, reduce a perceived regulatory burden on developers, and increase local participation.[17] This occurred in the context of a continued shift towards a market-led housing model, where the majority of new homes were delivered by the private sector.

In 2011 the coalition government revoked regional spatial strategies and handed all statutory planning powers back to local authorities. This removed the mechanism for strategic planning in England, making local authorities responsible for calculating housing need and allocating sites for development. In 2012, the coalition government launched the National Planning Policy Framework (NPPF) for England, a condensed document that replaced thousands of pages of detailed policy. This contains general principles which highlight the importance of sustainable urban form, stating that a core role of planning is to ensure that "…*sufficient land of the right type is available in the right places*".[18] It describes these places as those which support growth, innovation and the efficient provision of infrastructure, are accessible to a range of local services, encourage the use of public transport, walking and cycling, and help tackle climate change. It requires Local Planning Authorities (LPAs) to consider these criteria when allocating sites within a Local Plan.

While the NPPF contains an explicit focus on the pursuit of sustainable development, the pressure to increase housing supply within a market-led development model has led to concerns that wider economic, social and environmental goals are being compromised. For example, policies that require local authorities to maintain a five-year supply of deliverable housing land have been criticised for incentivising smaller developments on greenfield sites in more affluent areas.[19] The emphasis on economic viability in the NPPF has been criticised for reducing the scope of LPAs to promote low-carbon energy, sustainable transport and climate change mitigation.[20]

In 2014, the Communities and Local Government Select Committee commented that efforts to assess the operation of the NPPF were hindered by absence of reliable, up-to-date data on the location and scale of development.[21] In 2016, the RTPI warned that: "…*constant change is producing a planning system that is more complicated and more uncertain, with less local autonomy, consultation and accountability… …a reduced ability to ensure that development is well-planned and connected, and a narrower range and number of affordable housing to rent or buy."* The raised concerns that long-term costs could increase due to the incremental release of land for development in locations poorly served by transport and other facilities.[22]

It has been estimated that around 84% of the English population now live in some form of suburb.[23] This includes 24% living in the more urban housing estates built during the 19th century, and 44% living in the continuous estates of detached and semi-detached housing built during the mid-to-late 20th century. 16% live in the 'exurbs' - smaller housing estates located at the periphery of the continuous suburbs, interspersed with open land and often home to retired and more affluent communities.[24]

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[7] Williams, K. 2014.

[8] Hall, P. 1973.

Williams, K. 2014.

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[12] *Ibid*

[13] Williams, K. 2014.

[14] *Ibid*

[15] Barker, K. 2004. *Review of Housing Supply: Delivering stability: securing our future housing needs*. HM Treasury.

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[24] *Ibid*

3. The relationship between settlement patterns, urban form and economic productivity

Key messages

Large compact settlement patterns help to reduce the distances between homes and jobs and makes more efficient use of existing transport infrastructure. They enable high-capacity public transport, walking and cycling networks which reduce the overall cost of infrastructure and services, improves accessibility, and reduces congestion. These in turn generate wider economic, social and environmental benefits.

3.1. Introduction

Cities are drivers of economic productivity, but their performance varies considerably. London and other cities in the South East of England have the highest levels of productivity in terms of Gross Value Added (GVA), and many in the South West of England and Scotland perform above the national average. Cities in the Midlands and North of England tend to have lower than average productivity, and perform less well than comparable places in countries like Germany and France.[1]

Successive governments have sought to increase economic productivity and reduce regional disparities. Recent initiatives include the Modern Industrial Strategy, Northern Powerhouse and Midlands Engine. These focus on investments in education, training, research and development, and establishing new partnerships between government, key industries and small businesses. They also include investment in digital and transport infrastructure to improve connectivity within and between cities.

The focus on infrastructure recognises that economic activity depends on flows of people, goods, services and information. Infrastructure enables these flows to occur, but also influences the shape of the built environment. As urban economies grow, and towns and cities expand, the complex interactions between infrastructure, settlement patterns and urban form combine in ways which have a major impact on the economy. This chapter describes how these relationships can be shaped in a way which boosts economic productivity.

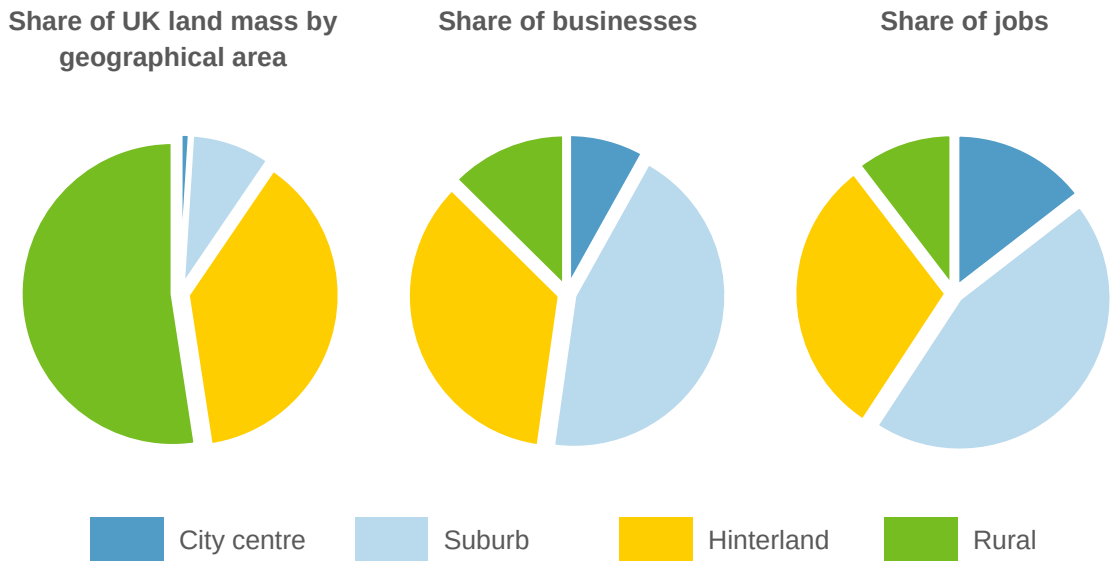
3.2. What makes an area economically productive?

Concentrations of people, activities and resources in urban areas generate economic growth, innovation and resource efficiencies.[2] This process of agglomeration occurs in two ways:

- When relatively similar firms locate in close proximity to minimise transaction costs from supply chains, access a specialised labour force, share research and development activities, and benefit from social interactions between workers in the same field.
- When firms from a diverse range of sectors locate in close proximity to benefit from complementary needs for services, infrastructure and labour, such as easy access to a wide and diversified labour market.[3]

Transport infrastructure drives agglomeration by increasing accessibility, bringing firms and employees closer together.[4] Knowledge-intensive sectors, including financial and business services, high tech services, real estate, retailing and management consultancy, tend to see the biggest productivity gains from improved accessibility. This is because they rely most on ideas, information and highly skilled employees. This leads them to cluster in city centres and suburbs where they can access these resources most efficiently.[5]

Figure 3.1: The distribution of businesses and jobs across four geographical areas. City centres and suburban areas cover less than 10% of UK land mass, but account for the majority of businesses and jobs. Reproduced from Serwicka and Swinney, 2016.[6]

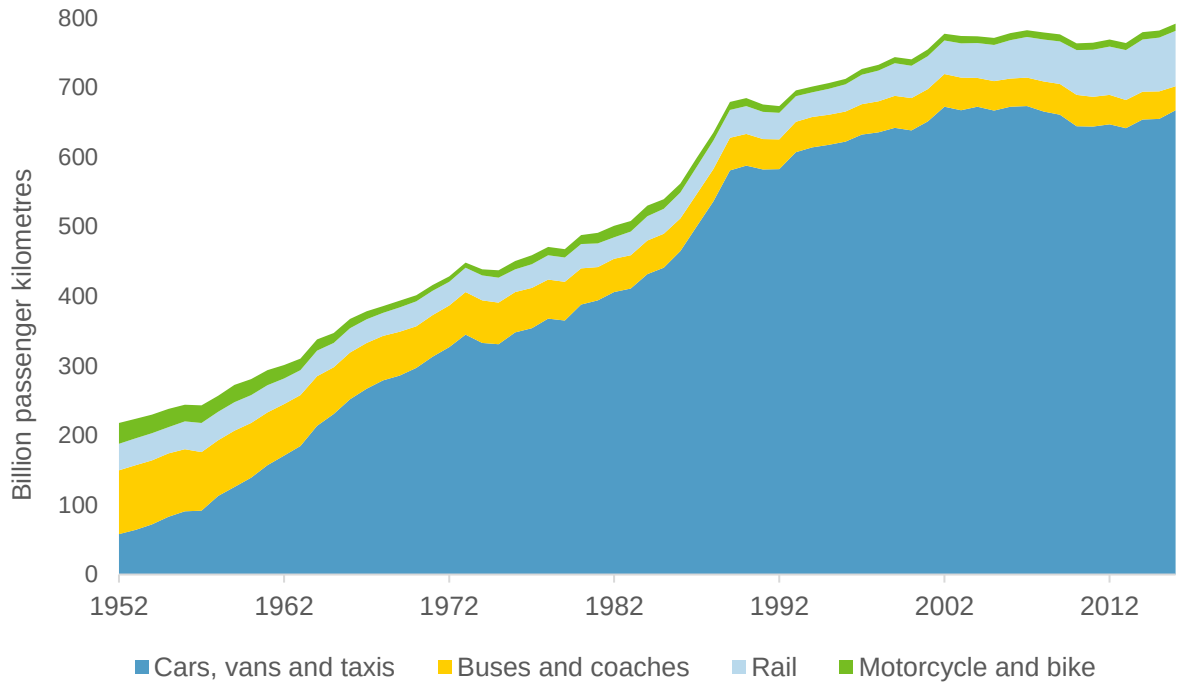


3.3. How can settlement patterns and urban forms constrain economic productivity?

Clusters of firms attract commuters from a wide geographical area, which includes the suburbs, exurbs and rural villages that that surround most towns and cities. As urban economies and labour markets grow, they create demands for additional housing and infrastructure. This shapes settlement patterns and urban form, which in turn impacts back upon accessibility and productivity.

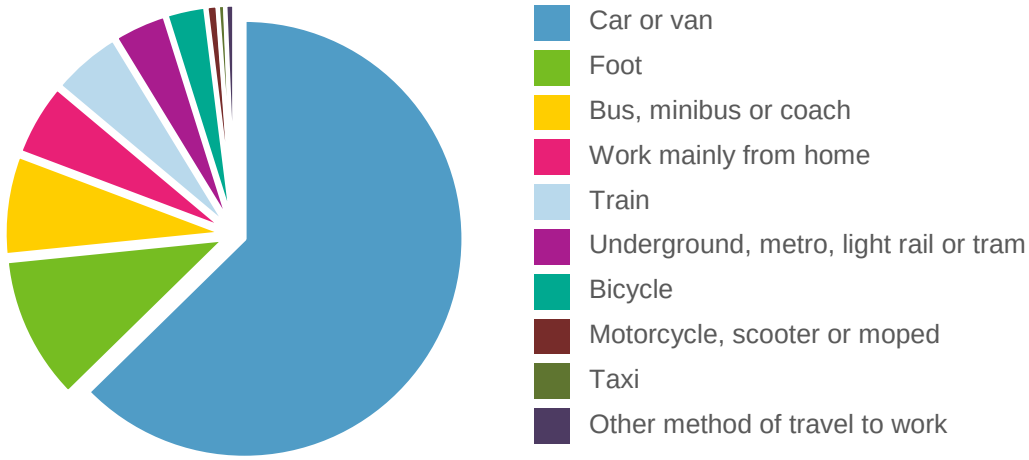
Chapter 2 described how, from the mid-twentieth century onwards, many towns and cities were shaped by the growth of the road network and rising car ownership. This lead to the creation of relatively compact urban centres surrounded by a combination of medium and low density suburbs, low density exurbs, and very low density rural areas. At these lower densities, it became increasingly difficult to provide frequent, accessible, comprehensive and affordable public transport. Meanwhile, development in peripheral areas, with low levels of land use mix, meant that residential areas were located too far from concentrations of employment, services and leisure activities to be accessible by walking and cycling.[7]

Figure 3.2: Trends in the mode and distance of travel in Great Britain, 1952-2015. Data from DfT, 2017.[8]



In all areas except Greater London, the majority of commuting journeys are now made by private car. This means that as urban economies grow and attract commuters from a wider geographical area, the average distance travelled by car increases. With limited road capacity, growing city-regions often suffer from problems of congestion on the road network during peak hours. Congestion then generates a series of negative externalities which undermine productivity.[9]

Figure 3.3: Modal split of journey to work for 16- to 74-year-olds in work in England and Wales. Data from DfT, 2014.[10]



The direct impacts of congestion are wasted time and fuel, which cost the UK economy approximately £7.8 billion per year. The indirect impacts to firms which operate in congested conditions, including higher freighting costs and business fees, are estimated to cost an additional £4.9 billion per year. If current trends continue, these direct and indirect costs are predicted to increase by 66% and 58% until 2030, at a cumulative cost of over £300 billion.[11] Studies indicate that congestion a key barrier for otherwise successful city-regions, making them less attractive places to live and invest.[12]

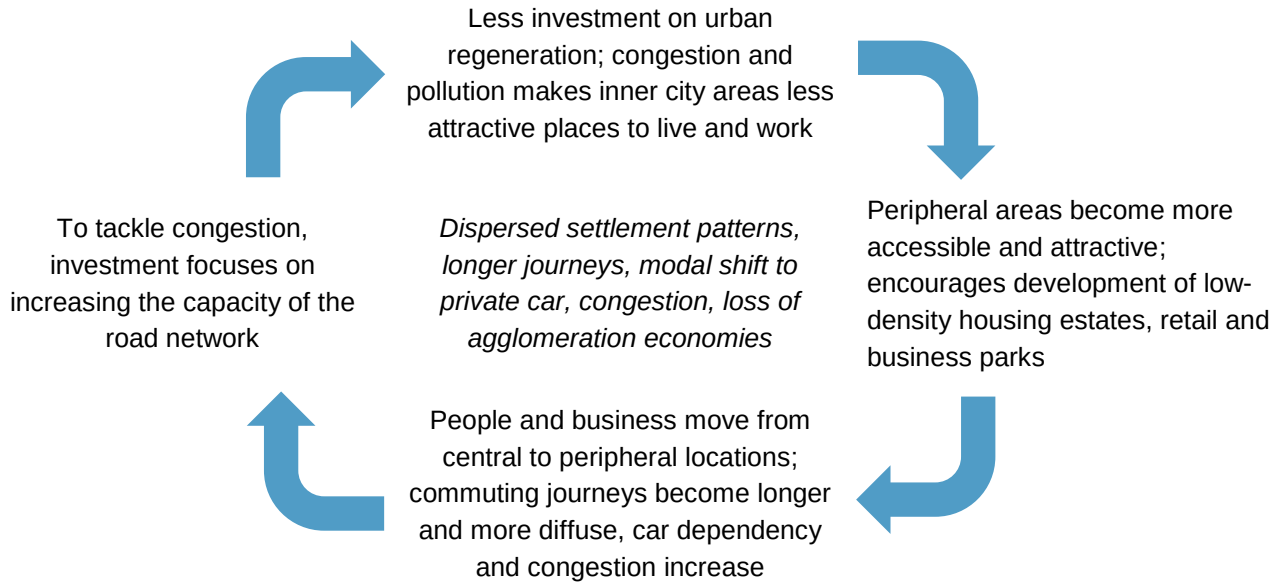
The common response to congestion is to increase capacity on the road network to meet the demand which occurs during peak travel hours. However, studies have repeatedly shown that benefits can be short-lived due to the phenomenon of 'induced demand'. This occurs when a new road, or increased capacity on an existing road, leads people to change their behaviour in response to improved traffic conditions. This can encourage road users to make more frequent journeys, to travel by car instead of public transport, to choose more distant destinations, or to make journeys which they would not have chosen before. This generates additional traffic and congestion, which in turn creates demand for increased road capacity.[13]

Over time, new roads and increased road capacity also improves accessibility to more peripheral areas. This can encourage people and businesses to relocate from compact urban areas (which area accessible by public transport) to cheaper houses and premises on the outskirts of towns and cities. As peripheral land becomes more accessible and attractive, developers respond by building new housing estates, business and retail parks, often at lower densities. This creates dispersed patterns of development which again generate additional traffic and congestion on the road network.[14]

Over time, the movement of people and economic activity from compact urban areas to low-density peripheral locations creates negative externalities which further undermine productivity. As car use increases, more space has to be provided in city centres for parking and vehicle movement. Congestion interrupts the flow of traffic and increases vehicle emissions, creating dangerous air pollution. Inactive travel patterns limit opportunities for physical activity and contribute to poor public health. These impacts are discussed further in Chapter 5.

Dispersed settlement patterns and low-density urban forms increase the cost of providing infrastructure and services such as roads, utility lines, school transport, waste collection, policing and emergency response. In the USA, an empirical analysis of public service expenditure across 283 metropolitan counties found that per capita costs for most services increased in more sprawling areas with lower densities.[15] Another found that the most sprawling parts of US cities spend around one-third more on infrastructure than those which followed smart growth principles, with a compact, higher density and mixed use urban form.[16] While 57% of these costs were internalised by residents (for example through vehicle fuel costs) 43% were externalised. This means that households in low density areas do not pay sufficient tax to finance the maintenance of infrastructure, and therefore require subsidy by the residents of more densely populated areas.[17] This can reduce the amount of funding available for infrastructure and regeneration in inner-city areas, which again make them less attractive places to live and do business.

Figure 3.4: An example of negative feedback mechanisms from the interaction between transport and land use change. Adapted from Wenban-Smith, 2016.[18]



3.4. How can settlement patterns and urban forms enable economic productivity?

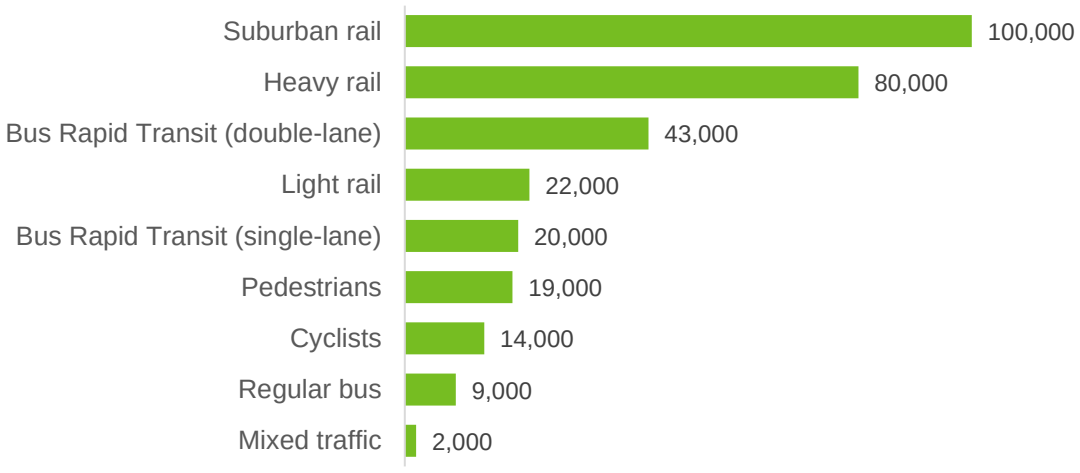
The previous section described how transport investments which increase accessibility and connectivity may also lead to the dispersal of housing and labour markets, resulting in higher traffic levels and congestion. However, by considering the interactions between transport and land use change, it is possible to promote settlement patterns and urban forms which favour movement by sustainable and efficient modes of transport.

Larger settlements with higher densities and mixed land use provide a greater volume and range of employment, shops and specialised services such as healthcare. This leads to higher levels of self-containment, reducing the need for travel to other towns and cities, and reducing average trip lengths.[19] Smaller, low density settlements are less likely to provide this balance of housing, jobs and services, and therefore tend to have higher average trip lengths even when accounting for socio-economic variables. Average trip lengths are highest in the most remote and isolated settlements, as shown on the next page.[20]

Figure 3.5: Average distance travelled by mode and rural-urban classification in 2014/15. Data from DfT, 2016.[21]

Increased density and land use mix use also encourages modal shift away from the car towards walking, cycling and public transport.[22] These forms of transport make more efficient use of available road space, which reduces the need for additional capacity and helps to decouple economic growth from the negative externalities of congestion and air pollution. A reduction in car use means that excess parking and road space can be converted to more economically productive uses, such as for housing, employment, services and green infrastructure.

Figure 3.6: Corridor capacity (people per hour) on a 3.5m wide lane in the city. Dedicated rail and bus lanes make the most efficient use of available road space, followed by pedestrian and cycle routes. Roads with mixed traffic are the least efficient way of moving people. Adapted from ITP, 2017.[23]



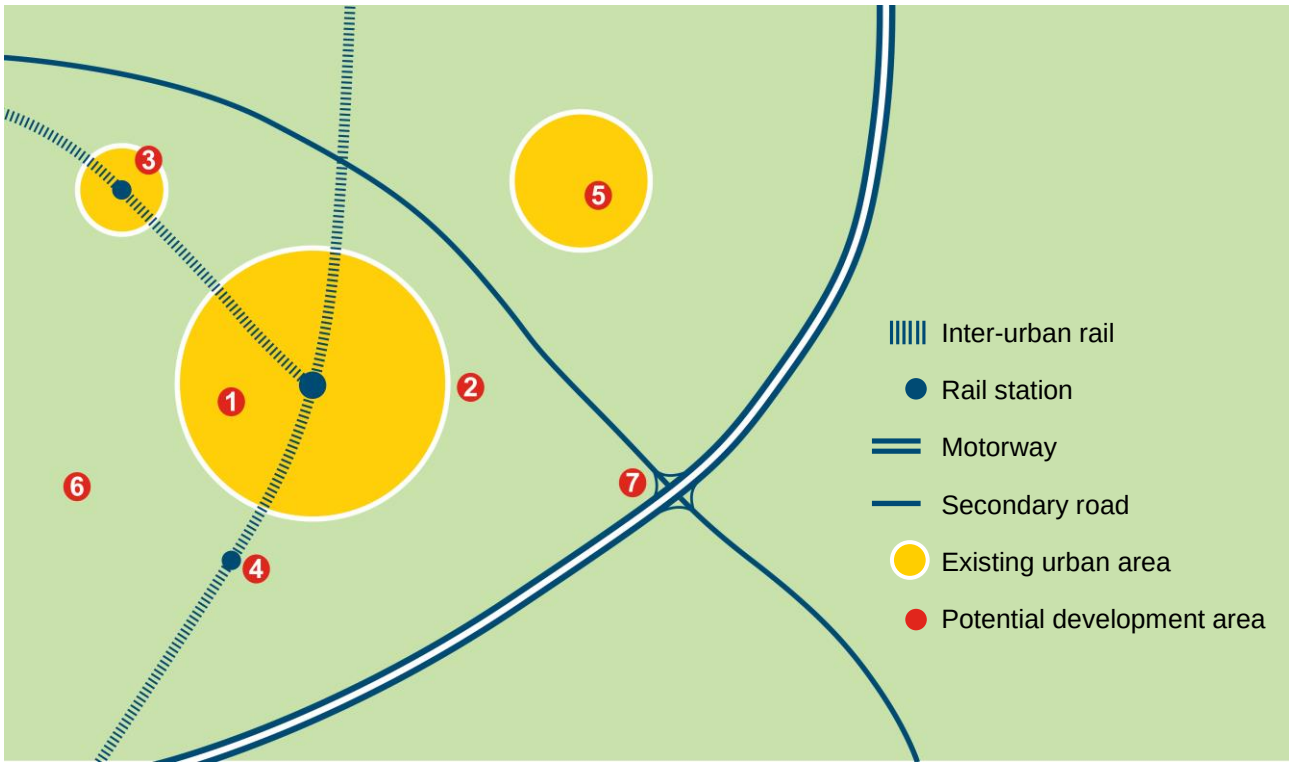
Increased physical activity from walking and cycling increases productivity by reducing absenteeism due to poor health.[24] Accessibility by walking and cycling also enables people on low incomes to access jobs and services at little or no cost, widening participation in the labour market.[25] These spatial factors have a positive association with agglomeration, generating higher levels of innovation, employment growth, wages and wealth creation.[26]

The benefits of sustainable transport on public health, air pollution and climate change are explored in subsequent chapters.

3.5. Which spatial principles encourage accessibility by sustainable modes of transport?

Settlement patterns and urban forms support economic productivity when they promote accessibility by sustainable modes of transport and reduce the need to travel by car. This means that new development should be concentrated in a small number of strategic locations, prioritising brownfield sites within large existing settlements or immediately around them, before expanding smaller towns, villages and rural areas. [27] These spatial priorities are demonstrated in the diagram below.

Figure 3.7: Diagram of strategic development locations at the city-region scale, ranked by the potential to generate traffic. Adapted from Hickman et al. 2009.[28]



1: urban brownfield site

2: urban extension

3: small settlement with good public transport

4: free standing new settlement with good public transport access

5: small settlement remote from rail

6: free-standing new settlement remote from transport infrastructure

7: free-standing new settlement with good strategic highway access

In order to promote sustainable mobility and reduce congestion, any development outside of large existing settlements should be located alongside well-served bus corridors and in close proximity to rail stations and other transport interchanges, in order to encourage patronage and reduce the use of the strategic road network.[29] Similarly, any new sustainable transport infrastructure, like rail and bus routes, should be located based on their potential to connect existing car-dependent settlements to major concentrations of jobs and services, and to support new public transport-oriented development patterns.[30]

Figure 3.8: Diagram of strategic development locations at the regional scale. Adapted from Hickman et al. 2009.[31]

To encourage sustainable mobility, housing needs to be located in close proximity to public transport nodes. A distance of between 250 to 300 metres is recommended for local bus services, rising to 500 metres for stops which provide high frequency services to centres of employment and key services.[32] This can also be considered in terms of housing density, with recommended average levels of 50-100 dwellings per hectare (dph) rising to 100-200 dph for developments located around important public transport nodes.[33] In order to reduce the need to travel, developments should also contain a mixture of uses, including essential community facilities which are within walking distance of housing, and buildings which can support a range of different uses.[34]

At the neighbourhood scale, urban form can encourage sustainable travel through the design of fine-mesh grid networks, and by limiting the use of cul-de-sacs and other street layouts with poor levels of connectivity.[35] CABE guidance suggests that, when coupled with improvements to walkability and public transport accessibility, parking spaces should be set at a maximum of one per household, and ideally 0.6.[36]

3.6. The need for complementary policies

While compact high density urban forms have a positive impact on productivity, they can also generate negative impacts which need to be addressed. Studies have indicated that increased densities provide overall net benefits. However, they are also associated with higher rents, income inequality and mortality risk, lower average traffic speeds and lower levels of subjective wellbeing.[37]

Higher rents are often singled out as a factor which can undermine productivity, as people relocate further away from their jobs and make longer commutes.[38] This may explain why, while the largest UK cities tend to have the highest levels of productivity, smaller and medium sized cities often report faster productivity growth.[39] The benefits of agglomeration may slow or even reverse in the largest cities due to the ever-increasing cost of land, housing, infrastructure and labour, coupled with problems like congestion and pollution.[40]

This can lead to calls for a more dispersed urban form, based on the assumption that development on cheaper land leads to more affordable housing and funding for infrastructure.[41] However, this view tend to discount the benefits of densification and undervalue the additional costs that result from sprawling and dispersed urban forms, which include greater land use per housing unit, residential parking requirements, higher infrastructure and utility costs, and household transport expenses.[42]

However, these criticisms do highlight why efforts to increase settlement size and density should not be pursued in isolation. Planning policies which promote compact, higher density urban forms also require the provision of housing at sub-market rates, and policies to support renters and first-time buyers. To promote sustainable modes of travel and reduce congestion and pollution, transport policy should be geared towards subsidising public transport instead of private vehicle use, managing traffic demand through road pricing, and raising the cost of parking.[43] These issues are explored in subsequent chapters.

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4. The relationship between settlement patterns, urban form and climate change

Key messages

Settlement patterns and urban forms that promote sustainable mobility can play a critical role in reducing emissions from the transport sector, where decarbonisation is urgently needed. Evidence shows that larger settlements, with higher densities and mixed land use, can increase levels of self-containment and reduce the need to travel by car. This helps to reduce emissions from the transport sector, and also reduces emissions from the buildings sector. Achieving long-term emissions reduction also requires investments in public and active transport infrastructure, urban regeneration and building energy efficiency, along with support for low-emission vehicles.

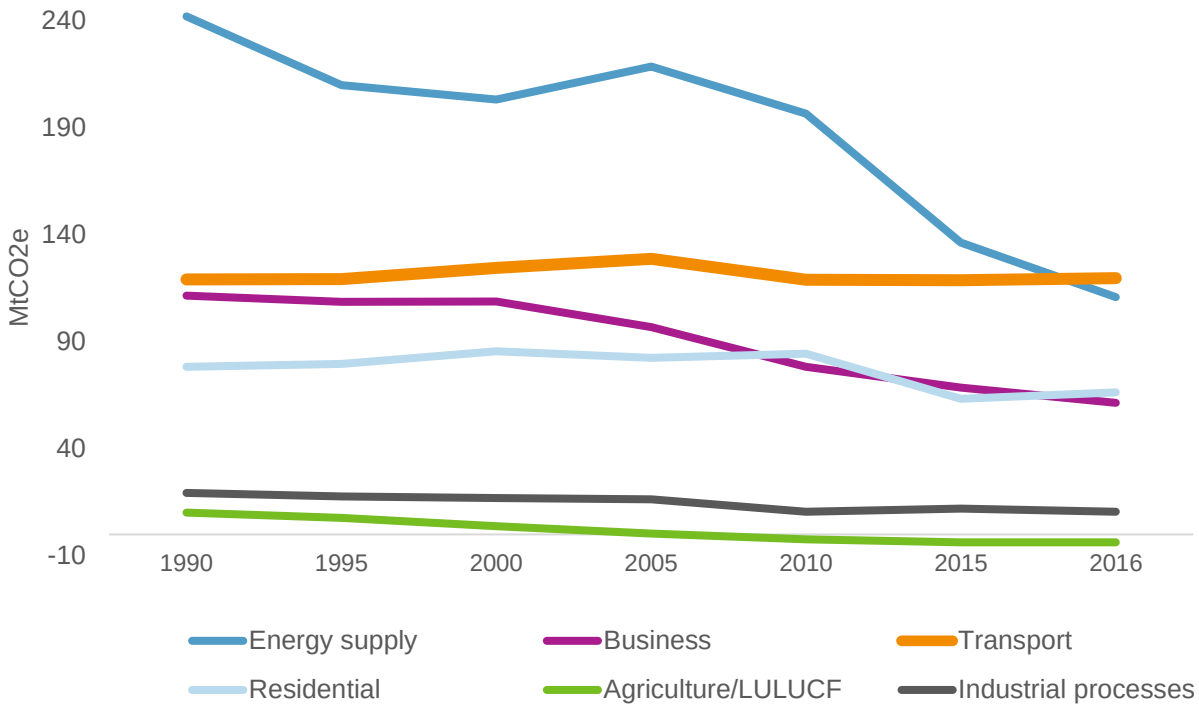
4.1. Introduction

The 2008 UK Climate Change Act commits the UK to reduce greenhouse gas emissions by 80% against a 1990 baseline by 2050. This target was developed as a contribution to a global emissions trajectory that aims to limit global average temperatures to around 2ºC above pre-industrial levels.[1] An interim target was approved by the UK government in 2016 for a 57% emissions reduction by 2030. The UK has also ratified the Paris Agreement, which aims to limit warming to well below 2oC and pursue efforts to limit it to 1.5ºC, and which also sets a target for net zero global emissions in the second half of this century.[2]

Climate modelling entails considerable uncertainty, however there is a broad consensus on the need for urgent mitigation that sees emissions peak within the next few years then rapidly decline.[3] A warming of under 1.5ºC would require annual emissions reductions of around 3% until 2200.[4] Delays in this process could result in a warming of 3ºC or more, accompanied by rapid, uncontrollable and unpredictable climate change.[5]

UK emissions were 42% below 1990 levels in 2016, and emissions have fallen by an average of 4.5% a year since 2012. This decline has been largely driven by decarbonisation in the power sector, as coal has been replaced with gas and renewable energy. However, there has been little recent progress in reducing emissions from buildings and transport. Transport emissions are at their highest levels since 2009, as reductions from improved vehicle efficiency have been offset by growing travel demand. In 2016, transport emissions accounted for 26% of total emissions, the largest share by sector, while buildings accounted for 19%.[6]

Figure 4.1: Over recent decades, emissions reductions have occurred largely in the power and waste sectors, while transport has seen a small increase. Adapted from CCC, 2017.[7]



The government published its Clean Growth Strategy in 2017, which set out plans to meet the fourth and fifth carbon budgets legislated for in the CCA. These require reductions of 51% by 2025 and 57% by 2030.[8] While this included a number of positive measures, additional policies and actions are still required to drive emissions reductions at the speed and scale required, especially in the buildings and transport sectors.[9]

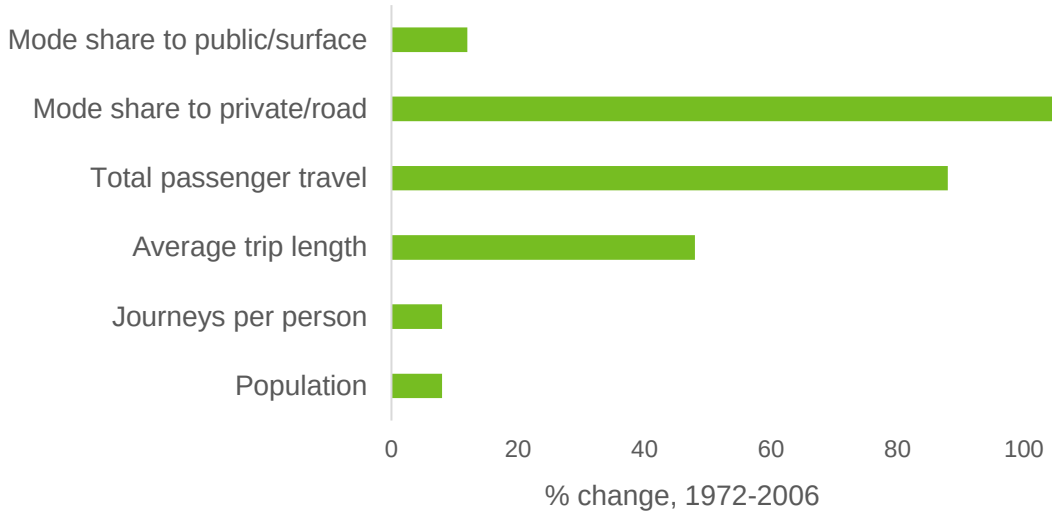
Local Plans are required to contribute to the mitigation of climate change. In England, the National Planning Policy Framework (NPPF) states that planning plays a key role in "*helping shape places to secure radical reductions in greenhouse gas emissions*" in line with the objectives of the Climate Change Act.[10]

4.2. How can settlement patterns and urban forms increase transport emissions?

The growth in emissions from the transport sector can be attributed to an increased demand for travel, increased average trip lengths, and the high proportion of journeys made by private vehicle. These trends are strongly related to settlement patterns and urban form, with low-density suburban expansion during the twentieth century generating additional traffic as people travelled further to access work, shops and services. High levels of car use were also a feature of the New Towns built in England between the 1940s and 1960s. Although these were designed to have high levels of self-containment, many were located close to established cities which encouraged inter-city journeys to access their jobs and services.[11] Even more self-contained new towns like Milton Keynes were designed with densities and land uses which encouraged car use over public and active transport.[12]

These processes of land use change played a major role in increasing transport emissions from cars, which more than doubled between 1972 and 2006. During this period, average trip lengths and the overall number of trips increased for all modes of transport, although the greatest proportion was made by car.[13] It has been estimated that the increase in average trip lengths and the modal shift to cars accounted for 69% of the observed increase in emissions from cars.[14] These outweighed emissions reductions from improved fuel efficiency standards in vehicles.[15]

Figure 4.2: Factors contributing to the increase in motorised passenger surface travel in the UK. Adapted from Goodwin, 2009 and Wenban-Smith, 2016.[16]



Government efforts to reduce transport emissions have largely focused on technological change, including policies to increase the share of hybrid and electric vehicles and improve the efficiency of conventional cars.[17] The CCC recommend that 60% of all new car sales will need to be electric vehicles (EVs) by 2030 in order to meet decarbonisation targets, while scenario modelling by the National Grid indicates this may need to rise to almost 100% by 2050.[18]

The National Grid suggest that the uptake of EVs could add between 6GW and 30GW to peak electricity demand, which currently stands at 60 GW. This variation reflects uncertainties around the rate of EV adoption, changes to consumer behaviour, and the future of the grid.[19] So while the transition to EVs will help to reduce emissions from the transport sector and tackle localised air pollution, it will require both increased capacity and faster decarbonisation in the power sector in order to reduce net emissions. Additional emissions and pollutants will also be generated from the production of EVs, including lithium ion batteries, the installation of charging infrastructure, and the recycling and scrapping of conventional vehicles.[20]

Relying on technological change alone is a high-risk option for reducing transport emissions.[21] Progress could be compromised by a number of factors, including delays in the uptake of EVs to recommended levels, delays in the rollout of charging infrastructure, pressures on the national grid, and delays in fully decarbonising the power sector. The CCC has recognised some of these risks and suggest a package of complementary measures to reduce emissions from the transport sector. These include local policies to reduce the demand for car travel and incentivise public transport, walking and cycling.[22] Given the significance of historic land use change on increasing transport emissions, this requires a greater focus on the role of settlement patterns and urban form.

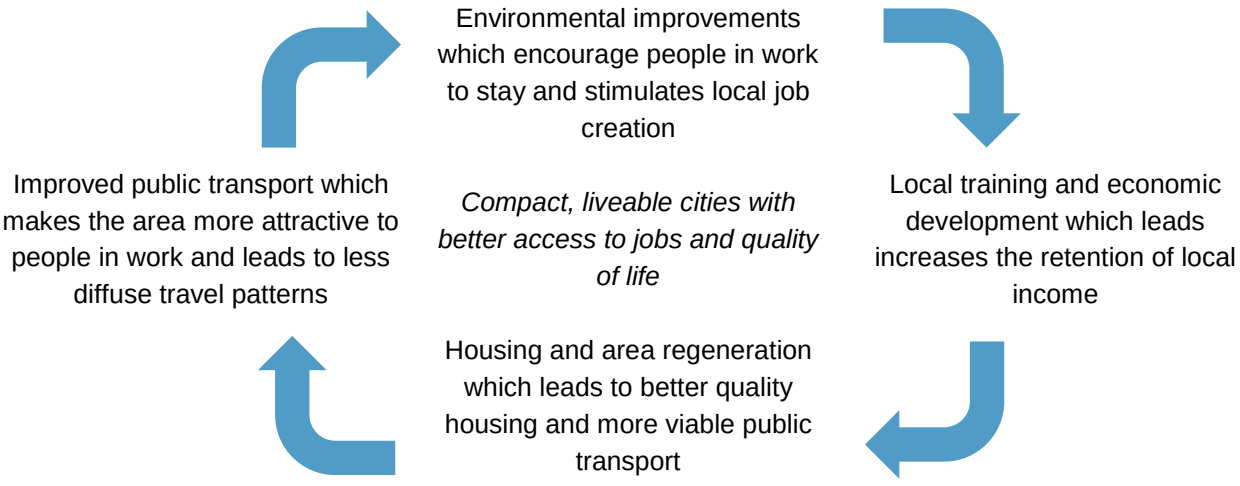
4.3. How can settlement patterns and urban forms reduce transport emissions?

Transport emissions can be reduced by planning compact settlements with sufficient levels of density and land use mix to increase public and active travel. The Intergovernmental Panel on Climate Change (IPCC) suggests that, when coupled with public-transport oriented development, urban regeneration and investment in new walking and cycling infrastructure, these measures could reduce global emissions by between 20% and 50% by 2050 against a 2010 baseline.[23] While the greatest emission reductions would be experienced in rapidly urbanising countries, they also apply to a UK context. Here, a number of studies have sought to model the contribution of different settlement patterns and urban forms on transport emissions.

One of the earliest simulations, carried out by Ecotec in 1993, suggested that a combination of urban regeneration, improved public transport and limited additional highway capacity could reduce transport emissions by up to 16% over a 20-year period, compared to a 'do-minimum' scenario.[24] Another, commissioned by the Department for Transport, described how radical changes to travel behaviour are needed to meet emission reduction targets. It suggested a package of measures which could achieve this, including higher density developments around upgraded public transport networks, major investment in walking and cycling, and efforts to vastly improve the attractiveness of urban areas for living and working. The study suggested that such measures could contribute up to one tenth of a 60% reduction in transport emission by 2030, against a 1990 baseline.[25] Another analysis of commuting patterns in Surrey found that different settlement patterns and urban forms accounted for around 10% of the variation in travel energy consumption, while 20-30% was attributable to socio-economic characteristics such as income and attitudes towards different transport modes.[26]

The measures described above could drive even greater long-term reductions in transport emissions by increasing levels of self-containment and influencing the locational choices of people and firms within the stock of existing buildings.[27] This requires an integrated approach to planning for land use and transport, coupled with wider economic and social policy, in order to drive the positive feedback mechanisms shown below:

Figure 4.3: Positive feedback mechanisms from urban regeneration than can reduce transport emissions over the long-term. Adapted from Wenban-Smith, 2016.[28]



In the UK, average trip lengths have recently stabilised, and the modal shift towards private vehicles has also started to decline. These improvements have been attributed in part to a more integrated approach transport and land use planning policy in the early 2000's. During this period, Planning Policy Guidance encouraged brownfield regeneration and set standards for density and maximum levels of parking, along with wider social and economic objectives.[29]

While difficult to quantify, settlement patterns and urban forms play an important role in making emissions reductions in the transport sector. As described in sections 3.5 and 3.6, this requires the concentration of large-scale mixed-use new development within existing settlements, the prioritisation of urban brownfield over peripheral greenfield sites, investment in walking and cycling infrastructure, and high frequency bus and rail connections between settlements.[30] Development phasing should ensure that public and active transport infrastructure is in place before new houses and businesses are occupied, as the preference for car-based travel is difficult to change once established, even with major investment in new infrastructure.[31] They also need to be supported with behaviour change initiatives and demand management based on the emissions intensity of different modes of transport. Collectively, these measures complement the transition towards transport electrification.

4.4. How can settlement patterns and urban forms influence building emissions?

The difference in typical house size and density between urban, suburban and rural locations also creates differences in average building emissions. Suburban and rural housing tends to be built at lower densities than development within or close to existing urban areas, and detached and semi-detached houses generally consume more energy than medium-rise, higher density houses. This is because they use more construction material per unit of development (resulting in higher embodied emissions) and require more energy for heating and cooling during the lifetime of the building (resulting in higher operational emissions).[32]

Studies suggest a positive correlation between higher densities and lower emissions, with medium-rise developments in existing urban areas consuming the least energy.[33] The correlation between density and lower emissions tails off at the highest densities due to the embodied emissions of the materials and construction methods required for high-rise construction, and to a lesser extent, the operational emissions of features such as elevators.[34]

Standalone settlements also generate high levels of embodied emissions from the construction of entirely new infrastructure networks. This is generally more resource and emissions intensive than expanding infrastructure networks to service new developments within existing settlements.[35] However, the most effective way of reducing building emissions comes from making improvements to the existing stock of buildings and infrastructure. Locating new development within established urban areas allows planning gain to be directed towards the refurbishment and repurposing of associated infrastructure networks, and to retrofitting existing buildings.

The efficient distribution of low-carbon heat for buildings also has implications for urban form. In 2016, heating and hot water for buildings made up 40% of UK energy consumption and accounted for 20% of greenhouse gas emissions.[36] Heat networks can play a key role in reducing these emissions by transferring waste heat in underground insulated pipes from a variety of sources to domestic and commercial premises which have a consistent demand for heat. In order to meet the

fourth carbon budget, the CCC recommends that around 40 TWh of low-carbon heat networks will need to be operational by 2030.[37] Due to the costs of constructing and laying pipes and the need to balance supply and demand, this form of infrastructure is best suited to higher density mixed use urban areas.[38]

4.5. How can settlement patterns and urban forms influence climate resilience?

Variations in settlement patterns and urban form are also important when considering resilience to the likely impacts of climate change. Climate adaptation emerged in the early 2000s as a concern for vulnerable countries in the global south, then spread to mature economies as the widespread impacts of climate change became apparent.[39] While adaptation is increasingly discussed at international and national levels, decision-making and implementation are primarily seen as issues for local government.[40] So in addition to reducing emissions, it is important to understand how different urban forms vary in terms of resilience to the impacts of climate change.

There are several criticisms of compact, higher density urban forms in relation to climate resilience. Increasing density can reduce the amount of permeable surfacing, which increases flood risk during heavy rainfall. A combination of limited space and higher land values can also reduce the use of Sustainable Drainage Systems (SuDS) for managing flood risk, natural solutions which have low embodied emissions and provide a range of wider benefits. This in turn increases reliance on large-scale, engineered and carbon-intensive flood defence infrastructure.[41]

Higher density urban forms can also reduce the flow of air in the urban environment, which traps pollutants.[42] Poor air quality can lead building occupants to favour carbon-intensive artificial air-conditioning over natural ventilation. During heatwaves, the use of air-conditioning in large high-density cities could lead to peaks in energy consumption which risk overloading the national grid.[43]

Despite these concerns, the ability of higher-density urban forms to reduce emissions is believed to outweigh the emissions associated with hard adaptation measures such as engineered flood defences and air conditioning. Climate change mitigation should also be prioritised in most cases as it reduces the need for adaptation over the long-term.[44] To reduce the risks associated with climate change in dense urban areas, planners, engineers, architects and urban designers should develop integrated solutions which boost resilience and provide wider benefits. An example would be restricting cars from dense urban areas to reduce air pollution, and converting former parking spaces into multi-functional green infrastructure. This increases resilience to both heatwaves and surface-water flooding, while the improved air quality enables buildings to be naturally ventilated.[45]

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5. The relationship between settlement patterns, urban form and public health

Key messages

Evidence shows that larger settlements, with higher densities and mixed land use, can increase physical activity by promoting accessibility by walking, cycling and public transport. This improves physical and mental health, reduces absenteeism and reduces the prevalence and severity of chronic lifestyle-related diseases. The negative impacts of density on health can be mitigated through measures to limit car use and the provision of high quality green space, equitably distributed across the urban area.

5.1. Introduction

Modern urban planning was conceived during the nineteenth century in response to the public health challenges in rapidly industrialising towns and cities, where large numbers of people lived in overcrowded and unsanitary conditions. However, as slums were eradicated and new building standards emerged, the connection between the planning and health functions of national and local government started to weaken. Over the course of the twentieth century, planning and health became the responsibility of separate national government departments. Planning focused on economic growth, housing, environmental protection and place-making, while health focused on the understanding and treatment of disease.[1]

Recent decades have seen improvements to many aspects of public health, with higher levels of overall life expectancy and disability-free life expectancy for both males and females (CABE, 2009). But as urban populations grew, it became apparent that the shape of the built environment was contributing to a rise in chronic non-communicable diseases, such as cardio-vascular disease, diabetes, asthma, cancer and obesity. Over time, urban form become recognised by international bodies such as the World Health Organisation (WHO) as critical enablers of a physical and mental wellbeing, rather than just ways to avoid the spread of disease.[2]

However, the relationship between settlement patterns, urban form and health is complex and difficult to analyse. In addition to the shape of the built environment, health is affected by factors such as income, genetics and cultural/behavioural preferences. This makes it hard to isolate the impact of specific urban form variables, such as changes in density or accessibility. Much of the research on this topic has also been conducted in the USA, with studies which use different methods for measuring key indicators. This makes it difficult to transfer findings to a European context.[3] But despite these caveats, a number of useful conclusions on the relationship between urban form and health can be established.

In the UK, national planning policy and guidance has emphasised the role of planning in creating healthy environments. In England, the National Planning Policy Framework (NPPF) states that the social role of planning is to support "…*strong vibrant and healthy communities*", and to "…*take account of and support local strategies to improve health, social and cultural wellbeing for all*" [4]

Planning Practice Guidance states that the built and natural environments are major determinants of health and wellbeing, and encourages planners to consider:

- Opportunities for healthy lifestyles, including those which help to promote active travel and physical activity, access to healthier food, high quality open spaces, green infrastructure, and places for play, sport and recreation
- The impacts of pollution and other environmental hazards from development proposals on human health
- The healthcare infrastructure implications of development proposals[5]

There is a growing body of advice on the integration of planning and health. In 2014 the RTPI published Promoting Healthy Cities, which explored how health challenges are being tackled through effective planning in a variety of global contexts.[6] In 2015, NHS England and Public Health England launched the Healthy New Towns initiative, to promote the integration of health and planning in developments.[7] In 2017, Public Health England published Spatial Planning for Health, a comprehensive review on the impacts of the built environment on health.[8]

5.2. How can settlement patterns and urban form restrict physical activity?

Physical inactivity directly contributes directly to one in six deaths in the UK. It is the fourth largest cause of disease and disability, and costs an estimated £7.4 billion a year to business and wider society.[9] It is a key contributor to rising levels of obesity which now represents a major public health crisis.

In England, 58% of women and 68% of men are now overweight or obese, with the prevalence of obesity increasing from 15% to 27% between 1993 and 2015.[10] Childhood obesity is a particular problem, with nearly one third of the population aged between 2 and 15 overweight or obese, and younger generations becoming obese at earlier ages and staying obese for longer.[11] Obesity increases the risk of developing certain cancers, type 2 diabetes, high blood pressure and heart diseases, and comes at a significant cost. The NHS spends an estimated £6.1 billion per year on treatment, while the wider economic costs stand at approximately £27 billion per year and are increasing.[12] If current trends continue, over half of the UK population will be clinically obese by 2050.[13]

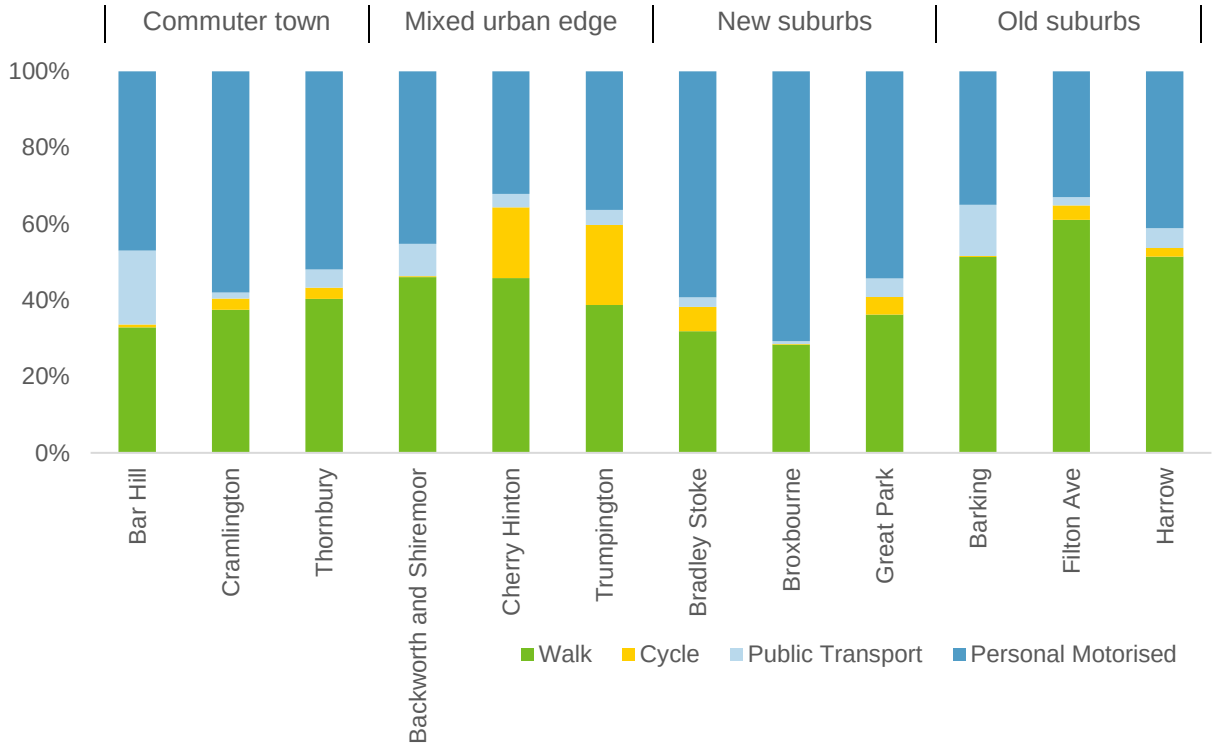
To address this problem, the NHS recommends that adults carry out 150 minutes of moderate aerobic activity per week, such as cycling and brisk walking, or 75 minutes of vigorous activities such as running or sport.[14] However, in 2012 it was estimated that only 67% of men and 55% of women were meeting these targets, with even lower levels of physical activity recorded among the elderly, those on lower incomes, and those who were overweight and obese.[15]

Many people are only able to achieve recommended levels of physical activity through daily active travel - walking and cycling.[16] With over 80% of the working population in England and Wales regularly commuting to work,[17] the method of travel used for these journeys has significant implications for public health. Long and inactive commuting journeys have been linked to higher blood pressure, BMI levels and rates of obesity, and reduce the time available to engage in healthy activities outside of work, such as exercise, food preparation and social interaction.[18]

Chapter 2 described how the distance between housing and jobs has increased over time, as populations moved into the suburbs while employment remained concentrated in urban centres. The average commute subsequently increased in both time and distance, with the majority of journeys made by car.[19] Car-based commuting is typically 'door to door' and inactive, while commuting by bus or train does at least provide an opportunity to incorporate some physical activity into a journey.[20]

This is also demonstrated through studies which show how different settlement patterns and urban forms affect how residents access various facilities, such as supermarkets, local food stores, banks, newsagents, pharmacies and recreation opportunities. The graph below shows travel behaviour in twelve case study areas, representing a mixture of planned new towns, planned urban extensions, unplanned suburban sprawl, mixed urban edge areas and older suburbs.

Figure 5.1: Modal split in case study areas, by locational type. Reproduced from Barton et al., 2012.[21]



This data shows that the suburban neighbourhoods of the 1980s and 1990s exhibited high levels of car dependency and low levels of active travel, while the opposite was true of older and more mixed-use neighbourhoods. However, these variations in travel behaviour could not be explained by residential density alone. The degree to which neighbourhoods are integrated into existing urban areas is important, as this increases accessibility to nearby facilities. Connectivity also matters, with the presence of cul-de-sacs and low permeability restricting active travel.[22] Travel behaviours are influenced by a range of demographic, socio-economic and cultural factors such as age, income and perceptions of safety.

Some suburban and rural developments can encourage physical activity by offering access to the countryside. However, these benefits can be countered if residential densities and land use mix are too low to support a range of shops and facilities, as this limits options for walking and cycling.[23] People living in rural areas drive 25% further than those living in the suburbs, and 44% than those living in urban areas, due to a lack of viable alternatives.[24] The health impacts of car

dependency are not only felt by rural residents, who miss out on opportunities for active travel, but also by urban populations who suffer the impacts of congestion and air pollution from car journeys made to access jobs and services in towns and cities.[25]

The physical activity of children is a specific concern. Only 22% of 5 to 15 year-olds are thought to meet the recommended target of 60 minutes moderate physical activity per day, and over a third of children are overweight or obese by the time they leave year 6.[26] One way of tackling this is by encouraging children to walk to school, which increases both daily physical activity and overall physical ability, and supports better learning and academic performance.[27]

Between 1975 and 2012, the proportion of secondary school pupils that walk to school decreased from 55% to 38%.[28] A key factor driving this trend is the growing distance between homes and schools, caused in part by a shift towards more dispersed, low-density and car-dependent urban forms, but also by a move towards increased school size, greater choice over school selection, and rising household affluence.[29] Factors such as connectivity, land use mix and higher residential density are also thought to influence whether children walk to school, along with socioeconomic factors and perceptions of safety.[30]

5.3. How can settlement patterns and urban form promote physical activity?

Urban form can encourage regular physical activity by enabling active travel between homes, jobs, services and leisure opportunities, either as a complete journey or as part of a longer journey. Higher levels of residential density, public transport density, street connectivity and public parks are positively correlated with physical activity. These have the potential to contribute nearly 90 minutes per week of physical activity, equating to 60% of the recommended target.[31] This relationship has been consistently reported across numerous studies, although the degree of influence of urban form is thought to be lower than socioeconomic factors like income.[32]

There is a close relationship between residential density and accessibility, with larger local populations providing patronage for a wider range of local shops and services in convenient locations, within easy walking or cycling distance.[33] Higher levels of residential density and land use mix around public transport stops also helps to make high-frequency services financially viable, and increases the number of public transport stops at the city-region scale. This in turn improves accessibility across the entire network, creating a virtuous cycle that reduces car dependency, increases levels of public and active transport, and reduces the number of physically inactive ‘door to door’ trips.[34] For example, London has higher than average levels of walking and cycling, and is the only city in England where the majority of journeys are not made by car. This is enabled in part by high public transport density, which means that a single stop can be used to access to a wide range of destinations. Commuters who regularly walk and cycle have lower mortality rates than those who rely on passive transport.[35] Cycling to work is thought to reduce mortality by almost 40% by reducing the risk of obesity and cardio-vascular disease.[36]

Studies suggest that there is no upper threshold to the levels of physical activity that can be achieved by increasing residential and transport density.[37] However, this does not mean that higher residential densities should be pursued in isolation. Multiple studies have shown the need for complementary measures, including increased land use mix and small block sizes, to improve street connectivity. The negative impacts of increased density can also be offset through high

standards of urban design and the provision of parks, recreational spaces and areas for local food growing. These need to be within close walking distance of homes, and perceived as safe to use.[38]

In 2004, the Department for Transport (DfT) set out distances which they considered broadly acceptable for walking and cycling trips. Average mean lengths were given as approximately 1 km (0.6 miles) for walking journeys, and 4km (2.4 miles) for cycling journeys, with journeys of up to three times these distances for more regular commuters. These vary according to factors such as fitness and physical ability, journey purpose and path conditions, but provide a useful indication of the proximity needed to promote regular walking and cycling.[39]

5.4. How can settlement patterns and urban form affect mental health?

There has been a recorded increase in mental illness since monitoring began in 1993, with 9.3% of the English population now regularly recording severe symptoms of a common mental disorder (CMD) such as depression and anxiety. The cost of CMD to the UK economy has been estimated at £70 billion per year,[40] with mental illness now the leading cause of absenteeism.[41] The direct costs of mental ill-health in England stand at an estimated £22.5 billion per year, and account for over 12% of the NHS budget. And while levels of anxiety and depression appear largely stable, the frequency and costs associated with dementia in an ageing population is expected to rise.[42]

Low density and dispersed urban forms may negatively impact mental health by increasing the distance and length of commuting journeys, and by encouraging passive modes of transport. While some longer commuting journeys do provide an opportunity to relax or catch up on work, others are associated with crowding, frustration and stress.[43] Longer commuting times tend to generate negative impacts on personal wellbeing, with the worst effects resulting from journeys of between 61 and 90 minutes. When the method of travel is taken into account, bus and coach journeys lasting more than 30 minutes appear to have the most negative impacts on wellbeing. Journeys of under 30 minutes by train, underground, light rail or tram have no significant negative impacts on wellbeing, with anxiety increasing for longer journeys by these modes. The commuting options that appear to have positive impacts on wellbeing are short car and train journeys under 30 minutes, long walking journeys over 30 minutes, and bicycle journeys.[44]

There is a relationship between physical activity and mental health, with adults who participate in daily physical activity having 20% to 30% lower risk of depression and dementia.[45] Regular walking is associated with greater grey matter volume and a reduced risk of cognitive impairment in late adulthood,[46] while the ability to walk or cycle to nearby facilities is thought to have a positive impact on the maintenance of social networks and mental wellbeing.[47] Urban forms which promote physical activity therefore offer the potential to improve mental health and reduce the costs of healthcare, although there is not a simple relationship between residential density and mental health. Research indicates that mental health outcomes also require increased land use mix, quality building design, access to facilities and green spaces, and guidelines to deal with social issues like noise.[48]

Access to green and open space is again an important factor, affecting levels of both physical and mental health. Higher levels of green and open space are positively associated with improved companionship, sense of identity, belonging and happiness.[49] Shorter distances between homes and green spaces were associated with reduced stress across all age groups, due in part to their role in promoting outdoor activities and active travel.[50] This shows that intensification policies need to be accompanied by the provision of high quality green space.

5.5. How can settlement patterns and urban form affect air pollution?

Air pollution in towns and cities is primarily caused by vehicle emissions and creates respiratory health problems in urban populations. The impacts are especially harmful to children and those with pre-existing health conditions such as asthma. They also contribute to the development of both asthma and other respiratory problems.[51] Conservative estimates place the public costs of asthma to at £1.1 billion per year.[52]

Section 3.1 described how levels of motorised travel can be reduced through policies which promote compact settlement patterns with higher levels of density, land use mix and accessibility. There is strong evidence that these urban forms facilitate public and active transport when compared to low-density and dispersed developments, and thereby reduce overall vehicle use. However, by increasing population density, intensification can also increases the amount of vehicle trips in a given area, leading to congestion and exposing a greater amount of people to polluted air.[53]

In the vast majority of urban environments, the health benefits of walking and cycling are even thought to outweigh the potential health risks from increased exposure to air pollution, especially if they replace car journeys.[54] However, it is important to recognise and mitigate the trade-offs between intensification and air pollution. Along with policies to promote sustainable modal shift, complementary measures may be needed to restrict car movement, limit parking spaces in developments, and locate key facilities like schools and hospitals in places which can be accessed without a car.[55] Green infrastructure can help to filter pollutants in street canyons, where high buildings limit air circulation.[56] A shift towards hybrid and electric vehicles can also help to reduce air pollution, although this may be offset by localised air pollution around electricity generating facilities unless renewable and low-carbon energy sources are used.

5.6. How can settlement patterns and urban form affect access to healthcare facilities?

As populations and settlements expand, additional healthcare capacity is required. This usually takes the form of new General Practitioner (GP) surgeries, larger community healthcare centres, or the expansion of existing hospitals. GPs are the first point of contact for the vast majority of the population, and play a critical role in both preventing and treating poor health. The NHS is moving a greater proportion of routine diagnostic procedures, treatments and care for chronic diseases to facilities in local communities, while English local authorities have been given responsibility for public health.[57] This creates the possibility for greater integration between planning and health, and consideration of how urban form can promote access to healthcare facilities.

Compact, high density urban areas allow healthcare services to be provided at lower per capita costs to a greater number of people, provided that measures are in place to enable access by public transport, walking and cycling.[58] It also increases the possibility for healthcare facilities to be co-located alongside other services, including education, social care, retail and leisure. As major energy consumers, the proximity to other buildings creates an opportunity to integrate healthcare facilities into district heating and cooling networks which increase energy efficiency.[59] There is a risk that healthcare facilities in dense urban areas will become increasingly vulnerable to overheating as climate change exacerbates the urban heat island effect, however this can be mitigated with building design and green infrastructure, as described in section 4.7.

Development in peripheral locations and new settlements either requires new healthcare services or improved access to services with sufficient capacity in neighbouring settlements. Small-scale and incremental patterns of developments do not generate sufficient developer contributions to fund new healthcare services or improve accessibility when compared to large, strategic developments. Low density urban forms also reduce accessibility to healthcare by public transport, walking and cycling, which impacts lower income groups and those who cannot drive.[60] This is particular issue in rural areas.[61] A government study in 2003 found that 1.4 million people had missed, declined or chosen not to seek medical help over the course of a year due to transport problems.[62] This can lead rural patients to experience poorer health outcomes that those living in urban areas. Healthcare facilities which serve rural and dispersed populations can struggle to attract GP trainees, and face challenges in providing healthcare over a wide geographical area. This is compounded by a lack of basic infrastructure and high proportion of elderly people,[63] issues which are explored further in Chapter 6.

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6. The relationship between settlement patterns, urban form and an ageing population

Key messages

Settlement patterns and urban form can be managed to maximise the benefits and reduce the costs associated with an ageing population. Compact, medium density, mixed use and public-transport friendly settlements encourage continued physical activity, economic participation and social interaction into old age. To realise these benefits, efforts are needed to make towns and cities age-friendly, including the provision of more appropriate and specialist housing.

6.1. Introduction

The UK population is rapidly ageing, and projections indicate that by 2040 nearly one in seven people will be aged over 75.[1] There are many different cohorts within older populations, including the very elderly and infirm, those who have been retired for some time, the recently retired and those still in employment. This diversity generate a wide range of preferences and behaviours around housing, locations and means of travel, and different accessibility needs for employment, leisure and services. As the UK population ages it will become more ethnically diverse, bringing different attitudes to ageing.

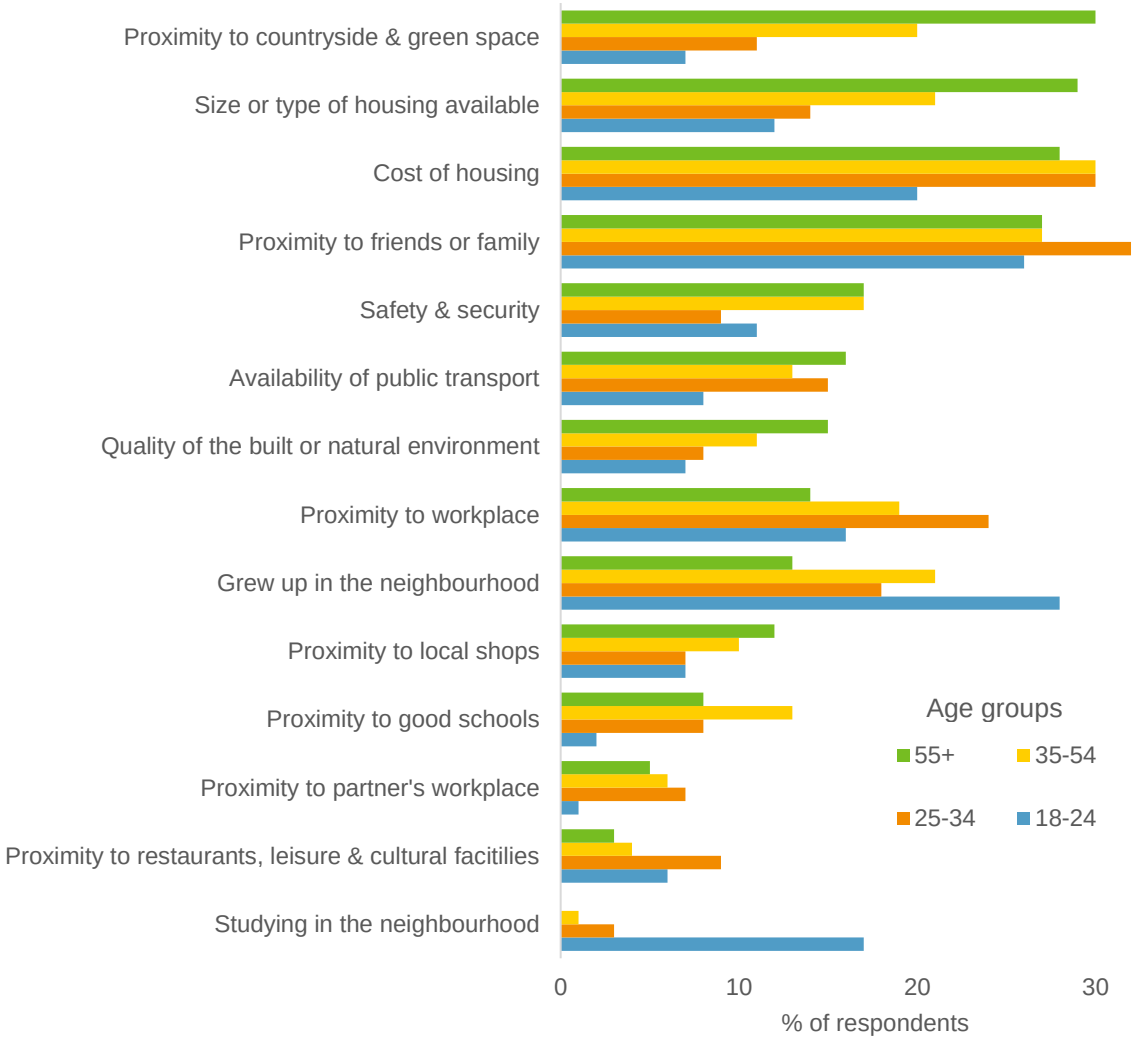
These variations make it difficult to make simple assumptions or generalisations about older people and the impacts of an ageing population. But despite this lack of homogeneity, existing trends and preferences suggest that demographic change will result in an uneven distribution of older people across different types of settlement and urban form.

Figure 6.1: Projected changes in numbers for different age groups across five settlement types in England between 2012 and 2037 (000s). Reproduced from Champion, 2015.[2]

While the number and proportion of older residents is projected to increase in all types of settlement, the largest increase will be felt in small towns and rural areas.[3] Here, as figure x shows, the most significant demographic change will be an increase of older people aged 70 and above. Within this, the over 85 age group is also projected to increase by 186% in rural areas as soon as 2028, compared to 149% in the UK as a whole.[4] While part of this will be caused by natural population growth, it will also be driven by retirement migration.

Many of the housing preferences of older people are similar to the wider population. This includes locations which are close to green space, public transport, shops and leisure facilities, and with good road and pedestrian access.[5] However, preferences can also change as older people work less or enter retirement, and become less constrained by proximity to employment. As such, the value placed on proximity to urban centres, commuter links and schools can start to be replaced by proximity to local shops, nature walks and views, healthcare, leisure facilities and adult education. Some of these are land-intensive and more likely to be associated with less dense environments.[6] The preference for small towns and rural areas is also connected to the type of housing available. Bungalows and houses with gardens tend to be developed in more peripheral and remote areas where cheaper land makes low-density development viable. There is also an increased demand among more affluent older people for second homes and holiday lets in rural areas.[7]

Figure 6.2. The main reasons why different age groups choose to live in their neighbourhood, based on respondents to a national survey. Reproduced from Thomas et al. 2015.[8]



6.2. Which settlement patterns and urban forms create challenges for an ageing population?

Despite advancements in healthcare, those aged over 65 still spend more time in ill-health. Unless there are significant improvements in health, or innovations in healthcare, an ageing population will result in more people living with chronic conditions, multi-morbidities and cognitive impairments to health.[9] The suitability of the housing stock for an ageing population is recognised to be of critical importance for individual health and public spending, especially in the NHS and social care sectors.[10] Settlement patterns need to promote access to hospitals, GP surgeries and walk-in centres, and access by healthcare professionals and service workers to households (reflecting the rise in people receiving treatment and ongoing care at home).

While young people are less likely to own a car and drive less, owned cars are the most common mode of transport for older people, and there is evidence that road mileage from the elderly is increasing. For elderly people living in more rural areas, car use is difficult to replace with more environmentally sustainable modes of transport due to lack of public transport options, perceived or actual unsuitability of public transport, and difficulties accessing public transport stops. However, as people age, it also becomes harder to drive. Loosing access to a car or a driver can have serious negative impacts on wellbeing and health, which have been estimated as similar in magnitude to the loss of a job or spouse over the long-term.[11] Those living in more rural locations often struggle to find alternative modes of transport, especially as local bus spending and route coverage has declined in many rural areas. While this has been replaced by community buses in some areas, it generally makes it difficult for older people to access both preventative and critical healthcare. This harms individual quality of life and creates additional costs for the NHS.

In 2011, a study showed that 630,000 people aged over 65 found it difficult or very difficult to travel to their GP, while less than half of those aged 80 and over said they found it easy to travel to a hospital. Those in the worst health and with the lowest incomes found it the most difficult to travel to health services. Social isolation is thought to affect between 7% and 17% of older adults, and is becoming more prevalent.[12] Those in more rural areas are thought to suffer more from social isolation, although more research is needed.[13] Social isolation is associated with higher rates of ill-health and mortality – for example people with a high degree of loneliness are twice as likely to develop Alzheimer's as people with a low degree of loneliness.[14] Living in car-dependent locations also reduces levels of walking, and there is evidence that this is also linked to increased rates of cognitive decline and dementia.[15]

The implications for public health infrastructure are also significant in terms of providing care at home for a more dispersed population. Care workers overwhelmingly use private cars to access patients, and often visit the same household multiple times in one day to provide services such as a morning wash, lunch, and help to bed in the evening. This means they spend a significant proportion of the day travelling, leading to high fuel costs and related transport emissions.[16] The costs of these journeys accrue to local government adult social care budgets which are already stretched. If a growing proportion of older people live in more dispersed and rural communities, and fuel prices increase, then local authorities will face increased costs for the provision of care at home.

This could be offset in part by technological developments. There is some early evidence that 'telehealth' (care provided by phone and email) could play a larger role in serving rural

communities.[17] Rural communities have also been shown to provide networks of informal care in areas with strong social cohesion, a benefit which should not be discounted.[18]

Finally, evidence also suggests that those living in single-occupancy housing in remote areas have a higher carbon footprint, using less energy at peak times but more energy overall during the day.[19] Rural housing is often more expensive to heat, which creates additional challenges for elderly low-income people during periods of cold weather, or if fuel prices increase.[20]

6.3. Which settlement patterns and urban forms support an ageing population?

As the population ages, the economic productivity of older workers will become increasingly significant. Improvements to healthcare mean that people are able to remain in work for longer, earn more, and have longer retirement years with less of a burden on public health finances. For example, by 2050, 35% of the working age population will be aged between 50 and the state pension age, an increase of approximately 8 million people.[21] This means that compact, dense urban forms which promote accessibility to employment remain important for a wider demographic cohort. However, these commuting patterns may be different, with older people still in work more likely to work irregular hours, part time, or from multiple locations.

Settlement patterns and urban forms that provide good access and close proximity to public transport, high quality green spaces, local amenities and diverse range of retail outlets are all thought to encourage healthy ageing, social interaction and improved access to healthcare, including care at home.[22] Sections 3.5 and 3.6 describe these spatial principles in more detail.

Most importantly, this needs to be complemented with efforts to tackle the shortage of high quality affordable housing in dense, well connected urban areas. Retirees often wish to downsize, but struggle to find appropriate accommodation from the private market.[23] Development needs to target the needs and preferences of older people for specialist housing, such as residential care and nursing homes and serviced flats. As high density housing is not always appropriate or attractive for older people, sites need to be allocated for lower density development within the existing urban realm. For example, younger old people may be attracted to smaller town houses with small gardens, if located near to key services and public transport.[24] Improved cycling infrastructure could also increase the attractiveness of dense urban environments for older people if coupled with measures to increase the use of electric bicycles (e-bikes). These modes of transport extend the age range for cycling but are underused in the UK, where cycling accounts for only 1% of all journeys amongst people aged 65 and over. Comparable rates of cycling are much higher in other countries such as the Netherlands (23%), Denmark (15%) and Germany (9%).[25]

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