The history of transport systems in the UK

Future of Mobility: Evidence Review

Foresight, Government Office for Science

The history of transport systems in the UK

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Executive summary

The purpose of this review is to summarise the major changes affecting transport systems in the UK over the last 100 years. It is designed to enable the Foresight team to bring relevant historical knowledge to bear on the future of transport and mobility.

The review analyses four aspects of transport and mobility across the twentieth century. The first section identifies significant points of change in the main transport modes. The second section addresses the principal factors accounting for these changes. The third section examines the consequences for the economy, social inequality and the environment. Finally, the conclusion draws out a number of overarching issues relating to the future of transport and mobility.

What were the significant moments of change during the twentieth century?

There was no common pattern of historical experience among the various modes of transport during the twentieth century. The winners were automobility and air travel, both of which experienced growth rates that outstripped contemporary predictions. Almost all other transport modes suffered from competition with them. These included walking, which underwent continuous decline; passenger shipping, the main means of international transport before the 1950s; rail freight, under pressure from road haulage from the 1920s; and buses and trams which, like other forms of public transport, lost out to the private car. Some declining modes saw recovery in the late twentieth century, notably sea freight and passenger rail.

Significant periods of change include the years after the world wars, when much passenger travel and freight transport was reorganised. The 1960s, years of experiment in transport as in much else, saw containerisation and rapid expansion of air travel, car ownership and motorway construction; with the last decades of the twentieth century experiencing privatisation of important parts of the air and rail systems, and the state promotion of major infrastructure projects.

What were the main drivers of change?

Analysing why change occurred is tricky because of the intersecting pressures which have affected transport modes differently. Broadly, four 'drivers' served to shape UK transport systems during the twentieth century.

The most powerful was consumer demand, predicated on a rising standard of living for much of the century. It prompted the spread of the bicycle between the wars, the expansion of car ownership under conditions of 'affluence' from the late 1950s, and the growth of package holidays abroad from the 1960s, fuelled by cheap flights.

Two further drivers were war and technological innovation. Wartime, when the state took control of transport along with other national resources, was the precursor to post-war intervention in

the name of greater efficiency. The two world wars boosted Britain's pioneering role in aviation and motor manufacturing, which transferred into peacetime gains. Technological innovation in these sectors was significant, especially in manufacturing, with the Mini and Concorde products of the expansionist 1960s. However, innovation in technology was not matched in infrastructure, where much of the stock remained antiquated. Only from the 1990s was large-scale investment in transport infrastructure other than roads undertaken, based on public-private partnership.

Government policy was a further, although less dynamic driver of change, setting the framework for transport, through regulation, ownership and subsequent privatisation. Through taxation it funded the motorways programme from the late 1950s and promoted transport research in areas such as road safety and civil aviation. But with some exceptions, government was reactive rather than proactive in relation to transport. Historically, Britain has not been a *dirigiste* state on French or German lines, although initiatives such as the Channel Tunnel and HS2 may be changing this pattern.

What were the consequences of changes in transport?

There have been consequences in three main areas. Transport changes had a significant effect, firstly, on the economic fortunes of regions and industries. Transport has consistently employed over a million workers with more in allied industries. It has had long-term consequences for regional economic growth and decline as the divergent fortunes of ports like Southampton and Liverpool indicate.

Secondly, mobility has been an important contributor to the growth of individual choice, especially for women. The car has been seen as a contributor to women's emancipation. At the same time, inequalities have been mirrored in and reinforced by lack of mobility, measured by the proportion of households in 'transport poverty', cut off from employment and services. Among those most affected have been the young, older people and people living in rural areas.

Thirdly the changes in transport have had a series of unintended consequences. These include traffic accidents and congestion, but the most fundamental have been the consequences for the environment from air pollution and climate change, emerging in the last third of the twentieth century. Automobility and roads were the main source of negative externalities, associated also with 'sprawl' and 'blight'.

Overarching trends and issues for consideration

From the historical analysis five issues were identified as relevant to the future of transport in the UK.

- Interactivity: while transport analysis and policy is often directed towards single modes (e.g. road, rail), it is clear that developments in some modes have been closely connected with those in others. Most journeys in the past were multi-modal.

- Mobility revolution: evidence points to a transformation in personal mobility in the later twentieth century, driven by consumer demand. Transformation has occurred in scale and scope in automobility, air travel and, more recently, rail travel.

- Overload: one of the results of the surge in the circulation of people and goods has been overloaded transport systems: congested roads, crowded trains and airports. UK transport can be read as a success story but old, under-funded infrastructure has consistently hampered expansion.

- Sustainability: since the oil crisis of 1973 the sustainability of transport has been a major issue, encompassing renewable resources, carbon emissions and pollution. Government has worked towards greater sustainability but it remains a major challenge.

- Alternatives: transport systems have been relatively stable over the last century, qualifying the idea of an imminent breakthrough to a new phase of transport. Most current options such as the electric car, road pricing and CAVs have existed for many decades. History suggests that change is as much a matter of recycling the old as introducing the new. The past thus remains an important resource for transport alternatives in the future.

Contents

1. Introduction

The purpose of this review is to bring a **historical perspective** to the project on the future of mobility in the UK. It aims to illuminate the project in a number of ways:

- Identifying long-term **trends** and patterns in UK transport;
- **'Learning from the past'**: understanding why developments succeeded or failed;
- Recognising **path dependence** and the limits to as well as the opportunities for change;
- The past as a repository: borrowing **examples** which might have benefits in the future.

This review is not therefore a narrative history but an attempt to bring historical knowledge to bear on future directions in UK transport policy. It is concerned with **transport systems** in the conventional sense (railways, roads, air, etc.) but also with **mobility**, forms of movement such as walking and cycling often omitted from transport history and policy.

The review concentrates on the century between the **end of the First World War** and the **present day** as the period most relevant to understanding future challenges. It is divided into four sections. The first section describes the most important points of change in the main modes of transport over the last 100 years. The second and third sections examine the principal causes and consequences of those changes. The concluding section identifies overarching trends and issues arising from the history of transport and mobility.

2. Significant moments of change

This section examines the **principal changes** in the history of UK transport over the last 100 years, broken down by mode. The later sections will analyse the relationship between the changes described in more detail but it should be borne in mind that they occurred interactively with developments in other modes.

Walking

Frequently neglected as a mode of transport, walking remained the **commonest form of mobility** throughout the last century. The effects of mass public transport and private automobility made walking less publicly visible in some cases but not necessarily less frequent. Between the 1890s and the 1930s walking was the most common form of **getting to work** and it remained the main means of commuting for one-third to one-fifth of the population in smaller towns and cities as late as the 1970s (Pooley and Turnbull, 1999).

Early twentieth-century film shows pedestrians moving freely around streets, weaving between trams and horse-drawn traffic (Toulmin, 2004). Between the wars the growth of motor traffic led to record **road deaths** among pedestrians as well as motorists, and a rapid rise of casualties to over 200,000 a year. Partly as a result walkers were pressed by planners onto pavements and sequestered behind railings away from roads. The **Pedestrians' Association** was founded in 1929 to push for improvements such as Belisha beacons and speed limits for motor traffic.

The onset of **mass automobility** after 1950 meant that walking became even more hazardous, especially in built-up areas, and increasingly invisible in planning. While motorways were built to accommodate traffic, walkers were forced into subways or onto bridges and raised walkways away from roads. As part of the reaction against roads and motorisation, city centres were **pedestrianised** after 1970; Reading and Leeds were two early examples where traffic was excluded from the central zone in favour of walking (Hass-Klau, 2014).

From the 1970s walking began to enter the domain of transport policy. It was increasingly conjoined at governmental level with **health** policies that stressed the benefits of an active lifestyle and with urban policies that emphasised sustainable transport as a corollary of sustainable cities (DfT, 2003; Rogers, 1999). Nevertheless, walking seems to be **declining** as a way of getting about in the twenty-first century. Walking fell from 27% to 22% of all trips between 1995/7 and 2012, interviews suggesting that people see it as less safe and 'normal' than walking appeared in the past (Pooley, Horton et al., 2014).A Transport for London report from 2015 indicated that the number of 'walking all the way' trips increased by 9.3% between 2008 and 2014 – exactly the same figure as for population increase in the capital over this period. This suggests that London bucked the national trend in walking and may also indicate a significant correlation between walking and population density.

Cycling

Cycling developed in the **late nineteenth century**, primarily as a leisure pursuit. Although initially pursued by the well-to-do, it was quickly taken up by the better-off working class. The opportunities the bicycle gave for moving beyond the town was one of the reasons given for the

weakened control of employers over factory workers in Lancashire textile towns in the 1890s (Joyce, 1980).

By the inter-war years the use of **bicycles spread** more widely, aided by the growth of mass production firms, such as Nottingham-based Raleigh, which made Britain a world-leader in bicycle manufacturing. Cycling received **official support** from the Ministry of Transport, with 280 miles of cycle lanes constructed as part of new roads between 1934 and 1940 (Reid, 2014). By the late 1940s when the number of bicycles in the UK reached its **peak**, cycling was second only to the bus as a means for people to get to work, accounting for one-fifth of all such journeys (Pooley and Turnbull, 1999). After 1950 the bicycle declined as a mode of transport in the face of competition from motorbikes and the private car. **Decline** was continuous to the mid-1970s, when it levelled off, and usage has fluctuated to the present (Parsons and Vigar, 2017).
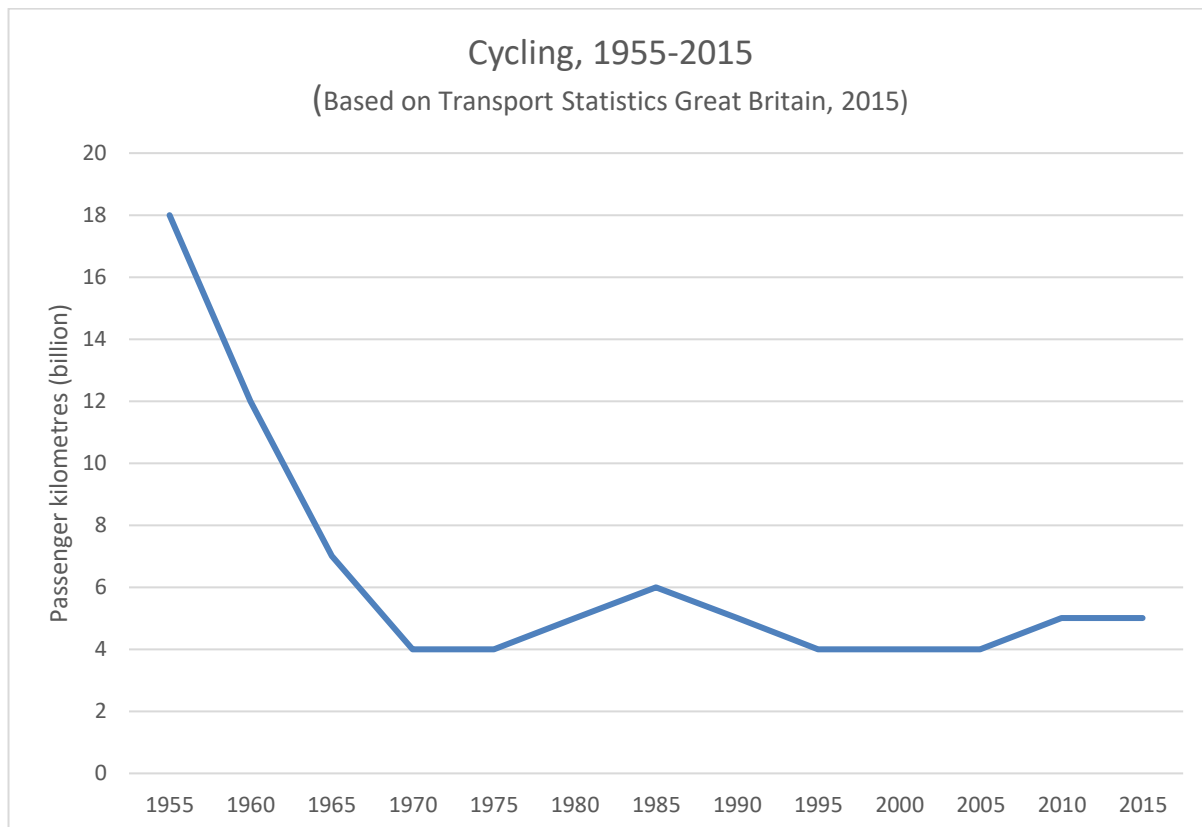

Figure 1. Cycling 1955-2015
Source:Transport Statistics Great Britain, 2015

Between the 1940s and the 1970s cycling was largely absent from the **policy** agenda; since the 1970s, however, cyclists have been as vocal as road users, channelling their demands through organisations such as the Cyclists' Touring Club (later Cycling UK). From the late 1970s **pressure groups** like Sustrans began to create cycleways, such as the Bristol and Bath Railway Path. Nevertheless, a European Commission report in 1989 ranked the UK as one of the **worst countries** for conditions for cyclists. It was only in the 1990s that official attitudes began to change with the publication in 1994 of *A Blueprint for Cycling Policy* by the Department for Transport, quickly followed in 1996 by the UK's first **National Cycling Strategy** and a National Cycling Network which came to encompass 12,000 miles of route (Golbuff and Aldred, 2012).

Rail

The major **period of expansion** in the UK's railways system occurred in the half-century between the 1840s and the 1890s. The majority of the railway network was established by the 1870s; the last mainline to London, the Great Central Railway from Sheffield via Nottingham, was opened in 1899. On a number of counts the **railways peaked around the First World War**. The length of national track levelled out at around 20,000 miles; 1920 appears to have been the highest year for number of rail journeys (2,186 million); and rail freight by tonnage peaked in 1924 (Mitchell, 1988).

Between the 1920s and the 1980s, the railways entered a **lengthy decline**. Both passenger and freight traffic experienced sharp contractions, especially in the depression years between the wars. **Freight** in particular never recovered the pre-war level of 1913 (Edwards, 2015). The tonnage of coal carried by rail nationally fell 16% between 1913 and 1937, while the companies operating in coal-producing regions saw mineral traffic more than halved (Aldcroft, 1975). As a result, the **profitability** of the private railway companies reduced in the inter-war period.
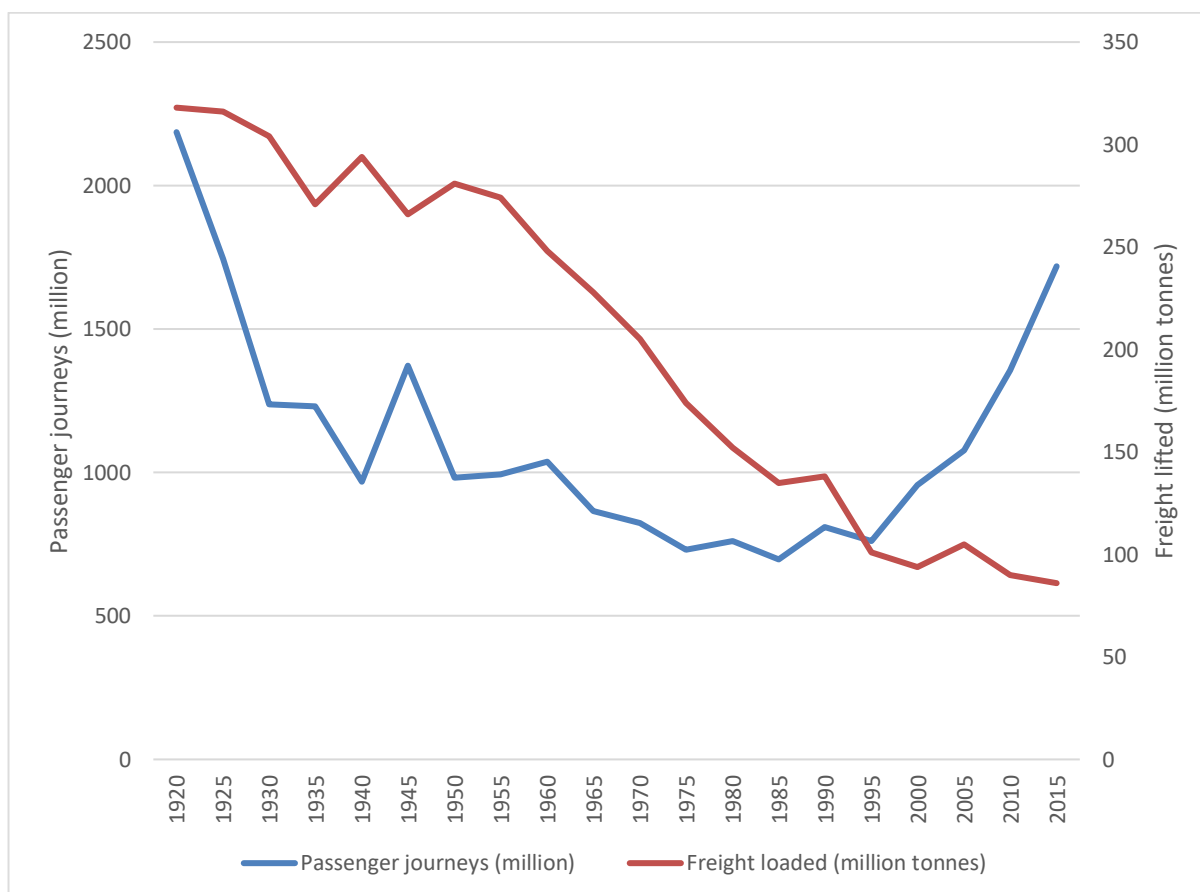
Figure 2. Railway passenger journeys and freight lifted, 1920-2015
Source: Based on Annual Abstract of Statistics

Central government, which took control of the railways in both world wars, responded by **reorganising the industry**. Following the **Railways Act** of 1921, the 120 existing railway companies were amalgamated into four, each with an effective monopoly of an area of the country. The reasons for amalgamation were threefold: the pre-war rail system was recognised as highly inefficient, Carlisle, for example, being served by seven different companies; state control during wartime showed how the system could be made more productive, carrying 50% more freight and large movements of troops; and the ending of state control after the war

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highlighted the parlous financial situation of many of the smaller companies (Bagwell, 1974; Edwards, 2015). In 1947 the government took the railways into **national ownership** under the control of the **British Transport Commission** (Barker and Savage, 1974). **Trams** and **light rail** saw a decline from the 1930s, and buses replaced trams in the course of the 1950s; Glasgow being the last large British city to abandon its trams in 1962.
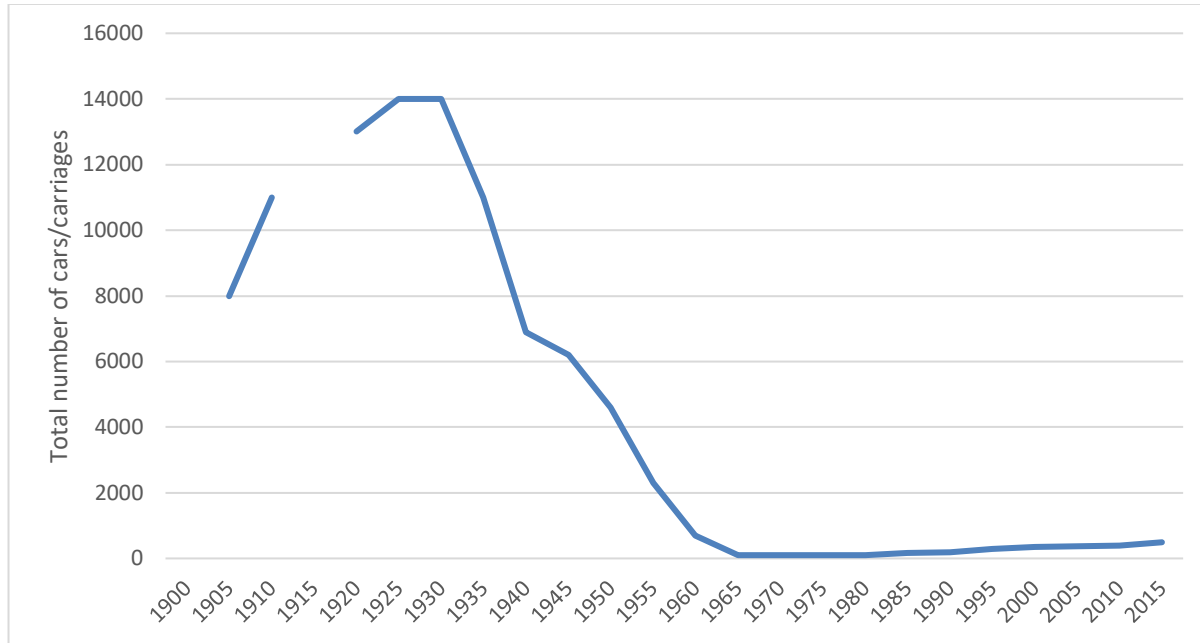

Figure 3. Tramcars & light rail carriages in England, 1905-2015
Source: Based on Annual Abstract of Statistics

State policy from the mid-1950s favoured making the railways more commercially competitive and modernisation programmes were undertaken by successive governments. **Diesel** and electric track replaced steam by the 1960s, but their immediate effect was limited. **Deficits** were recorded in every year from 1956, with a loss of £104 million in 1962 (Gourvish, 1986). It was in this context that the **Beeching report**, *The Reshaping of British Railways*, was published in 1963. Intended to restore commercial viability under a new Railways Board, the report recommended closing uneconomic lines and stations, developing inter-city routes and overhauling freight with a combined road-rail container service (Loft, 2006).

The **effects of Beeching** were drastic, for stopping and suburban services especially. Altogether, the report envisaged the **closure** of 9,000 of the total 18,000 route-miles. In the event some 7,000 route-miles had been cut by 1970, the number of stations was reduced by almost two-thirds and the rail workforce almost halved. The cuts were **unpopular** with the travelling public and Beeching became a symbol of the victory of narrow bureaucratic economism over the values of public service. From 1968 the government sought to restore the position of the railways but the spiral of decline continued in passengers and freight, with annual deficits escalating to £677 million by 1980 (Loft, 2006; Gourvish, 1986).

Privatisation of the railways was discussed by the government throughout the 1980s and finally effected by the **Railways Act of 1993**. This established a complex structure which separated track and railway companies. Privatisation was controversial at the time and remains so (Gourvish, 2008). Since privatisation, the number of rail passenger journeys has doubled, although there is undoubtedly a complex of factors behind the rise (DfT, 2017).

Shipping

Britain entered the twentieth century as the **world's leading maritime power**. During the course of the century it suffered decline, relative in amount of cargo carried and absolute in passenger traffic. Shipping included passenger liners, freight liners and tramp ships and was divided between ocean-going and coastal traffic. After 1900 steam ships increasingly replaced sail.

Like other transport modes, shipping enjoyed a brief boom after the First World War but the **economic slump** between the wars badly affected maritime trade, especially among tramp ships which were hit by the collapse of coal exports. Passenger liners also suffered; **emigrant traffic** from Europe, which had been so voluminous in the decades around 1900, all but disappeared by the 1930s. As a result the UK's share of world tonnage fell from 43% in 1914 to 26% in 1938 (Aldcroft, 1975).
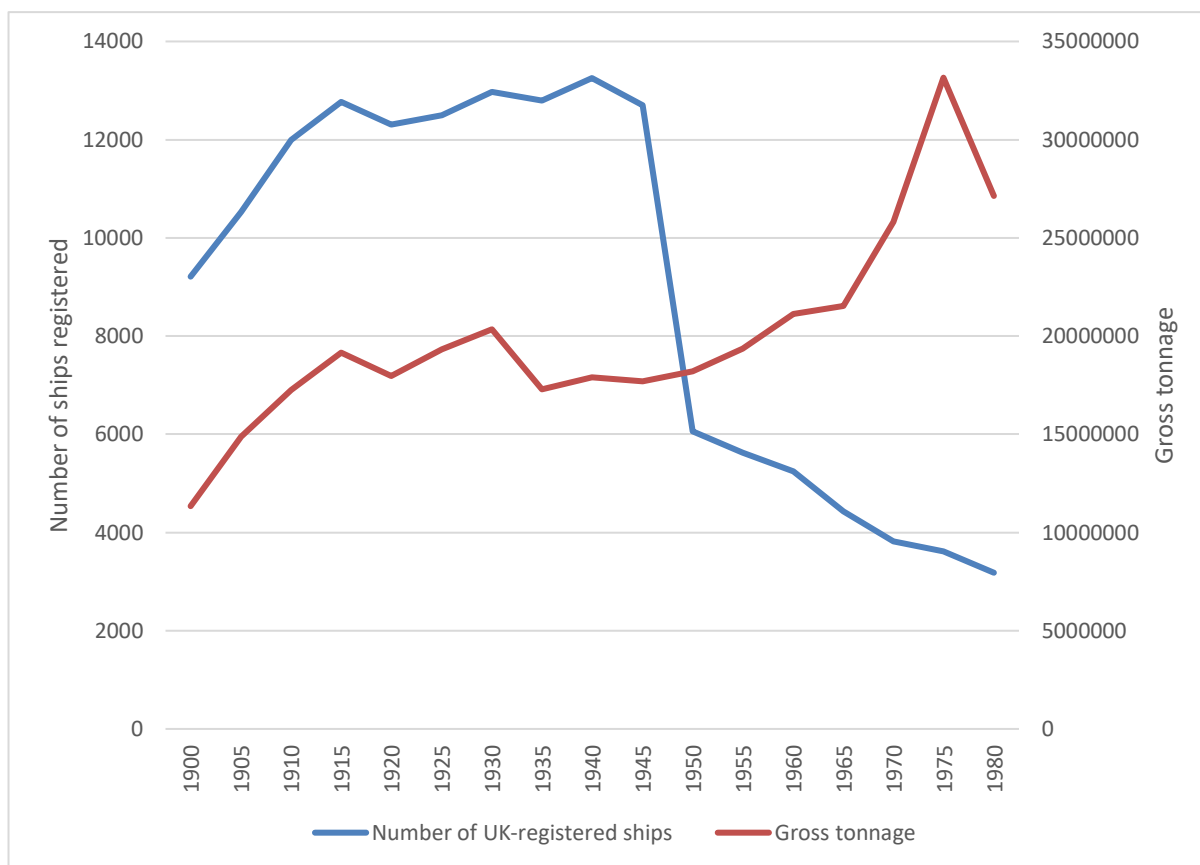
Figure 4. All ships UK-registered: total and gross tonnage, 1900-1980
Source: Based on Mitchell, 1988

The **falling share of the world shipping trade** in freight continued after 1945. By 1970 the UK's share of world tonnage had shrunk to a mere 11%. The **reasons** were multiple: competition from foreign fleets and the spread of flags of convenience; slowness to enter lucrative, new forms of trade, such as oil; antiquated shipping that remained tied to steam; and antiquated infrastructure in ports unable to adapt to new types of trade. In the same period, the number of **air passengers** overtook those going by sea for long-distance journeys by 1960 and for all international travel by 1965 (HMSO, 1970).

While parts of coastal shipping and docks were **nationalised** under the 1947 Transport Act, much of the shipping industry remained in private hands and fragmented. Six different

authorities were responsible for **Britain's ports** in the 1960s (Oram, 1971). The decline of shipping concerned government less than the railways, although the **Rochdale Committee of Inquiry** which reported in 1970 demonstrated official anxiety about the state of the industry. In particular, the committee recommended investment in the country's **docks** to accommodate tankers and containers. The state also intervened by setting up **Freightliner** in 1965 to integrate the growing sea container business with rail freight (Gourvish, 2015). But all this did not stem the decline of the British merchant fleet. Between 1975 and 1995 the number of British vessels greater than 500 tonnes shrank dramatically from 1,682 to 365 (Palmer, 2012).
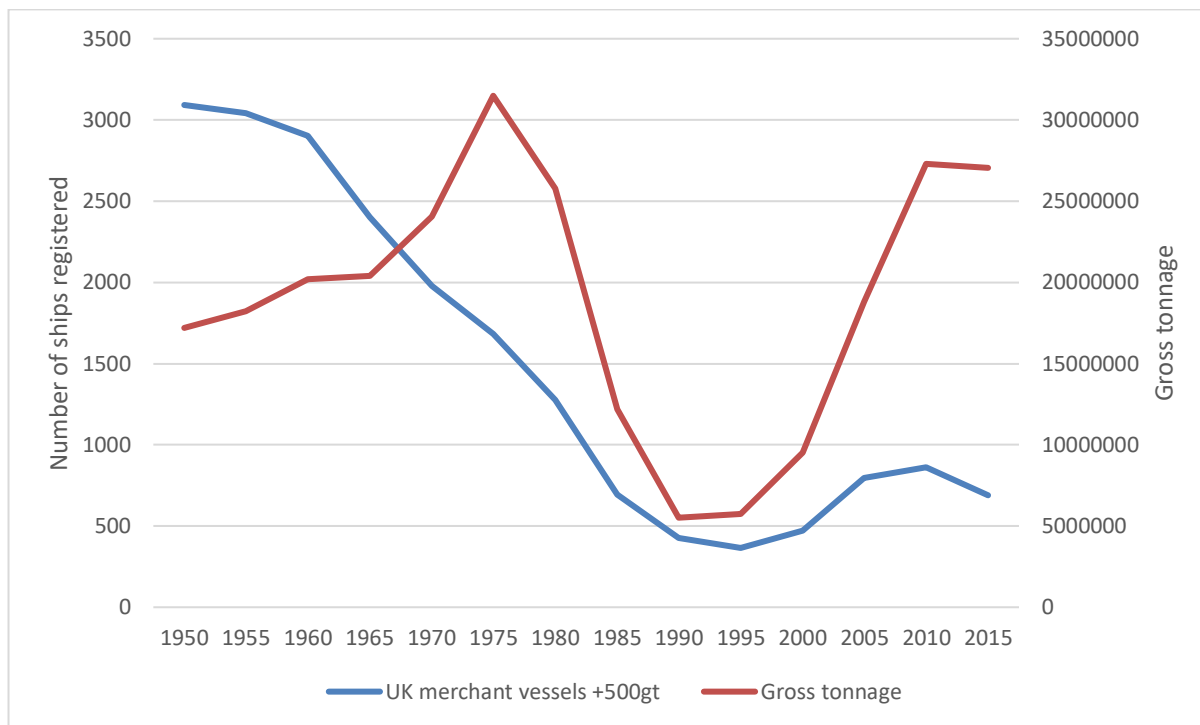
Figure 5. Merchant ships over 500 gross tonnes registered in the UK and Crown Dependencies: total and gross tonnage, 1950-2015
Source: Based on Transport Statistics Great Britain

With **containerisation** the historic pattern of Britain's ports changed: Felixstowe and Southampton emerged as the most important sites for the new containers, Immingham for bulk goods like coal, eclipsing the old ports of London and Liverpool (Levinson, 2016). This shift enabled a renewed growth in cargo after 1990. The orientation away from the **Atlantic trade to Europe** was confirmed by the expansion of Folkestone and Dover for cross-Channel traffic in passengers and road haulage from the later 1950s. Short haul **sea-ferries** from the Channel ports have been undercut by low-cost airlines and international high-speed rail. Since the opening of the Channel Tunnel in 1994 the main area of passenger growth has been in **cruise ships**, operating from a number of ports around the British Isles including Southampton, Holyhead and Orkney.
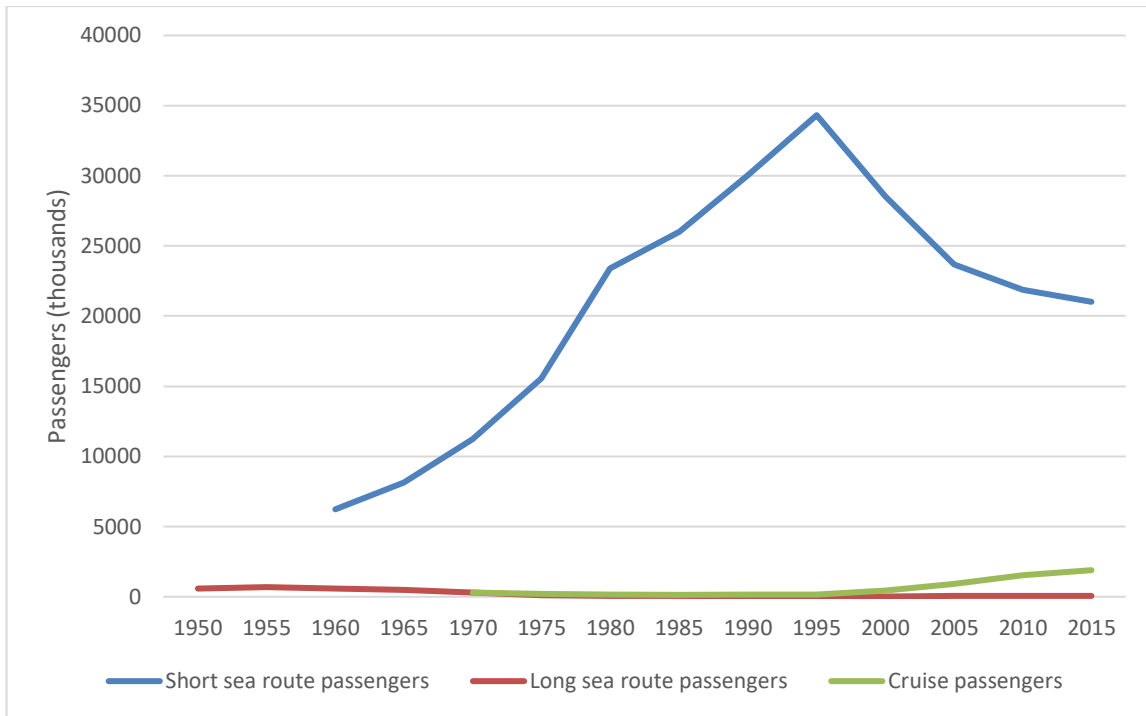
Figure 6. International sea passenger movements through UK ports, 1950-2015
Source: Based on Transport Statistics Great Britain

Automobility

Automobility was the single **most dynamic transport mode** during the twentieth century. It encompassed all forms of motorised transport, from lorries and buses to cars and motorbikes.
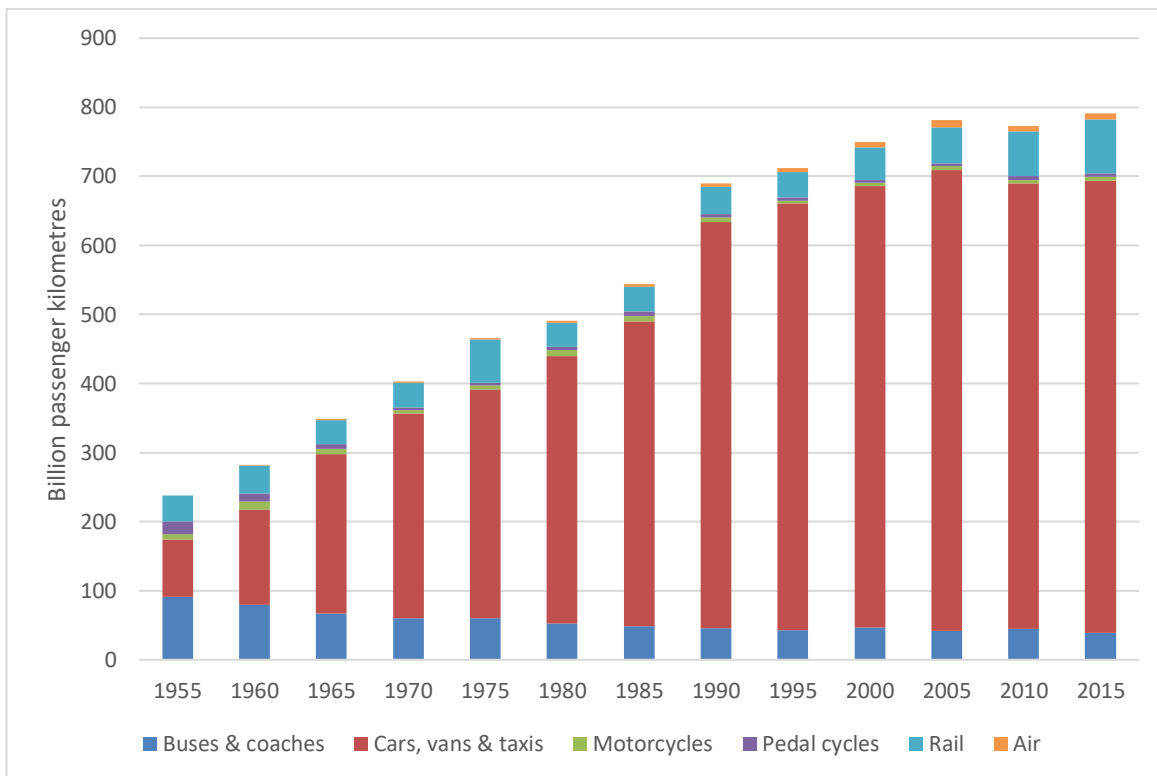
Figure 7. Passenger kilometres by mode of transport, 1955-2015
Source: Based on Transport Statistics Great Britain

Britain was a **motoring pioneer**. Cars were manufactured from 1896 and a number of leading marques like Austin, Rover and Sunbeam were launched before the First World War. A **national road network** was already in place and a classified system of A and B roads from 1922 with 'trunk' roads designated as a separate category was introduced from 1937. In 1920 the government established a **Road Fund**, using revenue from excise duty on vehicles and the sale of licences to pay for road improvements; and it introduced the **driving test** in 1935 (Plowden, 1971). With the major motoring organisations, the RAC and the AA, in existence by 1905, Britain between the wars possessed an established **motoring culture**, exemplified by the unique Shell Guides published from the 1930s (O'Connell, 1998).
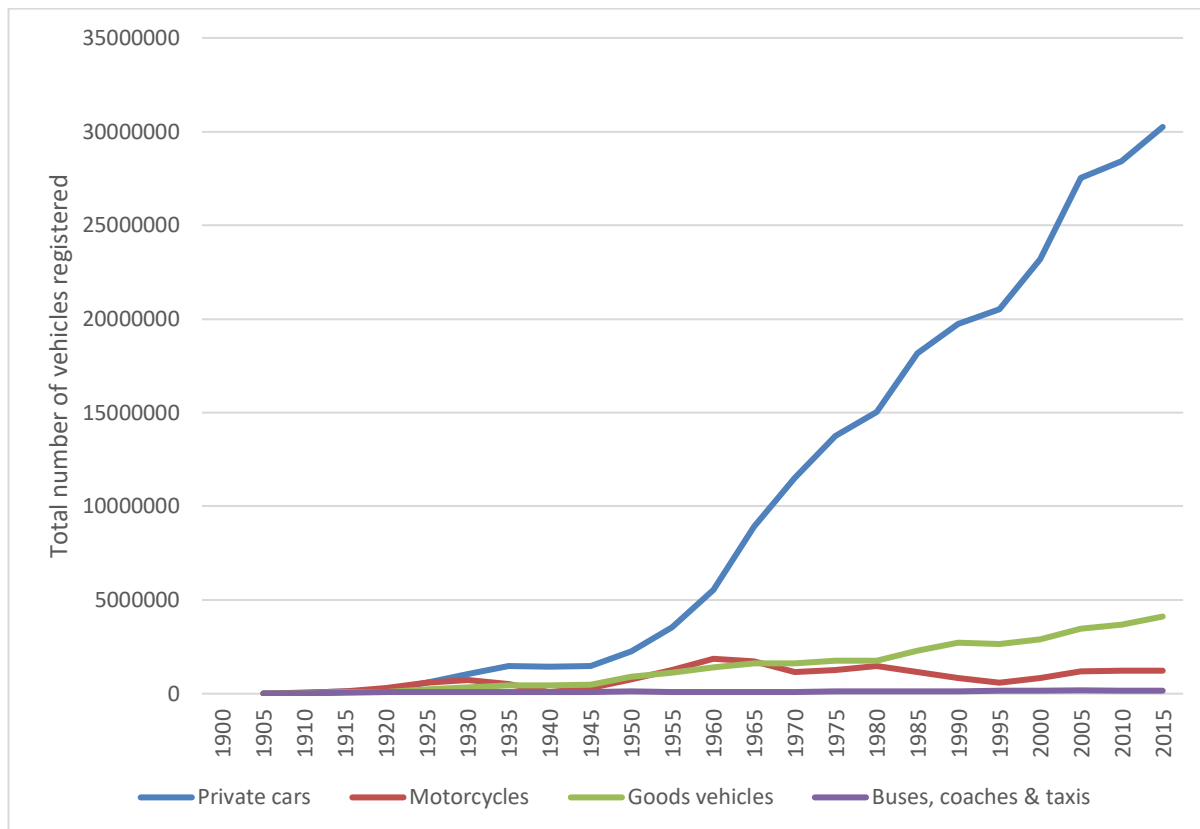
Figure 8. Motor vehicles registered in Great Britain by type, 1905-2015
Source: Based on Annual Abstract of Statistics

By the Second World War there were some two million motor vehicles on UK roads. But the most striking innovation in this period was not so much the growth of private car ownership as of **road haulage** and **motorised public transport**. Much of this expansion was at the expense of railways. While almost all categories of rail freight declined between the wars, numbers of **goods vehicles** increased five times to 488,000, the great majority owned by small independent operators. **Public bus transport** also increased exponentially, with 100 local authorities running municipal services by 1932, together with a host of private companies (Barker and Savage, 1974). London was a special case. From 1912 the **Underground Group** sought to coordinate the capital's public transport system but the increase in the number of private bus companies in the 1920s meant the situation was chaotic. In 1933 all transport services – rail, tram, underground and bus – were coordinated under the **London Passenger Transport Board**, the largest such undertaking in the world.

In recovery from near bankruptcy after the Second World War, the motor industry led the way in **exports**, enabling the British economy to stabilise after 1950 and domestic consumption to

grow. It was from this period that the phase of **mass motorisation** took off. The rapid expansion of car ownership - increasing five-fold between 1950 and 1970 – was a key marker of 'affluence', so that for the first time a car like the Mini or the Ford Cortina came within the reach of manual workers and their families (Gunn, 2013).

These decades also saw the British **motor industry** reach its zenith to become the most important industry in the country, producing more than a million cars for the first time in 1958 and employing over 500,000 workers by 1965 (Church, 1994). Other types of vehicle also participated in the 'motor revolution'. **Motorcycle** ownership reached a peak in the early 1960s. Buses replaced **trams** in the course of the 1950s; Glasgow being the last large British city to abandon its trams in 1962. The numbers of lorries also doubled in the 1950s and 1960s, including the new **'juggernauts'** of over eight tonnes.

Nevertheless, British society was comparatively under-prepared for the 'motor age'. It lacked the infrastructure of **motorways** of North American and European countries; the first extended length of the M1 was only opened in 1959 and Britain achieved the target of 1,000 miles of motorway only in 1972 (Merriman, 2008; Starkie, 1982). By 1960 there were serious concerns about the impact of traffic on the physical environment of British cities, leading the government to commission the **Buchanan report**, *Traffic in Towns* (1963). The report proposed restrictions on traffic in urban areas alongside wholesale reconstruction of cities to accommodate the rising tide of cars (Gunn, 2011). The 1960s saw a plethora of **experiments**, from the driverless car to the installation of computerised traffic control systems. At the same time, government policy towards transport remained based on the principle of 'predict and provide'.

From the later 1960s, too, government sought to **regulate driving behaviour** more strongly, conscious that death and injury on the roads was reaching a new peak with mass motorisation. **Drink driving** was made an offence in 1967 and car **seat belts were introduced** in 1968 (though it was only made compulsory to wear them in 1983). Increased regulation of driving coincided with mounting **anti-roads protest**, the campaign against the Westway (A40) in London and the ensuing cancellation of a proposed Motorway Box around central London in 1973 marking a high-profile beginning to what would prove to be a lengthy series of struggles lasting to the mid-1990s (Hall, 1980; Wall, 1999).

Reinforced by the oil crisis of 1973 and the doubling of petrol prices, the 1970s represented a hiatus in the otherwise steady march of motorisation. Nevertheless, **significant shifts** also occurred within it. The **motorbike** declined dramatically in popularity from the 1960s while the number of bus passenger journeys almost halved between 1950 and 1970. The winners were the private car and the lorry. **Road haulage** rose by 5.8% p.a. between 1952 and 1970, representing 80% of all freight tonnage carried by the later date. The **private car** meanwhile accounted for 77% of all passenger miles travelled in the UK in 1970 (Aldcroft, 1975).

By the later twentieth century the UK had become a **car-dominated society** (Dennis and Urry, 2009), the **number of cars** in the UK more than doubling from 11 to 23 million between 1970 and 2000. This rise reflected the increase of **women** as drivers. In the 1960s less than one-fifth of all women held a driving licence compared to half of all men; by the early 2000s almost two-thirds of women had acquired a licence.
Although still higher than for women, the proportion of men with a driving licence has remained relatively constant at four-fifths since the early 1990s.
At the same time, concerns about mass motorisation did not go away. Fears were associated initially with the effects of **air pollution**, especially from lead emitted by motor vehicles. The Department of the Environment published successive reports on the threat from air pollution, in

1969 and 1972, and the evidence of **lead pollution** mounted during the 1970s, partly stimulated by the opening of new urban motorway systems, such as the Gravelly Hill Interchange (informally known as Spaghetti Junction) in Birmingham (Gunn, 2017). After 1985 emissions from motor transport became associated with **climate change**. Studies have estimated that transport accounted for roughly one-quarter of all UK carbon emissions, the main source of greenhouse gases which cause global warming. Of this, cars, HGVs and vans were estimated to be responsible for 93% of CO_2 transport emissions (Committee on Climate Change, 2013).

Aviation

Aside from automobility, civil aviation is the transport mode which has seen the most dramatic changes in the course of the twentieth century. The story of early flight is well known, but the development of British aviation began with the setting up of the **Advisory Committee on Aeronautics** in 1909 to instruct the government. **War** was to remain a significant catalyst for the development of aviation for much of the century. Firms involved in planes for war production, such as Armstrong–Whitworth and Bristol, subsequently moved into peacetime aeronautics (Edgerton, 1991).

Empire was also a major driver in the development of civil aviation between the wars: the first major airline was **Imperial Airways**, established in 1924 with government subsidies, and serving destinations in the empire such as Cape Town and Calcutta as well as European routes (Pirie, 2012). Both civil aviation and the requirements of the RAF drove **aircraft production**; by 1940 Britain was the largest producer in the world (Smith, 1984). But the infrastructure of civil aviation was, in other respects, relatively undeveloped. Imperial Airways operated from Croydon Aerodrome; in other cities, such as Manchester, **airports** were constructed under municipal ownership in the 1930s. Costs of air travel remained high between the wars and the numbers of people flying annually were counted in the thousands, not millions (Lyth, 2000).

The advent of **passenger jets** from the 1950s transformed air travel. Between 1950 and 1960 the number of air passengers carried in the UK increased from just over one million to six million. At the same period the major London **airports** were developed, Heathrow (1946) and Gatwick (1958) while Manchester and Glasgow (Prestwick) were expanded for increased passenger traffic in 1958 and 1964 respectively.
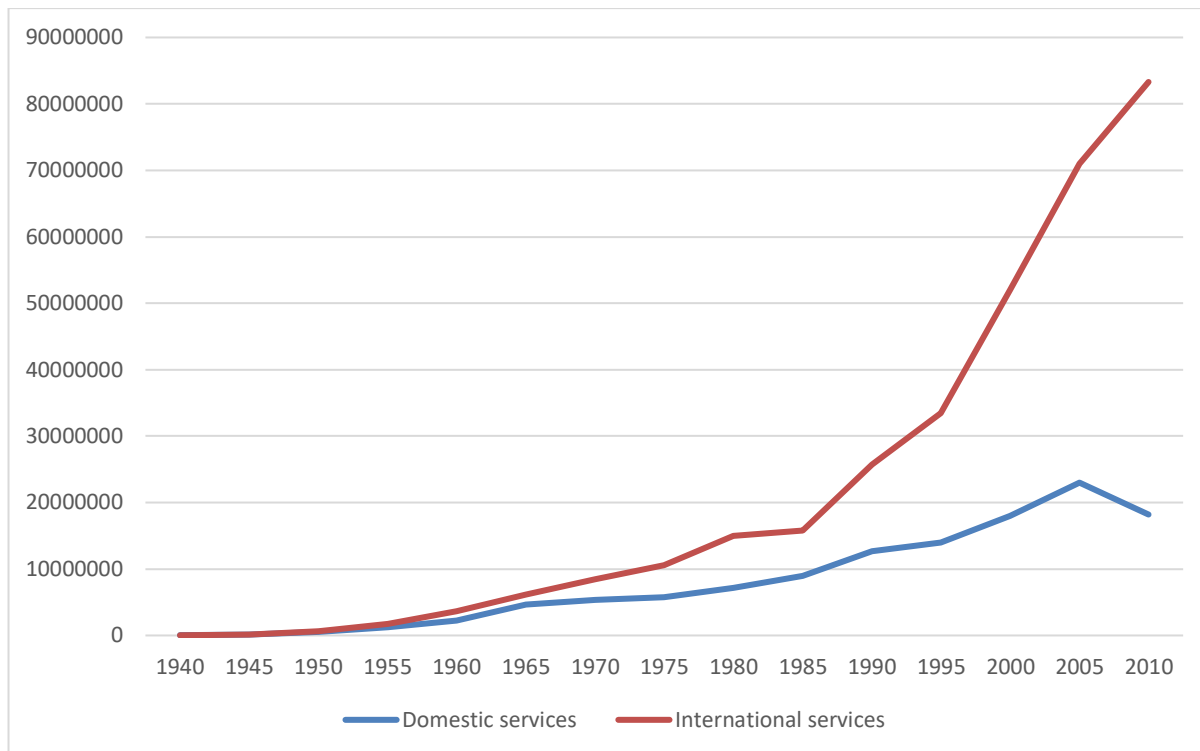
Figure 9. Passengers on UK airlines, 1940-2010
Source: Based on Mitchell, 1988; Annual Abstract of Statistics

While aircraft manufacture remained in private hands, the leading British airlines and airports did not. Imperial Airways had been merged and **nationalised** in 1939 to form the British Overseas Airways Corporation (**BOAC**), which in turn was divided with the creation of British European Airways (**BEA**) in 1946. BOAC and BEA were amalgamated to form **British Airways** in 1974. The major international airports – Heathrow, Gatwick, Stansted and Prestwick – were taken under the control of the **British Airports Authority** in 1966. The process of nationalisation was reversed in the 1980s. In the face of mounting debts British Airways was privatised in 1986 and the British Airports Authority followed suit. The **deregulation** of airlines in the UK and European Union from the early 1990s also encouraged the spread of **low-cost airlines**, including Easyjet and Ryanair, which helped feed the ever-rising demand for international air travel.

Like automobility, aviation caused **controversy** in the later twentieth century. The siting of the third London airport resulted in a fierce and protracted debate among planners, politicians and public, starting with the **Roskill Commission** in 1968. Roskill selected **Cublington** in Buckinghamshire but serious consideration was also given in 1973 to the development of **Maplin** in the Thames estuary. Faced with considerable local protest at both sites, the government decided to expand the existing airport at **Stansted** (Beckett, 2009). Like cars, aircraft have also been seen as a major source of carbon emissions, and thus a contributor to **climate change**. The current debate over the building of the new runway at Heathrow is a product of a long debate over amenity and environment (Lyth, 2016).
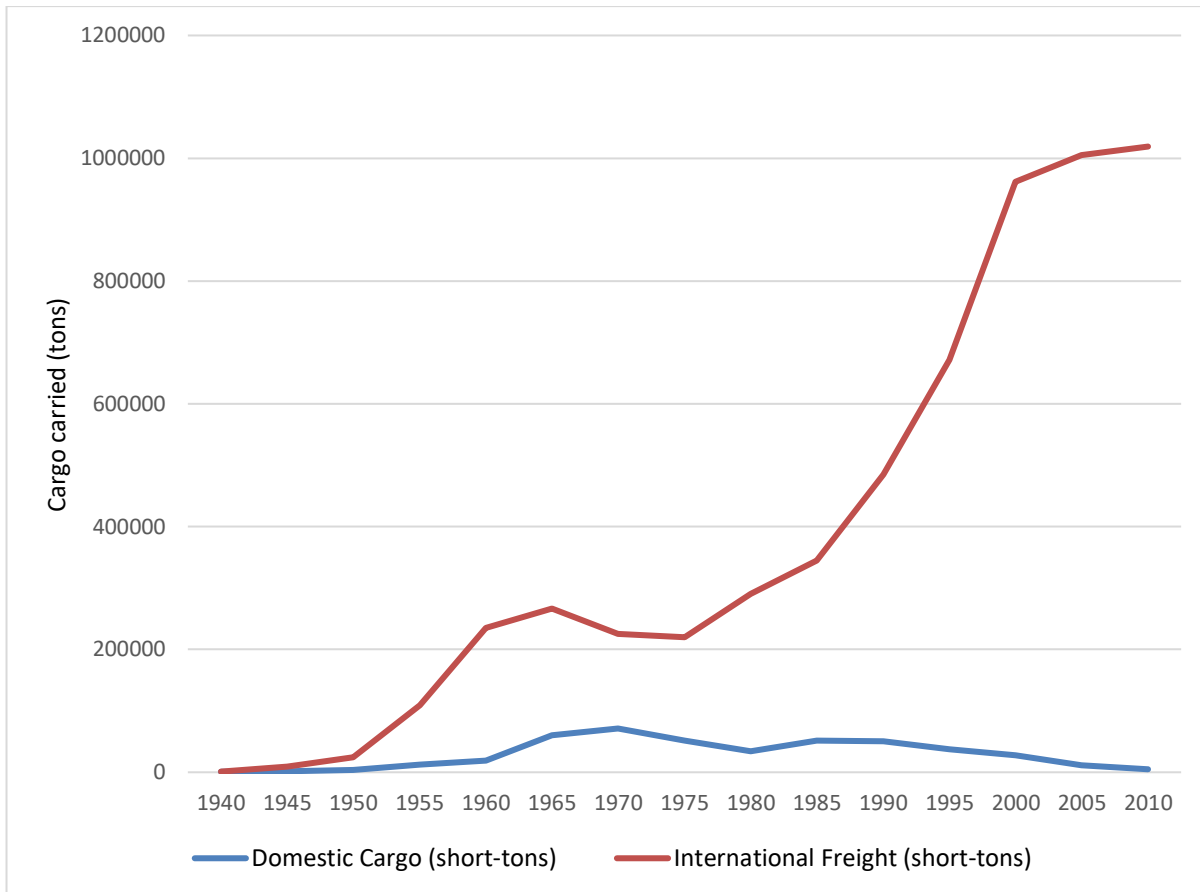
Figure 10. Cargo carried by UK airlines, 1940-2010
Source: Based on Mitchell, 1988; Annual Abstract of Statistics

All this reflects the fact that in the last third of the twentieth century, civil aviation saw an **unprecedented expansion**. Between 1970 and 2000 the number of UK flights more than doubled; the volume of international passengers carried from UK airports increased from 5 to 14 million; and the distance flown in passenger miles rose seven-fold. International **air cargo** increased three times in volume over the same period; but the continued dominance of road haulage meant that cargo was less important for aviation than the growth of passenger traffic. But whether judged in terms of aerospace manufacturing, passenger traffic or airport hubs, the UK remains a **major international player in aviation** as it has done since the 1930s.

3. The drivers of change

We do not have a comprehensive history of change and its causes in the domain of transport. Historians agree that the development of transport modes has been identified with new sources of **power and energy** – coal for the steam age, for example, oil for the era of the internal combustion engine. However, factors driving change tend to be seen as specific to a particular transport mode, such as shipping or automobility, rather than transferable across modes. Recent historians of transport and mobility also avoid the assumption that each new form of transport necessarily improves mobility. A recent study goes so far as to argue that had the use of the private car been restricted in twentieth-century Britain, patterns of mobility would not have differed greatly (Pooley, 2009).

This section identifies those drivers of change in modern transport history that historians have identified as **most important** across a range of transport modes. The drivers are grouped into **four broad categories**. The developments overlapped in many cases and did not work independently. We give some indication of this last point in the historical examples provided.

Technological innovation

Transport has been a fertile area for technological innovation and Britain has a long tradition of **heroes** from Thomas Telford, the eighteenth-century builder of roads and canals, to Alec Issigonis, the designer of the Mini. Britain also had a **pioneering role** in the development of canal and railway systems, including the London Underground from 1863. During the 1950s and 1960s British car designers and manufacturers led the world in producing a series of iconic cars: the Mini Cooper, Aston Martin DB5 and the Jaguar E-type. In the mid-twentieth century, Britain and France were the instigators of the first supersonic passenger aircraft, **Concorde**, a technological first. Meanwhile British transport planners, such as Colin Buchanan, author of *Traffic in Towns*, and Peter Hall, inventor of the 'Freeport', a precursor of the enterprise zone, were influential figures internationally.

But if technological innovation has been the hallmark of UK transport, one of the features of the twentieth-century transport system has also been its **stability**. '[The] transport systems we use today have been remarkably persistent over time', a recent study affirms. 'All have been available for more than a century and despite massive technological refinements and improvements they have remained fundamentally the same … [In] essence we still have much the same transport options as we did a century ago' (Divall, Hine and Pooley, 2016, 1-2).

Against the backdrop of an ageing and costly infrastructure, innovation was **not always a priority**. In shipping, British owners were **slow to modernize** the fleet and invest in the tankers and bulk carriers that dominated world trade from the 1930s. British Rail was late in electrifying main lines. On the roads, government was tardy by international standards in constructing a national motorway network (Starkie, 1982).

Why innovation in some sectors, like aviation, and **slowness to modernise** in others, like shipping? In reality, innovation occurred in pockets rather than sectors as a whole. So in the mid-twentieth century, British motor manufacturing was highly successful in creating **luxury models** and marques, like Jaguar, Bentley and Rolls-Royce, but less successful in the mass

car market where companies like British Leyland became a by-word for unreliable, poorly built models.

Moreover, before the twentieth century, the limited tradition of governmental investment in **transport infrastructure** (only in Britain were the railways developed entirely by private capital) meant that the state rarely acted as an innovator, at least in peacetime. The British state could be influential in **creating the conditions** for technological innovation, as with aerospace, but it seldom took the lead. Initiatives such as the Victoria and Jubilee underground lines (1968/1979) and Docklands Light Railway (1987) were restricted to London. Recent state-driven infrastructure projects like the **Channel Tunnel, HS2 and CrossRail** arguably represent a **break with the past** in this respect; their ambition is greater in both geographical and politico-economic terms than was the case with earlier initiatives.

There is plenty of evidence of failings at sectoral and governmental levels, but it is important to balance these with evidence of innovation in both private and public sectors. Government invested consistently over time in transport-related technology, for example through the **Road Research Laboratory**, which, alongside private research agencies such as **MIRA**, helped to pioneer new approaches to automobility and road safety from the 1950s (Charlesworth, 1987). In aviation, British firms such as **Hawker Siddeley** and **Rolls-Royce** were world leaders and major employers with 123,000 and 88,000 workers respectively in 1966 (Hayward, 1989; Edgerton, 1991). Overall, the incidences of failure in the motor industry, British Rail and shipping should be offset by the strengths and dynamism evident elsewhere in Britain's recent transport history.

Government policy

The governance of the UK transport system is **complex and differentiated**. This complexity is at least partly historical: government has played a role in transport that has varied across time, mode and region. While many of the significant historical changes in transport were initiated by **private enterprise**, they normally came to be **regulated by the state**. In the twentieth century, especially, government and state took a more directive role in parts of the transport sector through investment and ownership. Following **devolution** in 1997/8, strategic planning of transport, including roads, came under the authority of the new administrations in Wales and Scotland. Similarly, the government for Northern Ireland has been responsible for transport in the province, with the exception of shipping and civil aviation.

During both **world wars** the British state commandeered the transport system for the war effort and intervened in it directly thereafter. The **1921 Railways Act**, for example, set the framework for continued private operation of the railways by enforced amalgamation and standardisation (Aldcroft, 1975). Similarly, with motoring the government established the **Road Fund** as a source of revenue, set speed limits and subjected both buses and haulage to a system of licensing (Plowden, 1971).

The most dramatic interventions, however, were those of **nationalisation** and **privatisation**. With the **1947 Transport Act**, large swathes (though not all) of the railways, road haulage, canals and ports, were brought under the direction of the **British Transport Commission**, which with 900,000 workers became the largest employer of labour in the country (Barker and Savage, 1974, 218).

However, successive governments steadily returned parts of transport to the **private sector** over the following 40 years – road haulage as early as 1953 – with the largest tranche of privatisation coming in the 1980s and early 1990s with British Aerospace, British Airways and British Rail (Parker, 2009 and 2012). Both nationalisation and privatisation were **controversial** at the time and their effects have been debated (Gourvish, 2008). **Nationalisation** in particular suffered from the fact that industries like railways were ailing rather than expanding and in need of large-scale infrastructural investment.

Since its inauguration in 1919 the Ministry of Transport tended to be **reactive** rather than agenda-setting. One of the most active periods saw the expansion of the motorways programme, the Buchanan report on traffic and the Beeching report on railways – all milestones in transport policy but also responses to pre-existing problems. The **'predict and provide'** principle that guided transport planning between the 1950s and the 1990s tended to treat modes separately and militated against an integrated policy for UK transport as a whole. Attempts to integrate transport modes such as the creation of bus-rail **'interchanges'** in the 1960s struggled because they were based on modes experiencing passenger decline. Other initiatives of the 1960s, like the development of the **electric car**, were assumed to be a matter for private manufacturing rather than public policy.

In the late twentieth century, the growing environmental impact encouraged governments to think more holistically about transport policy. Governments had to balance investments to meet growing capacity with concerns for externalities (such as pollution). From the 1970s concerns about the externalities of motorway and roads meant that both national and local government sought to **shift the balance** from private to public transport. At the same time, road construction **continued incrementally**, the UK motorway network as a whole expanding from 660 miles in 1970 to 2,138 miles by 1998 (DfT, 2009). As late as 1989 the government could publish a white paper, *Roads for Prosperity*, which was notoriously reported to be 'the biggest road-building programme since the Romans' (Moran, 2009).

War

The effects of the two world wars on British society have long been debated by historians. For transport, however, their impact is not in dispute. The main effects were **organisational** and **technological**, and extended well beyond the wars themselves.

In both world wars, government took control of strategic areas of transport. In the **First World War** this extended to **railways** and **ocean shipping**, though it was not until 1916 that ships were universally requisitioned for the war effort. In both cases the industry remained in **private ownership** but the consequences of war were different for each. More than a third of the merchant fleet was lost, hampering the competitiveness of **British shipping** relative to rivals, like the USA, whose fleets had suffered limited damage (Aldcroft, 1975). Shipping continued to be much less subject to government intervention than **railways**, where the financial losses incurred during wartime meant that nationalisation was considered (and rejected) in 1920. Instead, government and the railway owners agreed a scheme of amalgamation and regulation embodied in the **1921 Railways Act.**

The First World War was less radical for transport than the interventions undertaken during the **Second World War**. While the **Ministry of Transport** had been formed in 1919 as a consequence of the First World War, the Second World War saw the creation of a much more powerful **Ministry of War Transport** in 1941 which took control of the whole of the UK transport

system, including road haulage and coastal shipping, in a way 'hitherto unparalleled' (Bagwell, 1974). This paved the way for the **1947 Transport Act** which undertook nationalisation on the lines discussed above.

The wars also provided a major boost to **transport technologies**. The clearest example is in **aviation** where manufacturers involved in wartime production, like Handley Page and Vickers, switched to making aircraft for commercial flying in peacetime. The **British Aircraft Corporation**, formed out of mergers of a number of large, established companies in 1960, continued to make both civil and military aircraft, forming an important part of manufactured exports during the **Cold War** and after (Gardner, 1981). Technology transfer between the motor and aircraft industries was likewise extensive, not least in the 'shadow factories' established in the 1930s to facilitate the switch to wartime production. Examples such as these led the historian David Edgerton to argue that twentieth-century Britain was a **'warfare state'**, characterised by a 'military-industrial-scientific' complex of which transport technologies were substantial beneficiaries (Edgerton, 2006).

Consumer demand

Consumer demand has arguably been the **most powerful** driver of changes in transport during the twentieth century. Government policy, for example, proved **relatively powerless** to prevent modal shifts, including the generic shift from public to private transport after 1950. It was not just the convenience of the car that assured its predominance. Planners underestimated the **emotional attachment** of drivers to the car as a privatised space and an extension of the home, which represents an additional obstacle to persuading people back to more sustainable forms of public transport (Sheller, 2004).

Demand drove the rapid expansion of **cycling** in the first half of the twentieth century and the dramatic increase in international **air travel** in the last third, most of the latter being fuelled by the growth in **holidays abroad** (ONS, 2011). Pressure of demand has been associated notably with the rise of **automobility** and the private car. In a transnational history of car culture in Europe and North America, Gijs Mom depicted the exponential rise of automobilism as the result of a middle-class **desire for status** that gained wider popular appeal (Mom, 2015).

Mom's thesis does not paint the whole picture. It recognises that demand for the car comes from more than convenience, having strong affinities with an idea of **freedom** for example. Surveys of car buyers in the 1960s showed **leisure** in the form of a drive in the country and holidays as a more potent incentive for car purchase than practical activities like shopping and commuting (Gunn, 2013). For women, especially, the ability to own and drive a car has been strongly connected with **independence** (Pooley, 2009). Historically, women came later to driving and car ownership than men; they were more reliant on public transport.

Demand has come from other directions, too, including industrial and commercial **freight**, although later twentieth century expansion has generally been accommodated by private enterprise **logistics**. More political, transport and mobility have long been the object of the demands of **pressure groups**. In the 1950s and 1960s the **'road lobby'**, composed of representatives of the RAC, AA, motor industry and road haulage associations, was known as the most influential pressure group in parliament (Plowden, 1971). Since 1970 the numbers of pressure groups have mushroomed, from **roads protest** (e.g. Homes before Roads) to permanent lobby groups like Sustrans and Living Streets, promoting cycling and walking. In the short-term such pressure groups have been effective in delaying or occasionally cancelling

projects (e.g. London Ringways in 1973) but they have also helped to create a consensus around **sustainable transport** so that the roads and airport lobbies are commensurately less vocal.

Consumer demand has been **volatile** and is in any case hard to assess or predict. Defenders of **rail privatisation** claim that de-nationalisation has been responsible for the rapid rise in passenger numbers since the mid-1990s, but it may equally have to do with travellers' frustration with roads congestion and high property prices pushing people to live further away from their workplace, especially in London and the south-east. The rise of rail has also been fuelled by the growth of inter-city travel by students and young professionals living in city-centre locations without a car. The second half of the twentieth century witnessed an **unprecedented increased general mobility** in the UK, most striking in automobility and air travel, but evident across almost all transport modes. Rising demand for travel has been part of this story but it has to be seen in the wider context of **changing patterns of living** and the normalisation of long-distance movement for work, education and social life.

4. The consequences of change

The consequences of changes in patterns of transport and mobility are difficult to assess. This is partly because they are **hard to isolate** from other historical trends, such as deindustrialisation, but partly also because they are **still playing out**. We have chosen here to group consequences under three headings: economic growth and decline; social inequalities; and unintended consequences, which include environmental impact.

Economic growth and decline

Trends in transport have consistently interacted with those in the **wider economy** of which it is a part. The loss of rail freight between the wars, for instance, reflected the steep decline of Britain's staple industries, especially coal, to which freight was closely tied. This was partly why transport policy tended to be **reactive** rather than proactive.

Transport, however, has been a **major industry in its own right**. Direct comparison is difficult across the twentieth century because of changes in the definition of occupational categories between censuses. But the figures suggest that numbers employed in 'transport and communications' remained relatively stable between 1.5 and 1.1 million, tending to decline in the decades following 1945 and then rise again from the later twentieth century (Mitchell, 1988; DfT, 2013). **Logistics**, incorporating freight transport and warehousing, has been a dynamic part of this sector, particularly in the early 2000s when it employed up to 600,000 people (DfT, 2010).

Industries linked to transport have also been significant employers of labour. Between 1955 and 1971 approximately one million workers were employed in **vehicle manufacture**, gradually declining in the course of the 1970s to three-quarters of a million. The British **aircraft industry** likewise expanded from 35,000 workers in 1935 to 250,000 in 1955 (Mitchell, 1988; Edgerton, 1991). Exact figures for employment in these industries are difficult to gauge, given the plethora of small firms which serviced them. But *The Times'* industrial correspondent estimated in 1958 that between one-quarter and one-fifth of Birmingham's active population was involved in the motor industry; by this date motor manufacturing was regarded by politicians and policy-makers as a **barometer of the national economy** (Gunn, 2018).

Transport has also had consequences for **regional economic growth and decline**. The orientation of trade and business towards the **European Union** after Britain joined in 1973 reinforced the economy of London and the south-east. In **shipping**, ports facing out to the Continent – Felixstowe, Harwich, Folkestone, Dover, Southampton – thrived, while ports oriented to the **Atlantic trade**, like Bristol, Liverpool and Glasgow, suffered. From the 1930s, the gradual decline of the docks and shipbuilding in Liverpool and Glasgow went hand in hand with larger economic and demographic decline, culminating in an urban 'crisis' in the 1970s and 1980s (Andrews, 2018).

Transport hubs, like motorway junctions, have also become generators of **economic activity**, the sites for out of town shopping parks, leisure centres and warehousing. From its inception as London's main airport in 1946, **Heathrow** developed the features of a medium-sized town; today it employs 76,000 people; an equivalent number to Guildford (Wicks, 2015). Transport, in effect could **make or break** cities and regions economically.
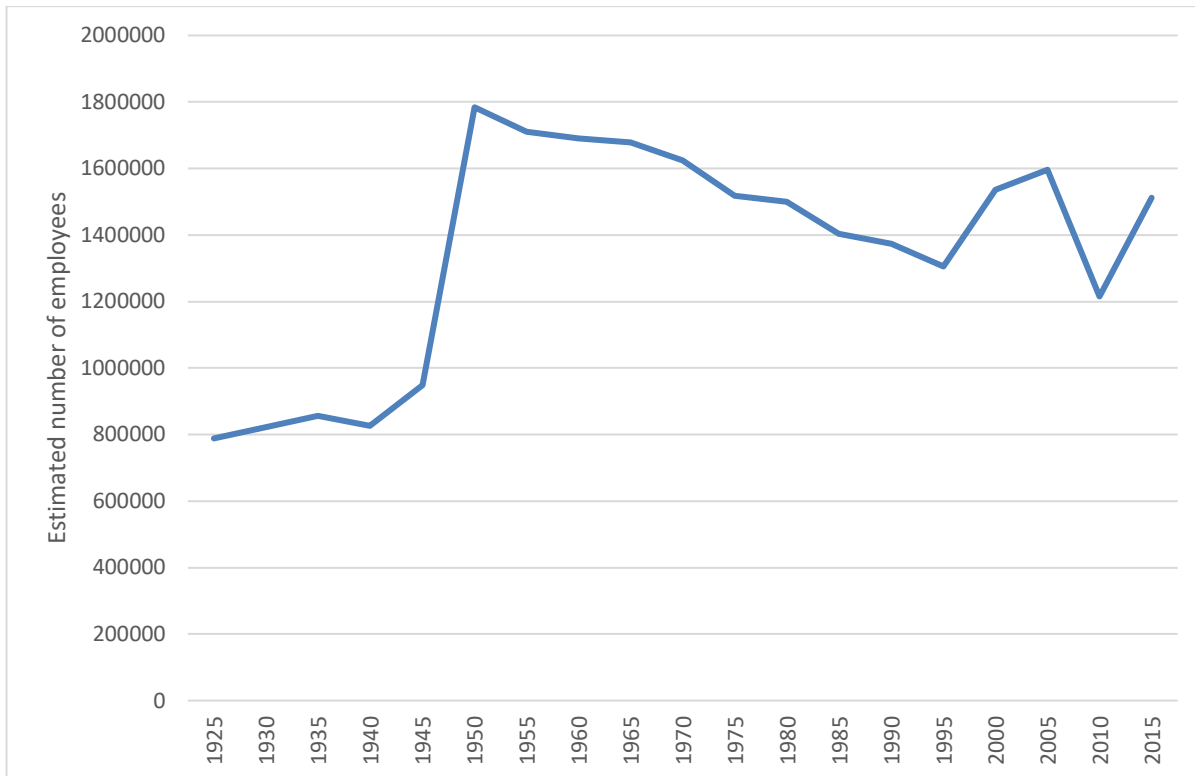
Figure 11. Estimated employment in transport, storage and communication, 1925-2015
Source: Based on Annual Abstract of Statistics

Freedom and inequality

Movement and mobility are very closely related to **freedom** in the modern political imaginary. In *Republic of Drivers*, Cotton Seiler argued that motoring in post-war America came to be a badge of **citizenship**, part of what it meant to be American (Seiler, 2008). This level of identification was rare in Britain, although organisations like the RAC invoked the 'freedom to drive' in campaigns to limit government regulation and politicians spoke of the emergence of a '**car-owning democracy'** from the late 1950s (Plowden, 1971). International travel is also commonly seen as part of an expansion of personal freedom from the 1960s onwards.

The reverse side of the transport revolution of the twentieth century, however, has been a sharpening of **social inequalities**. The figure of the 'car-driver' in the mid-twentieth century brought into relief the reality of the 'no-car folk'. Every survey since the 1960s has shown an intimate relationship between **household income** and **ownership** of one or more cars; the same is true of extent of travel more generally. As late as 1970 **households without a car** formed a majority in many urban areas: 70% of households in Newcastle, 58% in motor-mad Birmingham. In **rural areas** car ownership tended to be higher than in urban, but given the steady cuts to rail and bus services the ability to drive became an essential precondition of country living in the later twentieth century.

Throughout the period **women** have lagged behind men in automobility. In the 1960s only one-fifth of women held a driving licence compared to half of adult men. Men still outnumber women as drivers: four out of five men drive, whereas the figure is three out of five for women (DfT, 2013). It is women, however, who took to the wheel most readily from the 1970s onwards, contributing to the upward curve in numbers of vehicles on the road. Increased mobility through

private car ownership has been seen as a significant factor in **women's emancipation** in the last third of the twentieth century (Pooley, 2009).

Nevertheless, it is the **poorest sections** of the community who have generally been left out of the 'mobility revolution' of the later twentieth century. A significant portion of these groups have suffered what is now referred to as '**transport poverty'**, the state of having reduced access to employment and services due to inadequate or costly transport facilities (Pooley, 2016). **Spatial inequalities** between London and the regions, north and south, urban and rural, in transport and mobility appear to have become more marked in recent decades, especially where they overlap with other markers of social inequality.

Lack of mobility has for a long time been a major social problem and one of the sources of 'multiple deprivation' identified by social policy studies. The definition of the **'inner city'** from the 1970s was related to the lack of social and geographical mobility enabling inhabitants to 'get up and out' (Saumarez Smith, 2017). For much of the twentieth century citizen groups have been involved in forms of **low-level protest**: about the dangers of traffic to children, aircraft noise, cuts to bus and railways services, forms of everyday activism that go largely unreported and in consequence are invisible to decision-makers (Cowman, 2017).

Unintended consequences

Changes in transport have had consequences often unforeseen by policy-makers. Congestion and traffic 'accidents' are two such examples. From the 1930s planners designed new road systems to alleviate **traffic congestion** but by the 1960s (or even earlier) it was clear that there was no 'engineering solution' to the problem; traffic merely expanded to fill the new road space, creating 'induced traffic' (SACTRA, 1994). **Traffic 'accidents'** are likewise no such thing; rather, they are statistical regularities, the numbers of which can be calculated precisely year on year (Dennis and Urry, 2009). As policy-makers have come to recognise, transport can be **paradoxical** and **counter-intuitive** in its effects.

Transport has had unanticipated consequences for the **surrounding environment**. In the nineteenth century the construction of new railway routes in built-up cities like London meant that thousands of people were displaced. One result was to multiply **housing problems**, exacerbating crowding in nearby 'slums'; the phrase 'the wrong side of the tracks' took on a literal meaning (Kellett, 1969). The construction of new road systems from the 1960s also provoked a new phenomenon, **'blight'**, associated with falling house prices close to the new roads and in some cases the unwitting creation of **'twilight' areas**, neighbourhoods cut off from the larger city, with dwindling facilities, a shrinking population and a deteriorating urban fabric (Ravetz, 1986).

Over a long period, pollution from steam trains and motor vehicles has affected the air citizens breathe. The **Great London Smog** of 1952 was caused primarily by smoke from coal fires, but vehicle emissions from cars and buses also contributed (Corton, 2015). From the 1970s there were concerns about **lead emissions** from petrol, and their impact on the brain activity of children in inner-city areas (Gunn, 2018). There have been continuous concerns since then about the effects of **pollution** from transport on lung disease and other physical and mental disorders; documented and debated in a series of official reports (Sheail, 2002).

Modern transport systems produce effects at a **global** environmental level. The most obvious is the consequence of emissions from aircraft and motor vehicles, multiplied by the rapid

expansion in their numbers and use. The threat of **climate change** as a result of greenhouse gases, to which transport has been a major contributor, is potentially the most significant unintended consequence of all.

5. Conclusion: overarching trends and issues

What conclusions can be drawn from this historical survey for the present and future of mobilities in the UK? Here are five key points to consider.

The interactivity of systems

The history of the last 100 years shows that transport modes are deeply **inter-related** with one another. In some cases this relationship has been to the **detriment** of one or more modes. While the advent of the railway in the 1830s and 1840s undermined (though it did not wholly destroy) the primacy of canals in the carriage of land-based freight, the private car and road haulage from the 1950s successively undid the tram, rail and bus systems, competing with them and putting in question their commercial viability. Cycling and walking were similarly side-lined by the spread of the private car.

In other cases, the relationship has been **complementary**. Rail freight stimulated road transport to and from the rail head; most journeys to work combined a number of different modes, including walking. **Multi-mode travel** is indeed one of the most persistent features of mobility. Industrially, interactivity includes **transfer**, most conspicuous in the **technological development** of the motor and aviation industries, firms such as Rolls-Royce and Lucas being involved in both while the switching of wartime production encouraged **flexibility** in manufacturing processes which helped to make both major industries of the post-war period. An implication is that transport and mobility need to be thought of laterally and integrally rather than sequentially and separately.

A mobility revolution

A number of recent commentators have suggested that the UK witnessed something akin to a **revolution in personal mobility** in the later twentieth century. The evidence of this review indicates that transformation was most marked in automobility where private car ownership has continued to rise steadily, doubling between 1970 and 2000, and international air travel, where passenger numbers passing through UK airports increased twenty-fold between 1960 and 2000. The number of passengers travelling by rail has also doubled since the 1990s (DfT, 2017). **Consumer demand** has frequently been a **key agent of transformation**, in the personalisation of transport (the private car), leisure and tourism. **Other factors**, though, have also driven the rise in mobility including house prices, changing work practices and patterns of educational uptake.

This **unprecedented upsurge in mobility** has been largely overlooked by historians, though identified by some recent sociologists with the **'mobility turn'** and the concept of **hypermobility** (Sheller and Urry, 2006; Urry, 2007). Hypermobile individuals take frequent trips, often over great distances. The trends in travel are significant, particularly when viewed in conjunction with increased **geographical mobility** among the UK population for education, work and leisure since the 1960s. Significantly, too, the continuous expansion of travel over the period has increased **faster than economic growth** and more or less independently of other major economic and political shifts. A slowdown was apparent in automobility following the 1973 oil crisis and in air travel following the 2008 crash (ONS, 2011). But there are no signs that the revolution is over or that it is being reversed, despite talk of a 'new localism'.

Overloaded systems

Transport systems in the UK have suffered from recurring problems of **overload**. **Traffic congestion** has been more or less consistent since the 1930s, forcing local authorities in cities such as Manchester to establish traffic congestion committees (Pooley and Turnbull, 1999). The occasion of **gridlock** in central London at Christmas, 1958 prompted the government to require the Ministry of Transport to take direct control of traffic management in the capital (Gunn, 2011). Meanwhile, government and civil engineers were reporting in 1938 that, contrary to expectations, the provision of **new trunk roads** had little or no effect on reducing traffic congestion (SACTRA, 1994).

Other transport forms have likewise suffered overload. The **railways** struggled to cope with the numbers of passengers after the First World War and then again from the 1990s; **airports** have been forced to expand reactively to cope with the exponential growth of passengers since the 1960s. **UK population growth** from 52 million to 65 million between 1960 and 2015 is one factor. Another is the **failure** at policy level to connect transport with other forms of planning such as **land use**. But overload is also a consequence of the **success** of much of the transport sector: automobility, air travel, and, more recently, rail travel, have proved to be some of the fastest growing areas of the economy during the last 50 years.

The problem of overload is equally the legacy of **early industrial and economic development** which means that **much of the infrastructure is old**. Old rolling stock and track held back the railways from the 1920s; lack of appropriate berthing space meant that many British ports could not accommodate the new tankers and container ships from the 1950s. In 1961, 60% of Britain's fixed capital stock in railways and 54% in harbours, docks and canals was constructed before 1920 (Edgerton, 2008).

The **legacy of the past** resulted in transport systems becoming locked in to **path dependency**. Innovation was hampered by old infrastructure, fixed capital and inherited working practices which meant that significant change in transport systems required large financial investment and sustained political will. As recent academic commentators have stressed, new plans for transport that ignore inherited networks, modes and behaviour are **unlikely to succeed** (Divall, Hine and Pooley, 2016).

Towards sustainability

Transport has been a major source of **energy consumption** and **pollution**: coal-burning steam trains, petroleum-fuelled and carbon-emitting cars, buses and lorries. Though the effects of these on the environment from smog to carbon deposits were acknowledged by the 1950s, it was only after 1970 that a **wider environmental awareness** emerged in Britain.

Since the **oil crisis of 1973/4** the question of the **sustainability** of transport systems based on non-renewable fuels has been raised and is now a central factor in the regulation and planning of transport. The British state has played an important role in **disseminating knowledge** of the environmental effects of transport and in tightening the **regulatory framework** in areas such as emissions; motor and aviation manufacturers and pressure groups have also played a part. The **UK lagged behind** the USA, Germany and Japan in the later twentieth century in this field, partly due to the country's heavy reliance on coal and oil, but since 2000 it has played a full part

in creating a more **sustainable framework** for transport and mobility, including active policies for walking and cycling.

The presence of alternatives

Transport is a domain in which change has taken place **slowly**, despite the rapid growth in personal mobility. All of the transport modes discussed in this review have existed for over a 100 years and their form has altered relatively little. A modern aeroplane or car would be easily recognisable to anyone alive in the 1920s. Transport systems are resilient and **enduring**, and change is likely to be gradual, not sudden.

At the same time, the past is a resource for a large number of **options** that were not taken up or which were taken up much later. A prototype of the **driverless car** was first developed and tested by the Road Research Laboratory in 1960 and some of the first cars to be built were **electric**, but neither of these technologies was developed commercially at the time. The 1960s were a particularly fruitful time for innovations in traffic planning. Some of the innovations, like the application of **computer systems** to road signalling, were taken up; others, like **road pricing**, only took hold to a limited extent and at a later date, with toll roads and congestion charging (Rooney, 2016).

The 1960s were also a time of **experimentation** with all sorts of personal and public transport, from the hoverpad and the microlight to the rickshaw taxi and the monorail. Most of these were not developed. In some cases, transport modes from the past have made an unexpected **reappearance**; trams and light railways, abolished in the 1950s, have been re-installed in eight UK cities. Since the 1990s the transport sector has seen the emergence of a number of unplanned 'disrupters' of existing systems, such as **Uber** cars and low-cost airlines, as well as the introduction of **creative concepts** such as car-pooling and bicycle hire schemes, all encouraging multi-modal transport use.

What this suggests is that the idea of transport developing in a **linear fashion**, with one or several modes replacing others, is misconceived. The history of transport in the UK is a story of surprising **reversals and survivals**. Planners' emphasis in the mid-twentieth century on the petroleum car over all other modes now looks like a mistake because it overrode the many different mobilities which co-existed with automobility. The transport alternatives of the past are thus more than interesting relics. They may well offer clues to our **multi-modal future**.

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