Trends in Transport

Transport is a key driver of economic growth. It links people to their workplaces and connects businesses. It also affects health, the environment and societal wellbeing. This POSTnote looks at why transport is changing, outlines current trends across and within transport sectors and considers the planning of transport networks.

Overview
- The transport sector is affected by broad trends such as changes in demographics, technology and social attitudes.
- In the UK, travel by air and rail has risen since 1995, while bus use has fallen.
- Movement of freight by light goods vehicles has increased significantly.
- There is an increasing awareness of the effect of greenhouse gas emissions, air pollution and noise pollution on health.
- Revenue from both road vehicle and fuel duty is set to fall over coming decades.
- Emerging technologies give access to vast amounts of data, allowing improvements to the way transport networks are planned and a reduction in maintenance costs.

Background
There are a number of established and emerging trends in the transport sector. An understanding of these trends can be used to make projections into the future. These projections, while uncertain, can inform transport policy, including planning decisions and public spending.

Why is Transport Changing?
Changes to the transport sector are driven by a range of factors. These include, but are not limited to:
- Changes in UK demographics. The UK population is predicted to grow from 64 million to 77 million by 2050.[1] A greater proportion of these people will live in cities and the over-65 population is expected to almost double.[2] This will increase pressure on existing transport infrastructure and create additional mobility needs.[3]
- Increasing population and wealth of developing countries. Emerging markets and developing countries now account for more than half of global economic growth.[4] This is increasing their demand for resources and also affects global trade patterns.
- New behavioural trends among young adults (18-34 years). These include higher participation in further education and a delay in marriage and traditional household formation.[5,6] These trends have increased the number of leisure trips made by young adults.[7]
- Changes to the climate. As the global climate changes, the UK is expected to see increasingly unpredictable weather with more extreme events.[8] This will test the resilience of the UK's transport infrastructure.
- Technological innovation. Devices are increasingly connected to each other, enabling large amounts of data to be collected and analysed, which allows transport systems to be better understood and planned.[9]
- Integrated transport research. Academic research is increasingly considering the relationship between transport, wellbeing, health and the environment.

These factors are driving changes across all modes of transport and within specific transport sectors. These trends are outlined in the following two sections.

Trends across all Transport Sectors
De-carbonisation of Transport
Greenhouse gas (GHG) emissions from transport are the target of national and international policy. The Climate Change Act 2008 requires the UK to reduce GHG emissions across the economy. The EU framework on emissions to 2020 requires GHG emissions from transport to be cut by 10% from 2005 levels and also requires 10% of transport fuels to come from renewable sources.[10] However, aviation to non-EU countries and all shipping are exempted and their emissions are expected to rise.[11,12] The GHG emission reduction policies are driving adoption of several lower emission technologies.

- Electrification: many transport modes can be powered by electricity. These produce zero emissions directly, although they may cause indirect emissions through the electricity they use or their manufacturing process. Since 2008, 24,500 electric (including petrol-electric or diesel-electric hybrids) vehicles have been registered in the UK, with more than half of those registered in 2014.[13] The recent growth has in part been stimulated by Government grants of up to £5,000.[14] There has also been a large increase in the number of hybrid buses.[15] In 2014, these made up 2% of the UK fleet.[15] There is also increasing electrification of trains.[16]
- Alternative fuels: these include Liquefied Natural Gas (LNG), biofuels and hydrogen. A 2014 EU directive encouraged the development of LNG and hydrogen infrastructures, especially in ports and Heavy Goods Vehicles (HGVs) terminals.[17] There are only 600 LNG vehicles on the road in the UK and numbers are only increasing slowly.[18] Hydrogen-powered buses operate on one route in London and the first commercially available private vehicles are scheduled to be available in late 2015.[19]
- More energy-efficient transport: traditional combustion engines are becoming more fuel-efficient. The use of light-weight materials such as carbon fibre in new HGVs and planes is increasing fuel efficiency and safety. Improvements in ship design (to minimise drag) are also leading to fuel savings.

The rate of growth of these technologies may be limited by technological constraints including a lack of widespread charging infrastructure, the high costs of batteries and alternative fuels (POSTnote 492) and the limited options for decarbonising long-distance aviation and shipping. [20,21]

Increasing Demand for Energy and Materials
Global demand for materials used for transport is increasing as developing countries grow and different materials are used in new technologies. This rise in demand is likely to lead to long term increases in the price of commodities, such as steel and copper. Electric vehicle battery-grade lithium has tripled in cost since 2000 and further increases could affect the price of electric vehicles.[22]

Use of Materials
Given the higher costs of materials, levels of recycling, reuse and waste minimisation are increasing (POSTnote 425). The EU end-of-life vehicle directive requires the automotive industry to reuse or recycle 95% of a vehicle.[23] However, the increasing use of carbon-fibre based materials in efficient vehicles and planes will pose challenges to meeting these EU targets because carbon-fibre based materials are difficult to recycle or reuse. In April 2014, the EU launched a commitment to improving the reuse of carbon-fibre materials by the end of 2020.[24]

In another development, new manufacturing techniques such as 3D printing are becoming more economically viable (POSTnote 420). This may change the way that vehicles, planes and trains are manufactured and repaired, as replacement parts will be available on-demand. Concerns have been raised about the quality assurance of replacement parts and the protection of intellectual property.[25,26]

Commuting Patterns
Over the past twenty years the distance that people commute to work has increased slightly. However, there has also been a decrease in the number of commuter trips made. This combination of fewer, but longer commutes is likely due to several factors, including more opportunities to work from home and increasing suburban house prices which force commuters further from city centres.[27]

The proportion of jobs located in city centres is rising as the number of jobs in knowledge-based industries (typically located in city centres) increases.[28] This puts increasing demand on public transport in cities and may increase congestion on the roads and competition for urban space from car parking, if the car sector continues to dominate.[28]

Technology in Transport Systems
Technologies including smartphones, GPS devices and digital ticketing are driving an increase in the collection of data about how, why and where people travel. These data can be used to improve the way transport networks are planned (POSTnote 472) and real-time analysis gives access to time sensitive information, allowing decisions to be made in real time. Sensor technology can also gather data and is becoming small and cheap enough to embed in infrastructure. For example, sensors in roads can improve traffic management by reporting levels of congestion. Sensors could also report on the condition of infrastructure, making maintenance quicker, less disruptive and cheaper.[9]

Another technology trend is the increasing use of automation. Technologies such as parking assist and lane keeping are already being introduced to the vehicle market and driverless trains have long been used. Trials of platooning (where vehicles are driven in convoy) and automated ships are being carried out.[29]

As transport systems become more dependent on ICT and automation, the number of potential vulnerabilities may rise.
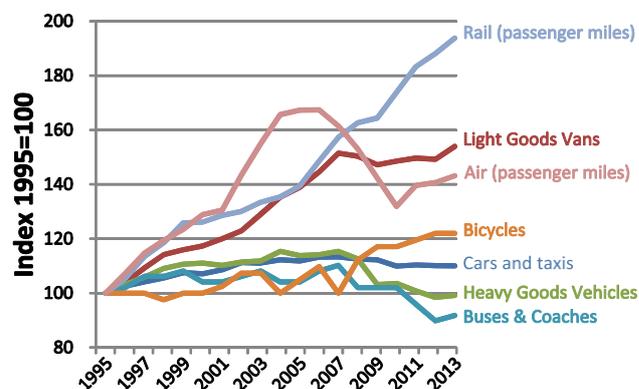

Figure 1. Change in miles travelled by different transport modes. (Vehicle miles unless indicated)[30,31]

Cyber-based vulnerabilities in the transport sector threaten human life and pose economic risks. There is wide agreement about the increasing need for proactive, rather than reactive, cybersecurity measures (POSTnote 389).

Trends within Transport Sectors
This section identifies key trends in the road, rail, aviation and shipping sectors. Many of these trends are different in London compared with the rest of the UK.

Road Transport
Frequency of Use
The makeup of traffic on UK roads is changing (Figure 1).
- While the total number of miles driven by car has increased since 1995, the average number of UK car journeys per person decreased by 12% from 1995 to 2013, with major decreases among the young, men above the age of 30 and London residents.[27,32] In contrast, the number of female drivers is increasing.[32] Several explanations exist for this, including the falling number of company cars, the economic impact of the 2008 recession, young people remaining in the family home for longer and improved public transport in urban areas.[33] Some academics suggest that the average number of miles driven by car per person per year has reached a peak ('peak car'), and will remain static in the future or begin to decline.[34,35] However, whether this trend will continue is unclear. Most agencies are using forecasts from the National Transport Model, which predicts that car miles will begin to grow again.[36]
- The number of light goods vehicles on the roads has increased steadily since 1995.[33] This is linked to the rise in deliveries from internet shopping.[32]
- Bus use across the UK has declined for a number of decades.[37] However, bus use in London has doubled since 1995.[38] The increase in London is likely due to population increase, congestion zone charging, the introduction of Oyster cards (which made buses easier to use), the integration of buses with other public transport, increased bus numbers and the ability of Transport for London to provide coverage of less profitable routes.[39,40]
- The number of cycle journeys is increasing in flat, dense urban areas such as London, Cambridge, Oxford and Brighton.[38] Factors behind cycling's popularity within London include significant investment in cycle infrastructure, the introduction of the congestion charge and the introduction of the cycle hire scheme (which has seen annual journeys increase to over 10 million in five years).[41,42]

Driverless Cars
In February 2015, the Government published a review of the legislation required to bring automated vehicles (POSTnote 443) to the roads.[43] It found that the UK's legal and regulatory framework is not a barrier to the testing of automated vehicles since there will still be a 'driver' figure in partial control of the vehicle. Further work funded by the Government will establish who is liable when vehicles become driverless. Three trials of fully automated vehicles have been announced in the UK.[44]

Usage Models
There are two key changes in the way people use cars:
- There is a trend away from vehicle ownership, with a rise of car rental schemes.[45] A number of these newer rental schemes involve collecting vehicles from street-side locations. Use of car rental alongside public transport could reduce road congestion and emissions.
- There is also an increasing use of new models for hiring taxis or minicabs. Companies, such as Uber, use the location awareness and internet connectivity of smartphones to quickly identify appropriate cars and set fares in response to the number of vehicles available and consumer demand.

Road Transport Taxes
The Office for Budget Responsibility forecasts that revenue from both fuel and vehicle duty will fall in future years if policy remains the same.
- Revenue from fuel duty (charged per litre of petrol and diesel) is forecast to fall by around 0.5% of GDP by 2035 because increasing fuel efficiency is expected to decrease fuel use.[46]
- Revenue from vehicle duty is projected to fall from 0.27% of GDP to 0.09% by 2035 as more vehicles fall into the lower tax bands for less polluting vehicles.[46] The DVLA predict that by 2020 over half of cars will fall into the lowest, duty exempt band.[46]
With falling revenues, some groups have suggested a movement towards road pricing, where drivers are charged in a 'pay-as-you-drive' model.[47]

Accessibility
Lack of access to transport has been shown to reduce quality of life.[48,49] Access to transport is affected by affordability, the physical ability to board transport, such as trains, the distance to the nearest public transport pick-up and the availability of transport that can pick up directly from people's homes, such as taxis. There are two key trends relating to bus access.
- Buses are increasingly accessible to users with a disability or poor mobility (POSTnote 432) with a three-fold increase in fully accessible buses in the past ten years.[38] This access will help an ageing population more at risk from mobility problems.
- The cost to the Government of its concessionary bus pass scheme for pensioners currently costs £1 billion a year and is predicted to rise with the UK's ageing population.[50] This has led to suggestions that eligibility for the bus pass should be means tested.[51,52]

Air Quality
Air pollution (POSTnote 458) is estimated to cost the UK around £16 billion a year, largely through health costs. Pollutants from road vehicles are being controlled through increasingly strict European standards. The most recent regulations, Euro 6 for light diesel vehicles and Euro VI for heavy vehicles, restrict the emission of nitrous oxide (NOx) from new engines.[53] These regulations will particularly affect diesel engines since they have higher NOx emissions. This effect may reverse a rise in the numbers of diesel vehicles

that stemmed from regulation of other pollutants.[54] Furthermore, in April 2015, the UK Supreme Court ordered Defra to put in place more ambitious plans on NOx reduction by the end of 2015, having failed to reach targets under the 2008 Air Quality Directive.

Rail
The annual number of rail journeys has doubled over the last 20 years with the fastest increase on commuter routes.[38] This growth is tied to several factors including decreased car use, economic growth, greater reliability and increased competition that has led to more choice of fares.[55,56] Total movement of freight by rail is rising by 2.5% per year.[57] This increase comes from moving freight over longer distances (though the tonnage moved has not increased). Rail freight currently accounts for about 9% of the total freight moved.[38]

Reliability and Capacity
Improvements in train technologies will increase the reliability and capacity of all rail networks, whether they are high speed networks or not. Conventional train speeds in the UK are limited to 125 miles per hour (mph) while trains on the High Speed 1 line between London and the channel tunnel can travel at 140 mph. Proposals for High Speed 2 involve up to 18 trains per hour travelling at 225 mph. To enable trains to achieve this speed and frequency, engineering challenges must be overcome to integrate new signalling technology with existing infrastructure.

Aviation
The number of passengers travelling through UK airports is rising and returned to pre-recession levels in 2014.[58] This rise is primarily driven by an increase in journeys made for leisure reasons, prompted by an increase in the affordability of flying.[59] Airspace at major London airports is approaching capacity and the Airports Commission is currently considering the location of a new runway in the South-East.[60] Plans are also under consideration for a new spaceport (Box 1).

A series of EU directives have caused a 90% decrease in measured noise pollution from aviation since 1974.[61] However, the number of people living within areas affected by noise from eight major UK airports has increased since 1991 and there has been an increase in people who report being "highly annoyed" by aviation noise pollution.[62,63]

Shipping
Trends in shipping include:
- Changing trade patterns: it is expected that global maritime trade will double by 2030 as newly developed countries increasingly dominate the trade market.[64] This will cause a shift in freight patterns as new trade routes appear, for instance an increase in South-South trade, which will start to compete with UK exports.
- Ship size: container ship size is increasing because of the expansion of the Panama Canal in 2015.[64] While economies of scale could reduce the cost of freight

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Box 1. Hypersonic Flight and Access to Space
There has been increasing interest in the development of hypersonic flight (at least five times faster than the speed of sound) to allow low-cost access to space and to decrease some journey times. Several UK companies are developing spaceplanes for the launch of satellites.[65] Current rocket launches cost between $10 million and $150 million and may have a waiting list of around 18 months to two years. It is expected that reusable spaceplanes would significantly undercut these times and costs. The Government considers the space industry a key sector for growth and in 2014 the Civil Aviation Authority announced a shortlist of eight potential locations for a UK space port.[65,66] The Government hopes this will become operational by 2018 and be the first of its kind in Europe.

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transport, it may also drive smaller companies out of the market.[64]
- Effects of climate change: climate change is leading to rising sea levels and may increase the frequency of extreme weather events, such as storm surges. Ports are particularly vulnerable to some of these effects.[67] Climate change is also shrinking summer Arctic sea ice coverage, which is starting to unlock Arctic shipping routes.[68]

Integrated Transport Networks
It is widely argued that planning should be more integrated; both between different transport sectors and between the Department for Transport and other Departments such as the Department for Communities and Local Government and Department for Health.[69,70] They suggest that a more integrated approach will help overall aims, such as reducing journey times and city planning. It may also affect a number of trends. For example, more consideration of the health issues associated with transport might increase support for walking and cycling. The National Travel Survey reports that the number of journeys made by walking has declined by 30% over the past twenty years, although there are concerns that the survey underestimates walking.[38]

One growing movement towards integration is the use of local single-ticketing systems, such as London's Oyster card and contactless payment system or the Plus-Bus train ticket. The convenience of a single ticket encourages the use of multiple modes of transport.[71] However, its success depends on multiple operators agreeing to accept multi-operator tickets, which can be difficult to negotiate without a single overarching authority, such as Transport for London. Several other cities have recently been granted or are seeking devolved powers, for example Transport for Greater Manchester.[72]

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