Healthy transport = Healthy lives

July 2012

BMA

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Abbreviations

BRT	bus rapid transit
CH_4	methane
CMO	Chief Medical Officer
CO_2	carbon dioxide
CVD	cardiovascular disease
DALYs	disability adjusted life years
dB	decibels
DfT	Department for Transport
GDP	gross domestic product
GHG	greenhouse gas
HGV	heavy goods vehicle
HSR	high speed rail
ICE	internal combustion engine
LGV	light goods vehicle
MVPA	moderate to vigorous physical activity
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
N_2O	nitrous oxide
NO	nitric oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
O_3	ozone
$PM_{2.5}$	particulate matter less than 2.5 microns
PM_{10}	particulate matter less than 10 microns
SO_2	sulphur dioxide
TfL	Transport for London
THSG	Transport and Health Study Group
VOC	volatile organic compound
WHO	World Health Organization

Glossary

Adapted from the *Illustrated glossary for transport statistics: IV edition* published by Eurostat, the International Transport Forum and Economic Commission for Europe.

Active travel/transport

Active travel refers to any form of transport that incorporates physical activity; the two main forms are walking and cycling.

Alternative fuel

A type of motor energy other than the conventional fuels, petrol and diesel.

Bus lane

Part of a carriageway designated for buses and distinguished from the rest of the carriageway by longitudinal road markings.

Bus rapid transit

Bus rapid transit is a term applied to a variety of public transportation systems using buses to provide a faster, more efficient service than an ordinary bus line.

Car/lift sharing

Often organised at the workplace level, a scheme which partners up individuals who make similar car trips at similar times, to share travel, costs and reduce congestion.

Car club

A community level scheme offering locally available cars, and sometimes vans, to be booked and used by members.

Community severance

Community severance describes the way transport infrastructure, such as rail lines and major roads, can reduce access within and to the communities through which it runs.

Congestion

Congestion is a condition on road networks that occurs as use increases, and is characterised by slower speeds, longer trip times, and increased vehicular queuing.

Cycle lane

Part of a carriageway designated for cycles and distinguished from the rest of the carriageway by longitudinal road markings.

Cycle track

Independent road or part of a road designated for cycles and sign-posted as such. A cycle track is separated from other roads or other parts of the same road by structural means.

Electrified rail
Track provided with an overhead catenary, or a conductor rail, to permit electric traction.

Greenways
Traffic-free routes for walking, cycling and other non-motorised uses, often built along other forms of transport infrastructure in disuse, such as abandoned railways.

Heavy goods vehicle
Road vehicles with a gross vehicle weight above 3,500 kilogrammes, designed, exclusively or primarily, to carry goods.

High speed railway
A line specially built to allow traffic at speeds generally equal to, or greater than, 155 miles per hour (250 kilometres per hour) for the main segments.

Light goods road vehicle
Road vehicles with a gross vehicle weight of not more than 3,500 kilogrammes, designed, exclusively or primarily, to carry goods.

Light rail
A rail line mainly for urban transport of passengers, often electrified. Stations are generally less than 1,200 metres apart. In comparison to metros, light rail is more lightly constructed, is designed for lower traffic volumes, and usually travels at lower speeds.

Marginal costs of car ownership
The marginal costs of owning a car include the costs of fuel, tyres, service labour costs, replacement parts, parking and tolls, motor vehicle insurance and taxation. They contrast to the average costs of owning a car, which include the initial cost of purchase.

Metro line/subway
An electric rail line, mainly for urban transport with the capacity for heavy volumes of traffic, involving very frequent train movements. Metro lines are also characterised by closely spaced stations, normally with around 1,000 metres between the stations.

Public transport
This report defines public transport as encompassing bus, taxi, metropolitan and underground rail travel.

Reallocation of road space
Local transport schemes which remove road capacity from private motor transport and reallocate it, in the form of wider pedestrian footways, segregated cycle lanes etc.

Road danger reduction

The danger reduction approach to road safety addresses risks as well as casualty data; some roads do not record pedestrian or cyclist casualties because they are actually too dangerous and threatening for individuals to walk or cycle. This contrasts with a traditional approach, which often seeks to reduce casualties by preventing pedestrians and cyclists from making the trips they need to undertake (eg by the use of guardrails and barriers).

Sustainability

Sustainability is defined as satisfying the basic needs of the population, ensuring a good quality of life, without compromising the ability of future generations to meet their own needs or quality of life.

Sustainable transport

Sustainable transport encapsulates:
- a reduced demand for travel
- increased demand for walking and cycling, public transport, rail, and public transport oriented development
- planning decisions that are based on accessibility, rather than mobility, through the development or protection of urban transport systems that are low carbon and anti-sprawl
- increased vehicle efficiency, and the promotion and use of sustainable fuels for existing modes of transport.

Traffic calming

Traffic calming comprises a series of measures to reduce the volume and speed of cars on roads.
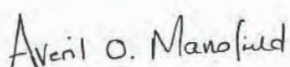
Foreword

People have always wanted to reach destinations quickly, safely and efficiently. But as the UK transport environment has become increasingly complex, transport's impact on health has become unnecessarily harmful; to the point where it is a significant cause of morbidity and mortality.

The BMA published its first major report on this subject in 1997, entitled *Road Transport and Health*. This highlighted the many ways in which transport affects health. There has been little change in transport policy since this publication. The number of car users continues to increase, numbers walking and cycling have stagnated, and changes to the built environment continue to prioritise the ability to travel, rather than the ability to reach destinations. All of which mean that the health of the nation continues to suffer.

To date the approach to transport policy in the UK has in part been based on short-term objectives, even though the decisions taken can potentially last decades. Economic considerations have been prioritised over health. This is despite a substantial evidence-base demonstrating that making health a key objective in transport policy is cost effective, and will have short-, medium- and long-term benefits. It is vital that we have policies that encourage a modal shift away from unnecessary car use and the development of a transport environment that facilitates active and public transport journeys. The measures taken to achieve this will have multiple co-benefits for health. These include reducing road traffic injuries and death, increasing activity levels, and improving the environment through reductions in air pollutants.

It should be recognised that no single transport policy measure is a silver bullet. The decisions needed to get the UK back on the right track will not be easy to implement. Effectively integrating health in all transport decisions can only take place with strong commitment and leadership at a governmental level. This needs to be supported by integrated working between governmental departments, with health improvement as an objective in all transport policy development. Healthcare professionals and the NHS also have a key role to play, from the advice given to patients, to being exemplars of good practice at a local and national level.

The BMA has long been at the forefront of campaigns to improve the UK transport environment, from lobbying for seat belt legislation and reductions in the drink drive limit, to calling for improved walking and cycling networks. The aim of this report is to demonstrate the positive effect that integrating health into transport policy will have. It proposes areas for action that prioritise health for all relevant transport sectors. This report is intended for transport, energy, sustainability and climate change policy makers with strategic or operational responsibility for public health and health promotion in the UK, and will be of interest to health professionals and the public.

Averil O. Mansfield

Professor Averil Mansfield
Chairman, Board of Science

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1. Executive summary

This report considers the need to prioritise health in transport planning and policy decisions. It aims to highlight the benefits to health of developing a sustainable transport environment where active travel and public forms of transport represent realistic, efficient and safe alternatives to travelling by car.

Over the last 60 years road traffic density in the UK has steadily increased, and congestion in many urban areas is a significant problem. The most significant change in travel behaviour has been in car use, which is seen by many as their primary means of transportation for short and long-distance journeys. This shift has resulted from the increasing affordability of car use relative to other transport alternatives, as well as land use policies that have prioritised mobility over accessibility.

The adverse impact of transport on health
While the expansion in car use has brought many social and economic benefits, the increase in vehicle numbers and traffic volume in the UK has also had negative impacts on health. These include an increased risk of road traffic crashes, as well as greater exposure to air and noise pollution.

Long-term exposure to air pollutants from road traffic has been found to decrease life expectancy by an average of six months, due to an increased risk of cardiovascular morbidity and mortality. Prenatal exposure to air pollution is associated with a number of adverse outcomes in pregnancy, including low birth weight, intrauterine growth retardation, and an increased risk of chronic diseases in later life. Individuals who reside or work near busy roads or airports are at particularly high risk of exposure to the health harms of air pollution. Areas of high deprivation are known to suffer a greater burden from air-pollution-related morbidity and mortality.

Transport-related noise pollution (predominantly from roads, railways and airports) can adversely affect the cardiovascular system (including increasing blood pressure and myocardial infarction), mental health status, and school performance in children. As with air pollution, socially disadvantaged people are more likely to live near busy roads, and are at greater risk of the negative effects of noise pollution.

While the UK has seen an overall long-term decline in the number of road users killed or seriously injured, there were still more than 200,000 reported road casualties in 2010. These disproportionately affect vulnerable road users, such as pedestrians and cyclists. Most pedestrian injuries occur on built-up roads in towns and cities, and the risk is greatest when car use is at its highest (eg during peak commuting hours). The greatest risk for cyclists is associated with crossing junctions.

Active travel
Active forms of travel, such as walking and cycling, are the most sustainable forms of transport and are associated with a number of recognised health benefits. These include improved mental health, a reduced risk of premature death, and prevention of chronic diseases such as coronary heart disease, stroke, type 2 diabetes, osteoporosis, depression, dementia, and cancer. Walking and cycling are also effective ways of integrating, and increasing, levels of physical activity into everyday life for the majority of the population, at little personal or societal cost.

The unintended consequence of increased car use has been the suppression of walking and cycling levels in the UK. With the increasing traffic density on UK roads, there has been a corresponding increase in risk of injury for pedestrians and cyclists. This has been coupled with a lack of investment in walking and cycling infrastructure. The decline in active travel has also resulted from poor urban design. Low-density land use patterns (such as urban sprawl) restrict accessibility to jobs, education, services and other destinations by active forms of travel. Even where destinations are geographically near, busy roads and poor infrastructure for active travel can lead to community severance. In many urban areas, travelling by car has become the easiest and safest option for accessing services, irrespective of journey length.

The suppression of active travel in the UK is associated with generally higher levels of physical inactivity and sedentary lifestyles. This in turn can contribute to higher levels of morbidity and mortality through an increased risk of clinical disorders such as cardiovascular disease, overweight and obesity, metabolic disorders, and some cancers.

Public transport
Using public transport can help individuals to achieve recommended levels of daily physical activity by incorporating active travel as a component of the journey. It is also viewed as the most sustainable transport option for longer journeys because it emits less harmful emissions at average occupancy compared to car use.

The uptake of bus services in the UK is low as a result of high levels of congestion on roads, chronic underinvestment in services, declining standards, and increasing costs for passengers. While the cost of travelling by rail in the UK is also high compared to the cost of car use, the demand for services often exceeds capacity at peak periods of travel. This has led to a situation where car use commonly represents a more attractive and practical alternative to travelling by public transport. There are also significant inequalities in access to public transport – in particular in relation to disabled people, the elderly and rural populations – which can discourage its use among these groups.

Transport in rural areas
Those living in rural areas face a distinct range of transport issues. While rural communities suffer less from congestion and pollution problems, they often have to contend with more limited access to services, and an inadequate provision of active travel infrastructure and public transport networks. This is associated with increased levels of car use, and lower levels of physical activity. Rural dwellers with poor access to public transport and without access to a car are also at an increased risk of social exclusion.

A modal shift in transport policy
Strong governmental leadership is needed to re-focus transport policy in the UK. Prioritising accessibility over mobility will encourage a modal shift towards transport behaviours with the greatest health benefits. This will require measures to reduce the demand and need to travel by car, in tandem with policies that will increase the uptake of active travel and public transport in

urban and rural areas. It is essential that planning and land-use policies create an environment that offers everyone (including people whose mobility is impaired) convenient, safe, well-designed and direct access to workplaces, green spaces, homes, schools and other services via active travel and public transport networks. Where car use is necessary, efficiency improvements are important, including encouraging higher occupancy per journey and technical interventions to improve vehicle efficiency. There is also a need to monitor the impact of transport policy decisions – such as the development of high speed rail (HSR) networks – on transport behaviour and health.

Healthcare professionals can play an important role in supporting this change through their influence on local planning decisions, and by encouraging patients, colleagues and employees to walk, cycle or use other modes of transport involving physical activity. There is also a need to ensure healthcare facilities are easily accessible by a range of active travel and public transport options.

The following sets out a number of areas for action to support a modal shift in UK transport policy.

A strategic approach to transport policy and the urban environment

- Transport policy should aim to reduce the need to travel long-distances to access jobs, education, services and other destinations, and encourage a modal shift away from private motor transport towards active forms of travel which benefit health. This will include:
  - prioritising accessibility over mobility in planning decisions to ensure local facilities and services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity
  - reducing congestion and improving usability of roads by pedestrians and cyclists through reallocation of road space, restricting motor vehicle access, road-user charging schemes, and traffic-calming and traffic management (including area-wide 20 miles per hour speed limits)
  - the provision of a comprehensive network of routes for walking, cycling and using other modes of active travel that offer everyone (including people whose mobility is impaired) convenient, safe, well-designed and direct access to workplaces, homes, schools and other public facilities
  - the creation of safe routes to school so that children and parents can travel to school by walking or cycling, and the provision of suitable cycle and road safety training for all pupils.

- Ambitious growth targets for walking and cycling should be set at national and regional levels, with increased funding and resources proportional to target levels.

- Road safety should be addressed at a strategic level through a danger reduction approach that addresses the factors that put pedestrians and cyclists at risk, rather than seeking to reduce casualties by limiting pedestrians and cyclists from making the trips they need to undertake.

- Land use and planning policy should prioritise:
  - high density mixed-use neighbourhoods, which facilitate active travel and the use of public transport

- accessibility of goods and services by a range of high quality active and sustainable travel options, including walking and cycling networks, and public transport
- providing green spaces and access to nature, to encourage social contact and integration, as well as space for physical activity.

- Low carbon transport options and energy efficient technology should be adopted where car use and motorised transport is necessary. Any efficiency savings in engine technologies should be accompanied by regulation that prioritises active and sustainable forms of transport, and planning decisions that prioritise accessibility over mobility, to ensure efficiency savings are not translated into a higher prevalence of car use.

- There should be further development of, and incentives for, alternatives to traditional car usage patterns such as workplace car sharing schemes and car clubs.

Public transport
- Adequate provision of public transport, that is tailored to meet the needs of users, should be available and accessible to all passengers, including elderly and disabled people. This requires public transport services which are accessible in terms of the distance taken to reach them, and in terms of gaining access to them.

- Public transport should be affordable to all to ensure that it represents an effective alternative to car use in cities, towns and rural areas. Special consideration should be given to the use of subsidy in rural areas.

- Demand responsive transport may offer a more effective transport solution for improving social inclusion and meeting the needs of rural communities.

- To maximise the potential for car-free travel, facilities should be improved for combining active travel with local and longer-distance public transport.

- The introduction of HSR should be monitored to assess the extent to which it encourages a modal shift in transport behaviour away from car and air travel, and its wider impact on health.

The role of healthcare professionals and the NHS
- All planning decisions in the NHS should prioritise accessibility over mobility to ensure healthcare services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

- Healthcare organisations should work in partnership with local authorities to ensure local transport plans/infrastructure, and proposals for urban development and regeneration support physically active travel, including prioritising the needs of pedestrians and cyclists over motorists. This should incorporate the use of the World Health Organisation (WHO) health economic assessment tool (HEAT) for cycling and walking.

- Healthcare professionals and managers in the NHS who have responsibility for promoting workplace health should ensure there is an organisation-wide plan or policy to encourage and support employees to be more physically active, including policies to encourage employees to walk, cycle or use other modes of transport involving physical activity (to travel to and from work and as part of their working day).

- When it is clinically appropriate, healthcare professionals should:
  - promote walking and cycling as an effective way of improving physical activity levels through the use of brief face-to-face advice, remote support (either delivered by the telephone or internet), and approved individual (eg pedometers) and group-based interventions (eg walking and cycling schemes)
  - encourage parents, carers and families to complete at least some local journeys (or some part of a local journey) with young children using a physically active mode of travel
  - sign post to information about opportunities for active travel in the local community.

- Healthcare professionals can use their influence as community members and leaders to promote walking, cycling and other modes of transport involving physical activity by:
  - acting as role models and opting for travel involving physical activity whenever it is practical
  - working as advocates in local strategic partnerships to ensure accessibility is prioritised over mobility in planning decisions so that workplaces, homes, healthcare services, schools and other public facilities are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

2. Introduction

Transport is an essential activity, connecting people to healthcare services, education, employment, family, community, shops and recreation. The connectivity provided by transport is crucial for a modern economy. It allows goods to be moved to market, helps employees get to work, and provides access to a wide range of services and leisure activities.

Transport can have a positive impact on health, through the health benefits of physical activity associated with walking and cycling. It also has negative influences, which include road traffic injuries, air pollution, traffic noise, the suppression of physical activity, and contributions to climate change. At present, the negative effects on health from the UK transport policy environment outweigh the positives, at an unacceptable level.

Transport's increasingly negative impact on health has been reflected by changes in the mode, and the amount, of UK travel. Compared to the 1950s, the total amount of travel undertaken by all modes of transport has more than trebled, from 135 to 508 billion passenger miles by 2007.[1] The relatively rapid expansion of car ownership over the past 60 years has been mirrored by declines in the proportion of journeys made by walking, cycling, bus and rail.[1]

Many of the health harms associated with the transport environment can be mitigated with policy action. With demand for transport increasing, health improvement must be an objective in all future transport planning decisions.[2] Decisions taken today concerning the UK transport infrastructure can determine how people travel for decades. Making the right decisions, and considering the impact on the health of the community they serve, is vital.

The aim of this report is to demonstrate the need to re-focus transport policy in the UK to improve health and well-being. It considers the evidence base for a number of areas of transport, and identifies areas for action for the UK Governments, healthcare professionals and the NHS.

3. Sustainability

3.1 Sustainable transport and health

Ensuring that transport is sustainable[a] will have health benefits. Sustainable forms of transport, such as active and public transport, include physical activity as a component of travel, which has a range of positive health benefits.[3-22]

Active travel is a viable alternative to the many short journeys traditionally made by car; although travelling by foot or bike is not always practical for long distances. In these instances, public transport is viewed as the most sustainable transport option for longer journeys. Public transport is also associated with greater health co-benefits, than travelling by car. When at average occupancy, for example, public transport modes emit less harmful pollutants than cars.[23]

When policies that promote sustainable transport are accompanied by policies that aim to reduce demand for unsustainable forms of transport – most prominently reductions in travelling by car – there are further health benefits. These include reductions in local air and noise pollution in towns and cities, as well as reductions in road traffic crashes.[16, 17, 19, 24] The level of UK car use negatively impacts on health as a result of physical inactivity, road traffic injuries, air and noise pollution, and the loss of the street as a social space.[16, 25-31]

Refocusing UK transport policy so health and sustainability are at the forefront cannot take place over night. In the interim, low carbon and energy efficient technologies should be adopted wherever possible to mitigate the negative health impacts of cars and other forms of motorised transport. While the need to refocus policy in this area is starting to be recognised – for example, with the development of the 2012 *National planning policy framework* for England – the decisions necessary to implement these policies will not be easy to implement, and can only be achieved with decisive leadership and a strong commitment to improving health.[32]

3.2 A sustainable transport environment

Changes to the built environment are essential to optimising the health improvement potential of sustainable transport policies. A vital component of this is ensuring that planning decisions are based on accessibility, rather than mobility.[b] Mobility has been prioritised over accessibility in UK planning decisions for much of the recent past.[16] These changes have led to an increasing shift of residential, industrial and economic activities away from the centre of cities to edge-of-town and out-of-town developments. This has contributed to more dispersed land use patterns and urban sprawl, and travel intensive lifestyles, whereby it is easier and more practical to travel by car.

Much of UK policy to date can in part be attributed to the governmental focus on expanding the automotive industry, rather than prioritising the health of the nation.[16] Increases in car ownership have been further exacerbated by the lack of any realistic alternative; in part a result of the privatisation of public transport.[16] The privatisation of public transport has been associated with

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a   Sustainability is defined as satisfying the basic needs of the population, ensuring a good quality of life, without compromising the ability of future generations to meet their own needs or quality of life. The concept of sustainability was first described in 1987, in response to anxiety that economics were the main factor in developmental decisions.

b   The ability to travel is known as mobility. It is distinct from the ability to access services, known as accessibility.

increases in travel costs and reductions in standards of quality. All of which lead to a situation where travelling by public transport is an increasingly unattractive option.

Area for action
- Transport policy should aim to prioritise accessibility over mobility in planning decisions to ensure local facilities and services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

3.3 Sustainability and climate change

The public health consequences of climate change are of concern to health professionals. Motorised transport is heavily dependent on non-sustainable fossil fuels,[33] and burning of these contributes to climate change (see **Appendix 1**). Increasing demand for sustainable transport, mirrored by reductions in demand for unsustainable forms of transport, is likely to contribute to mitigating the impacts of climate change. This is in addition to the range of health co-benefits associated with sustainable forms of transport.

The 2006 Stern Review on the economics of climate change highlighted transport as a key sector where emissions reductions, and alternative sources of energy, are needed in the UK.[32] It concluded that the cost of inaction greatly outweighed the costs of mitigation and adaptation, particularly if the action was immediate.[32] It is worth noting that the findings of the Stern Review have been challenged in the scientific and academic literature. This primarily concerns the time it would take before the negative impacts of climate change are fully felt. The need for immediate and costly action has been questioned, especially when the benefits of such activity will take many years to be realised.[34]

The BMA believes that there is an urgent need for decisive action at an individual, organisational, political and global level to prevent unmanageable climate change. Further information can be found at www.bma.org.uk/climatechange

4. Car use

4.1 The adverse health impacts of car use

While car use has a number of recognised social and economic benefits, car use is also associated with a number of adverse health impacts.[16, 25-30] Traffic volume, as well as air and noise pollution can lead to negative health outcomes for road users, as well as those living near heavily congested roads. The health impacts of exposure to air pollution from transport exhaust fumes include lower life expectancy, increased risk of cardiovascular and respiratory disease, including myocardial infarction, effects on physical development in children, increased risk of mental illness, and poorer school performance in children.[16, 25-30]

Traffic speeds and volumes are known to influence how individuals choose to travel, with higher volumes of walking and cycling where traffic is less (and a suppression of active travel where it is greater).[35] They also influence social interaction, which impacts on health and well-being.[36]

Road traffic crashes are an important health impact from car use.[31, 37] These are not exclusively borne by motorists, and disproportionately affect vulnerable road users, such as pedestrians, cyclists and those from deprived communities.[31] While road deaths are not a major cause of loss of life in the UK, the numbers injured on roads remains too high, and child road safety is a particular area of concern. In 2010, there were 208,648 reported road casualties for all road users, which includes 1,850 killed, 22,600 seriously injured and 184, 138 slightly injured.[31] As demonstrated in **Figure 1**, while it is positive that the number of killed or seriously injured road users in the UK is in decline, further reductions are still necessary.[31]

Figure 1 – number killed or seriously injured in the UK by road user type, 1994 to 2010
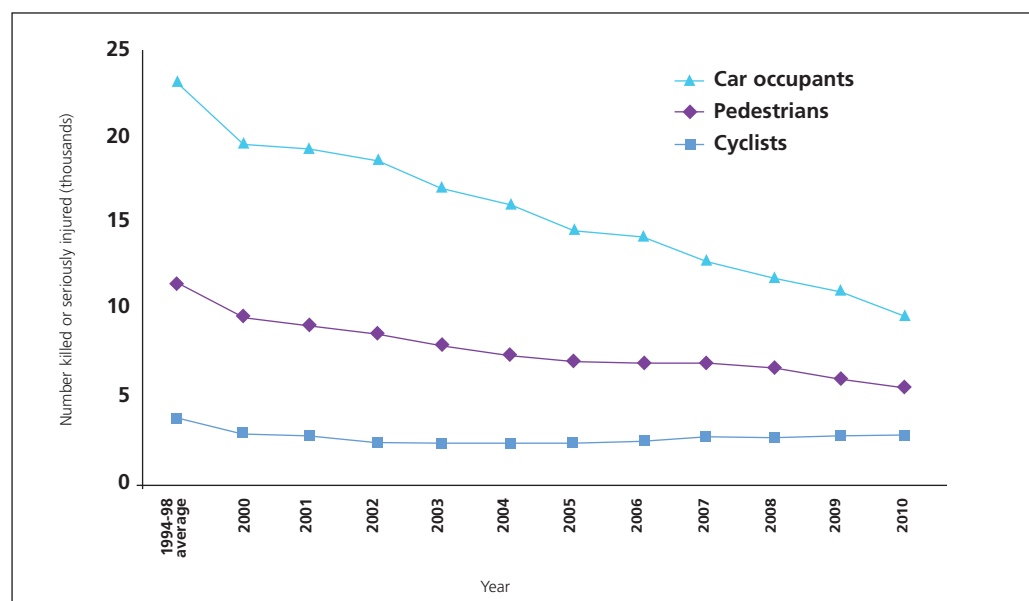
Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.

4.2 The costs of car use

The relative inexpensiveness of driving a car, compared to other forms of transport, has contributed to its increased use. In 1949, UK car users drove approximately 13 billion miles per year, whereas in 2010 UK car users drove 240 billion miles per year – an almost 16-fold increase (see **Figure 2**). Car ownership has also increased. Between 1994 and 2011 the number of cars licensed for ownership in Great Britain increased from around 21 million cars to nearly 28.5 million.[38]

Figure 2 – number of UK car miles, 1949 to 2010
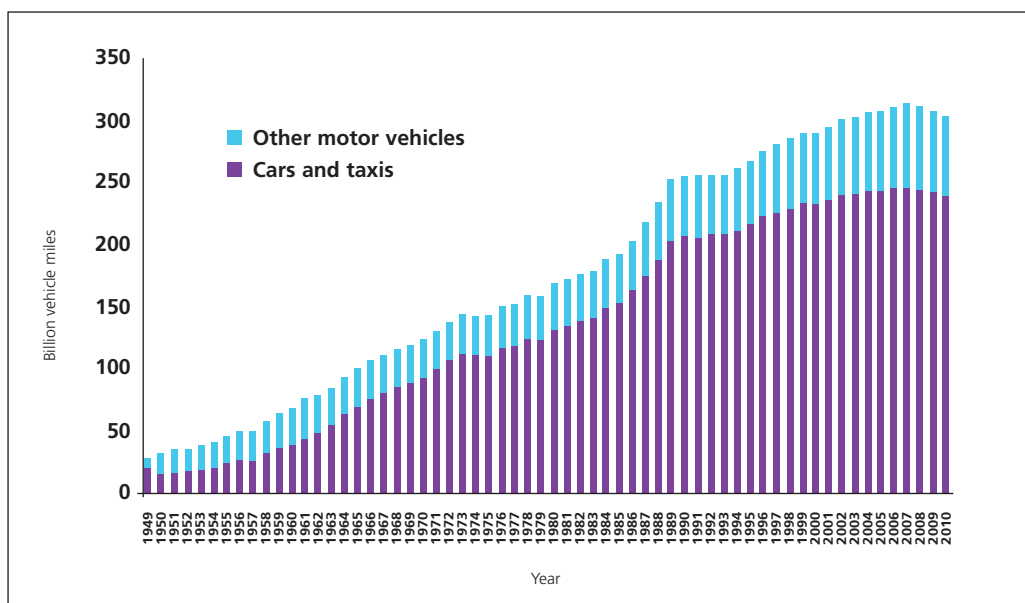
Source: Department for Transport (2012) *National road traffic survey*. London: Department for Transport.

In the UK, the cost of car use has decreased in real terms over the past 30 years.[39] Once the purchasing and annual costs of owning and running a car are paid, it is relatively inexpensive and affordable to a large proportion of the population to pay the marginal costs[c] of car ownership, despite recent increases in fuel prices. This contrasts with the public's perception of driving, which is widely perceived to be an expensive mode of transport, especially in comparison to travelling by public transport (see **Appendix 2**).[40, 41]

Falls in the real cost of car use has contributed to an increase in car ownership. Between 1985-86 and 2010, households in England, Scotland and Wales with access to a car increased from 62 per cent to 75 per cent.[42] In Northern Ireland, the proportion of households with access to a car has been steadily increasing for the past five years, and in 2010-11 was at 78 per cent.[43]

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c   The marginal costs of owning a car includes the costs of fuel, tyres, service labour costs, replacement parts, parking and tolls, motor vehicle insurance and taxation. Marginal costs are distinct from average costs of car ownership. Average costs include all these values, as well as an initial (generally) high cost of purchasing a car. When talking about the marginal costs of car use, travelling by car is generally seen as inexpensive, however, when considering the average prices or travelling by car, it is often more expensive than alternative methods of transport.

Once a car has been purchased, travelling by car is substantially cheaper than the cost of a public transport journey. This has led to a situation where, for car owners, mixed use of public transport and car use is economically prohibitive because of the greater cost associated with public transport. The real cost of car use has declined by 17 per cent between 1980 and 2009 (see **Figure 3**), and in real terms the average weekly spend on motoring has decreased from £68.27 in 2000-01 to £63.60 in 2008, although recent increases in fuel prices may lead to this figure increasing.[39, 44, 45] Buses and coaches, in contrast, have seen fares rise by an average of 55 per cent, while rail fares have increased by an average of 49 per cent over the same time period (see **Figure 3**).[44] This has been mirrored by dramatic increases in numbers travelling by car, not seen with other forms of transport.[46]

Figure 3 – changes in the real cost of transport and in income in the UK, 1980 to 2009
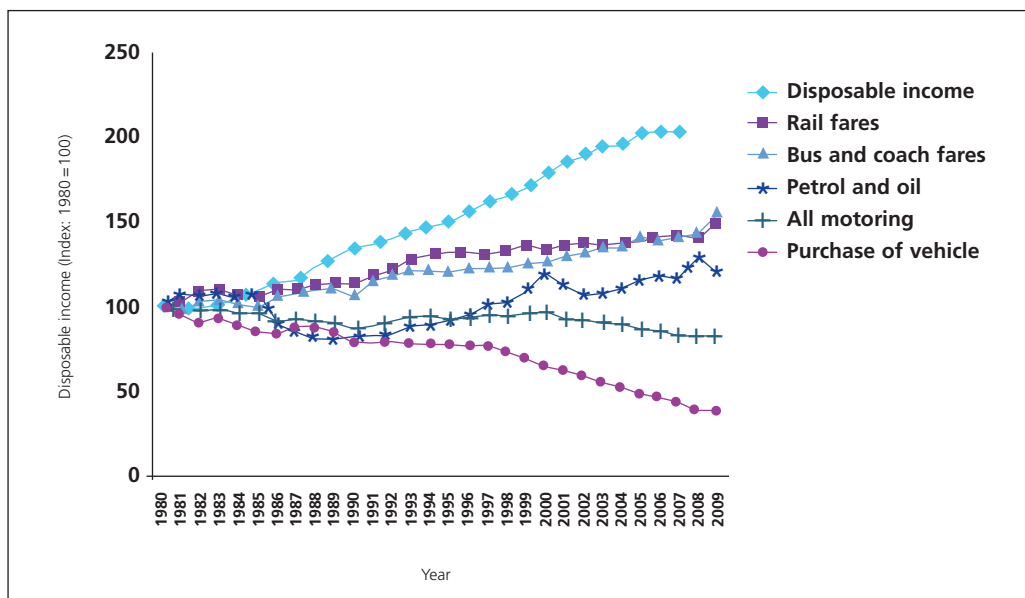
Source: Department for Transport (2010) *Transport trends: 2009*. London: Department for Transport.

Despite the relative inexpensiveness of car use, access is not equitable. The initial high cost of car ownership is prohibitive for individuals from lower socioeconomic backgrounds. The Sustainable Development Commission examined equity and access to transport, and found that in the lowest income quintile, fewer than half of adults hold a driving licence and less than half of households have a car.[47] Half of all households in the highest income quintile have two or more cars. Almost two thirds of those claiming income support or jobseeker's allowance do not hold a driving licence or have access to a car.[47] This is particularly concerning, given that the marginal costs of car ownership have been shown to be less than public transport costs. The disproportionate impact of transport on the finances of lower income groups has contributed to a situation whereby individuals in these groups travel up to two and a half times less than those in the highest income bracket.[47]

4.3 The need to reduce car use

Reduced traffic volume improves road safety and creates a safer environment for active travel. Modelling has suggested that shifting transport away from car use will have health benefits.[24] A strategy focusing on reducing car use and increasing walking and cycling in London, for example, will save 7,332 disability adjusted life years (DALYs) and 530 premature deaths per million population.[24] A strategy focusing only on lower emission motor vehicles will save 160 DALYS and 17 premature deaths per million population.[24] Combining the two strategies could save 7,439 DALYs and 541 premature deaths per million population.[24] These health benefits would be achieved primarily through reductions in local air pollution and increases in physical activity in the population, and are mediated through decreases in ischaemic heart disease, cardiovascular disease (CVD), breast cancer, colon cancer, dementia, and depression.[16-19]

Reducing car use would also reduce congestion on UK roads. The majority of congestion occurs during peak periods, such as commuting.[48] The average vehicle delay from congestion in the UK in 2010 was approximately 3.55 minutes for every 10 miles travelled.[49] Congestion is reported to be worse in and around towns, as opposed to major travel routes.[48] In many towns and cities, such as Central London, travel by bicycle is faster than driving over short distances, due to severe congestion, and despite the modest state of cycling infrastructure in most urban areas.[50] Research from the US has estimated that the public health impacts of traffic during periods of congestion may lead to an estimated 3,000 deaths per year.[51] The cost of congestion is high, and can add up to as much as 3 per cent of a city's gross domestic product (GDP).[33, 51] The Cabinet Office estimates that congestion costs nearly £11 billion per year to the English economy (see **Figure 4**).[52]

Figure 4 – wider costs of transport in English urban areas, 2009
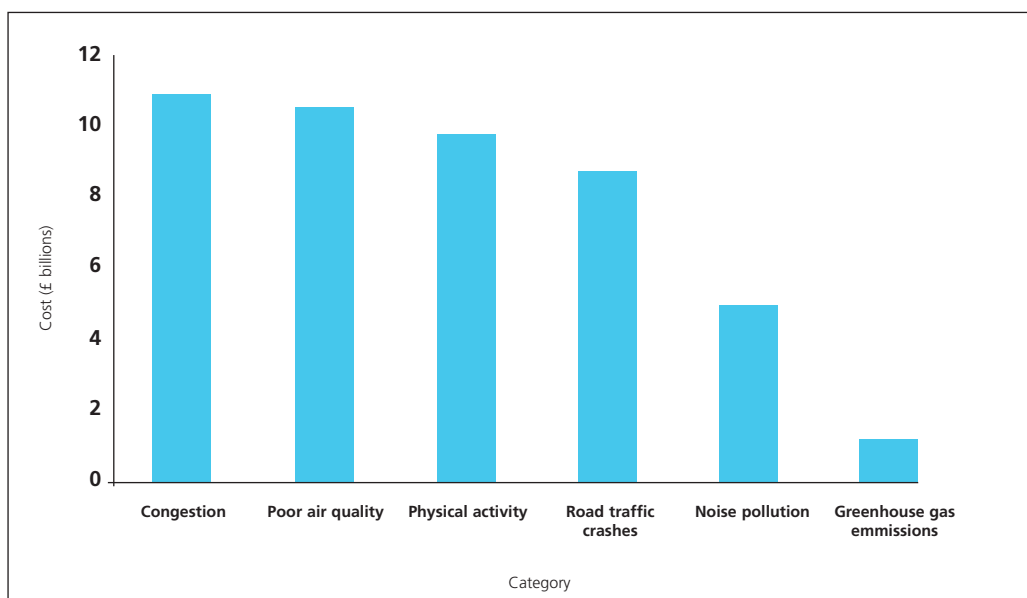
Source: The Cabinet Office (2009) *The wider costs of transport in English urban areas in 2009.* London: The Cabinet Office.

Congestion is a major problem on many UK roads. Car use in the UK continues to increase at a rate greater than new roads are being built, and new roads appear to encourage more car use. It is has been suggested by the Transport and Health Study Group (THSG) that the UK road system is saturated, and therefore the development of any new road system will, rather than alleviating congestion, invite more car users.[16] This leads to greater overall emissions, and does not reduce congestion levels.[16,53] Suppressed demand has meant that more people wish to use roads than there is capacity for.[16] Any new developments to reduce congestion will therefore be negated by roads reaching optimum capacity.[16] It is only through the development of more attractive alternatives to car use that congestion can effectively be reduced.[16]

4.4 Reducing demand for car use: areas for action

Measures that discourage car use have been shown to be effective in reducing demand for transport.[54-60] Reallocation and prioritisation of road space towards more sustainable forms of transport are also effective in promoting their use.[61]

Promotion of sustainable forms of travel

The majority of car journeys in urban areas are less than five miles, so there is scope to reduce the number of shorter car journeys by shifting to active travel, with longer journeys moved to public transport. In London, 11 per cent of all car journeys are less than 1.2 miles, and 55 per cent are less than five miles.[24] Across the UK, nearly one quarter are within one mile, and over 40 per cent are within two miles.[62] This is because the current transport environment favours travelling by car, which for many represents the most convenient and safest method of reaching destinations. With appropriate policy action it is likely that a proportion of these journeys can instead be made by cycling and walking.

Road charging

Road charging can influence decisions to drive, and positively benefit health through reducing traffic volume and improving local air quality.[63,64] The introduction of the London congestion zone has been accompanied by reductions in volumes of traffic. By 2009, traffic entering the congestion zone fell by 20 per cent, with traffic within the congestion zone down by 16 per cent, when compared to pre-congestion zone levels.[64] Around 100,000 motorists pay the congestion charge each day.[64] Increases in the number of passengers entering Central London by public transport were also seen at the time of the introduction of the London congestion zone (see **Figure 5**).[65] Up to a half of that growth was estimated to be displaced car travellers transferring to the bus network.[64,65] This is thought to be partly because of the increased reliability, and speeds seen on London buses since the introduction of the congestion zone.[64] The number of pedestrians and cyclists entering Central London were also shown to increase following the introduction of the London congestion zone.[65]

Figure 5 – bus passengers entering central London during the morning peak, 1978 to 2009
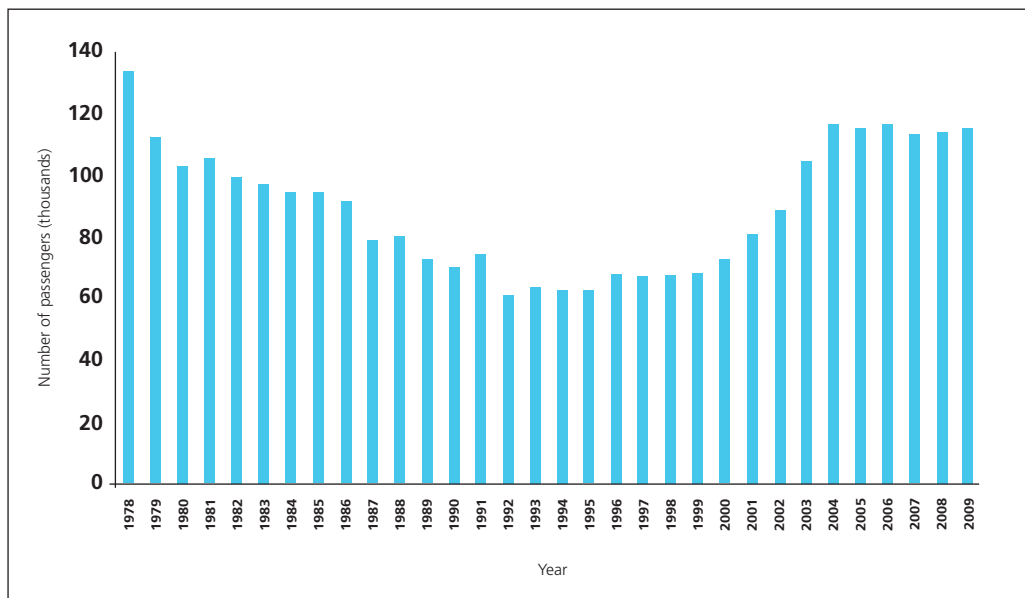
Source: Transport for London (2010) *Travel in London: report three*. London: Transport for London.

The congestion charging scheme has reported impressive health benefits, in terms of reductions in air pollution levels.[63] Research has demonstrated that after three years of implementation, the introduction of the congestion zone was associated with 19 per cent reductions in CO_2 emissions.[64] Within the congestion zone, 420 years of life per 100,000 residents are projected to be gained over a ten year period, attributed to reductions in nitrogen oxides (NO_x)[d] and particulate matter.[64] The 2010 Marmot review, highlighted that the largest improvements in air quality have been seen in the most deprived areas of London.[2]

Parking restrictions

The provision, cost and accessibility of parking influences driving behaviour.[66] Parking also creates obstructions that can impair visibility of pedestrians to drivers. This can affect road safety and uptake of active travel, as well as contributing to community severance.[54] The THSG have suggested that the provision of free parking in residential, commercial and town centres effectively subsidises car use, distorting the real costs of driving. This is because the costs of providing free parking are partially incurred by local authorities and commercial businesses.[54]

The availability of parking in residential and commercial areas encourages driving and discourages active travel. New residential developments that have limited residential car parking to between 0.4–0.7 spaces per unit have seen reductions in car use.[55]

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d   Nitrogen oxide is a generic term for the mono-nitrogen oxides nitric oxide (NO) and nitrogen dioxide (NO_2).

Speed limits and traffic calming

Traffic calming comprises a series of measures to reduce the volume and speed of vehicles on roads. Higher traffic speed is known to result in more severe injuries. Traffic calming can benefit health through increasing active travel levels, pedestrians and cyclists are safer on roads with lower speed limits.[56] Traffic calming can also contribute to improving the local environment, as well as reducing community severance.[56]

A number of traffic calming measures are known to impact on road traffic volume and road safety. Strategies include slowing down traffic (eg road/speed humps, mini roundabouts), visual changes (eg road surface treatment, changes to road lighting), redistributing traffic (eg blocking roads, creating one way streets), as well as changes to road environments (eg increased trees and shrubs along roads which provide a buffer between vehicles and pedestrians).[56, 67, 68] Speed cameras can be used to enforce speed limits and reduce traffic speeds, as well as being an effective intervention in reducing road traffic crashes and related casualties.[57]

Area-wide approaches to traffic calming are the most effective. The use of area-wide 20 miles per hour zones have been shown to decrease the speed and volume of traffic, decrease total road traffic injuries, and increase walking and cycling.[60] Traffic calming measures that elicit a one mile per hour reduction in mean speed, can result in a 5 per cent reduction in injuries and collisions.[59] In some traffic calmed areas, collisions have been reduced by between 60 to 70 per cent following speed reductions of nine miles per hour.[56] A 2009 study by Grundy et al demonstrated that, in London, 20 miles per hour zones decreased injuries by 40 per cent on average, and by 50 per cent in the most deprived areas.[2,60]

The use of area-wide 20 miles per hour speed limits is advantageous to designated 20 miles per hour zones: the use of zones requires changes to road infrastructure while area-wide speed limits only require signage. Modelling of the impact of reducing the speed limit in built-up areas across Northwest England from 30 to 20 miles per hour found that, between 2004 and 2008, an average of 140 killed or seriously injured child casualties could have been avoided each year.[69] The BMA has previously called for 20 miles per hour speed limits near schools and in residential areas, and this approach is supported by a wide range of transport and public health organisations.[70]

Car sharing

Car sharing is when two or more people share a car or travel together. Increasing vehicle occupancy benefits health through alleviating congestion, as well as noise and air pollution. Car sharing can also contribute to reducing individual travel costs.

Schemes targeted at the daily commute may operate across a number of different employers in an area, or for parents taking children to and from school. Car sharing schemes and car clubs can be effective in reducing total car use, parking space requirements, and individual travel costs, without negatively impacting on the use of other forms of transport.[71]

Examples of good practice in car sharing schemes include Peterborough, which engages with business to promote car sharing. Businesses are encouraged to implement a number of simple measures to increase the number of people car sharing. These include:
- providing dedicated priority parking for staff who car share
- providing a guaranteed ride home service for car sharers in case of an emergency
- holding a 'car share coffee morning' where staff interested in car sharing are invited to meet potential sharers, receive guidance and have questions answered
- offering incentives to car sharers, for example prize draws for a free car wash or MOT, and ensuring the scheme gets internally publicised.[72]

Despite small pockets of good practice, the availability and uptake of car sharing schemes in the UK is relatively limited.

Reducing the need for travel
Congestion, overcrowding and transport emissions could all be reduced if people travelled less. Technologies such as tele- and video-conferencing are becoming common and accepted in business practice as they become more sophisticated, reliable and available. These technologies will be able to replace an increasingly larger proportion of business travel, which makes up a large component of transport in the UK and internationally. Reducing commuting is also a step that can be taken to reduce travel. Approaches include working on fewer days in a week and greater use of home working. It should be noted, however, that these approaches may not be appropriate for all types of jobs, especially healthcare.

Areas for action
- Transport policy should aim to reduce congestion and improve the usability of roads by pedestrians and cyclists through reallocation of road space, restricting motor vehicle access, road-user charging schemes, and traffic-calming and traffic management (including area-wide 20 miles per hour speed limits).
- There should be further development of, and incentives for, alternatives to traditional car usage patterns such as workplace car sharing schemes and car clubs.

4.5 Lower carbon transport
Creating an environment where there is less demand for car use is a long-term objective. In the interim, the development of low carbon technologies are important to mitigate some of the negative health harms associated with car use. Advances in vehicle technologies include developments to engine technologies, vehicle design, and types of fuel used. It is important that this investment is coupled with a commitment to encouraging a modal shift away from car use, and the prioritisation of active travel and sustainable forms of transport. This is because, while increasing the efficiency of cars over a limited period appears to improve their impact on health and the environment, when considered over a longer time frame, any improvements in efficiency may be negated by increasing numbers of cars on the road.[73,74]

Engine technologies

Internal combustion engines

Cars driven by an internal combustion engine (ICE) produce a number of emissions, mainly in the form of CO_2. Car manufacturers expect ICE cars to remain their core business over the next 20 to 30 years, but accept that developments, such as improved fuel systems, advanced transmission, and hybrids, could deliver additional efficiency gains.[73] Efficiency alone is unlikely to reduce total emissions, because it also leads to an increase in demand.[75] Engine efficiency increased 30-fold over the 20th century, but has led to more car use, and therefore increased emissions.[63,76] Historically, efficiency gains in engine technologies have translated into greater affordability of travelling by car. Without regulation, this greater affordability will translate to more vehicle use and increases in distances travelled, which will lead to rises in emissions, rather than reductions.

Electric vehicles

Electric vehicles have no exhaust emissions, and produce no emissions at the point of use.[75] It should be noted, however, that there is an environmental impact from the manufacture and production of electric vehicles, as with the production of all other car technologies.

If recharged from renewable energy sources, electric vehicles are considered to be less damaging to health, with near-zero emissions. This is in terms of improved local air quality to drivers, other road users, and pedestrians. The main source of energy production in the UK comes from petroleum, coal, and natural gas, accounting for 88 per cent of all energy production in the UK, with renewable energy accounting for under 7 per cent of energy production.[77] The number of electric vehicles recharged from renewable energy sources can be assumed to be low.

Hybrid technologies

Hybrid technologies increase the overall efficiency of a vehicle and reduce exhaust emissions. A hybrid vehicle combines an ICE with a battery and an electric motor. Many manufacturers consider hybrids to be part of the short- to medium-term future of private transport.[73]

It is important that any developments and expansion in the use of automotive batteries for cars takes into consideration the need to dispose them in a way that does not negatively impact on health and that complies with European legislation.[e] Batteries contain chemicals such as lead, mercury or cadmium. When these are disposed of within the normal waste stream the majority will end up in landfill site where the chemicals they contain may leak into the ground. This can pollute the soil and water and potentially harm health.

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e   Directive 2006/66/EC aims to reduce the exposure of hazardous substances to the environment by prohibiting the sale of most batteries and accumulators with a high mercury or cadmium content. It also establishes rules for the collection, recycling, treatment and disposal of batteries and accumulators.

Fuels

Oil-based fuels

Oil-based fossil fuels – primarily petrol and diesel – provide for nearly all of the UK's transport needs.[78] These types of fuel are a source of CO_2 emissions and a range of pollutants, and are inherently unsustainable. Stricter fuel requirements have removed, or reduced, a number of the hazardous compounds, such as sulphur, that used to be commonly found in oil-based fuels.

Biofuels

Biofuels are derived from vegetation – a renewable resource. The introduction of biofuels requires relatively little in the way of modification to existing transport infrastructure.[73] Biofuels are often described as carbon neutral, because although they emit CO_2 when burned, CO_2 has been absorbed from the air during plant growth. This carbon neutrality is dependent upon the crop, its cultivation, and processing, which each have energy costs.

Biofuel production can involve land use change away from food production, and result in destructive practices such as deforestation and intensive agriculture.[79] There is a growing consensus that first generation biofuels, traditionally produced from cereal crops (wheat, maize), oil crops (rape, palm oil) and sugar crops (sugar beet, sugar cane), will have a limited role in providing a sustainable alternative to oil-based fuels due to their impact on the environment and food security. Second generation biofuel technologies, may offer a greater potential as they often involve the consumption of waste residues and use of abandoned land not in competition with food production. Second generation biofuels are produced from cellulosic materials. These raw material options may result in the production of more fuel per unit of agricultural land used, and require less chemical and energy input per production and harvesting. Such raw materials may be considered more sustainable.

Hydrogen

Hydrogen (H_2) is highly combustible and can be used in fuel cells and ICEs to power vehicles. Hydrogen combustion produces minimal pollutants – the main emission is water vapour. Hydrogen can be generated from fossil fuels such as coal and gas, which produces CO_2 emissions. It can also be generated from water using electricity which, if it comes from a sustainable energy source, does not produce as much CO_2 compared to coal, gas and petroleum energy production. Barriers to the common use of H_2 as a power source centre on a lack of market demand, combined with the need for carbon-free production, storage and distribution challenges, and safety issues.[73] Despite this, H_2 is recognised as being a possible long-term zero-emissions alternative to the use of oil-based fuels.[73]

Area for action

- Low carbon transport options and energy efficient technology should be adopted where car use and motorised transport is necessary. Any efficiency savings in engine technologies should be accompanied by regulation that prioritises active and sustainable forms of transport, and planning decisions that prioritise accessibility over mobility, to ensure efficiency savings are not translated into a higher prevalence of car use.

5. Air and noise pollution

5.1 Health effects of air pollution

Transport is a major source of air pollution.[80] There is considerable evidence that long-term exposure to air pollutants affect health. Road-traffic emissions come from a number of sources including exhaust pipe emissions and re-suspended road dust. The main pollutants from road traffic include:

- particulate matter less than 10 or 2.5 microns (PM_{10} and $PM_{2.5}$ respectively)
- nitrogen dioxide (NO_2)
- sulphur dioxide (SO_2)
- benzene and other volatile organic compounds (VOCs)
- ground-level ozone (O_3) formed by interaction of VOCs with NO_x in the presence of sunlight and heat.

It is estimated that in the UK, air pollution is associated with 50,000 premature deaths per year.[81,82] Research from 2010 estimated that in the UK particulate matter from transport leads to an average loss of life expectancy of six months, with 18.2 to 32.4 million life years lost.[83] Higher summer temperatures are expected to exacerbate the health effects of air pollution in urban areas, and ground-level ozone may contribute up to an additional 1,500 deaths per year in the UK.[84]

Long-term exposure to these pollutants has been shown to decrease life expectancy.[85] Fine and ultra fine particulate matter in air pollution increases cardiovascular morbidity and mortality, incidences of life-threatening myocardial infarctions, cardiac arrhythmias, and respiratory illness.[85] Inhalation of PM_{10} and NO_2 from road traffic pollution is associated with an increased acute risk of myocardial infarction for up to six hours after exposure.[86] Ambient concentrations of air pollutants can aggravate asthmatic symptoms, but exposure to air pollutants does not appear to be a direct cause of asthma.[87]

There is a growing body of evidence showing that prenatal exposure to air pollution is associated with a number of adverse outcomes in pregnancy. These include low birth weight, intrauterine growth retardation, and an increased risk of chronic diseases in later life.[11-16] Emerging evidence also suggests that long-term exposure to particulate matter, at levels such as those seen in major cities, can alter emotional responses and impair cognition.[88]

In urban driving conditions, vehicle engines are inefficient and generate more emissions per kilometre than on motorways.[62,89] The one exception to this is ground-level ozone pollution, which also affects rural areas.[16] A large proportion of individuals travel relatively short distances by car, but they may experience substantial exposure to pollutants. Many transport micro-environments, such as main roads, are heavily polluted, and most journeys, which often include commuting to and from work, or taking part in the school-run, are made during rush hours. During these time periods increased volume of traffic results in up to three times greater ambient pollution levels, as demonstrated in **Figure 6**.[89]

Figure 6 – relative exposure concentration of fine particulate matter, and the influence of traffic, according to the time of day
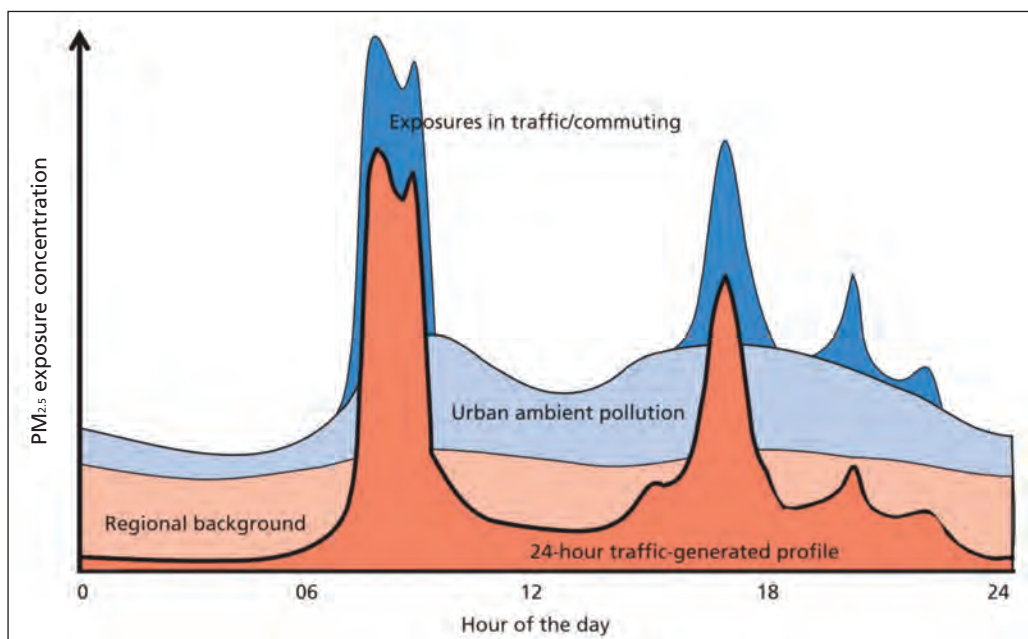
Source: World Health Organization (2005) *Health effects of transport related air pollution*. Copenhagen, Denmark: World Health Organization.

Individuals who reside or work near busy roads are at particularly high risk of exposure to the health harms of air pollution.[89] The same is true of those that spend longer in traffic.[89] Car occupants are typically exposed to higher levels of air pollution than cyclists or pedestrians.[89] This is, in part, because cyclists and pedestrians can use quieter streets with lower traffic volumes, which are less heavily polluted.[89] A 2011 study conducted by Sustrans, found that the air quality on London greenways (safe, quiet routes through parks, green spaces and lightly trafficked streets) was significantly better than on adjacent busy roads.[90] Congestion is also strongly associated with air pollution, with pollutant levels generally higher inside vehicles than in ambient air.[89]

A close link has been shown between areas of high deprivation and pollution. Research has demonstrated that those living in more deprived areas are exposed to higher concentrations of air pollution, often because homes and residences of these groups are situated next to roads with higher concentrations of emissions (see **Figure 7** and **Figure 8**).[91] Deprived communities suffer greater burdens from air-pollution-related death and sickness. As highlighted in the 2010 Marmot Review, individuals in deprived areas experience more adverse health effects at the same level of exposure compared to those from less-deprived areas.[2] This is, in part, because of a higher prevalence of underlying cardio-respiratory and other diseases, as well as greater exposure to air pollution as a result of homes being situated nearer to busy congested roads and with fewer green spaces.[2,82]

Figure 7 – social distribution of UK air quality concentrations, 2001
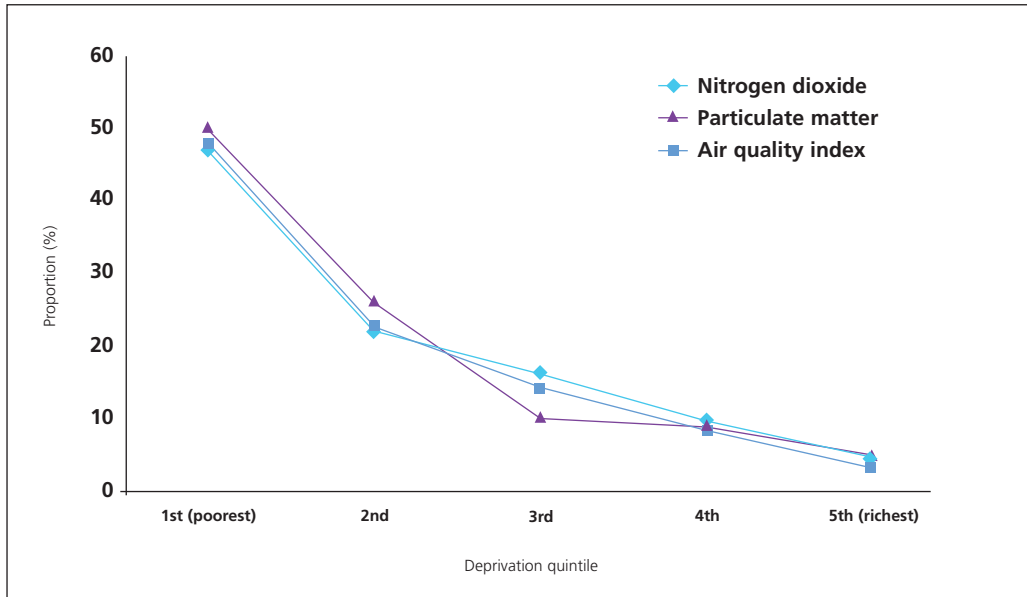
Source: Environment Agency (2003) *Environmental quality & social deprivation – phase II: national analysis of flood hazard, IPC industries and air quality*. Bristol: Environment Agency.

Figure 8 – social distribution of UK air quality concentrations, 2010[f]
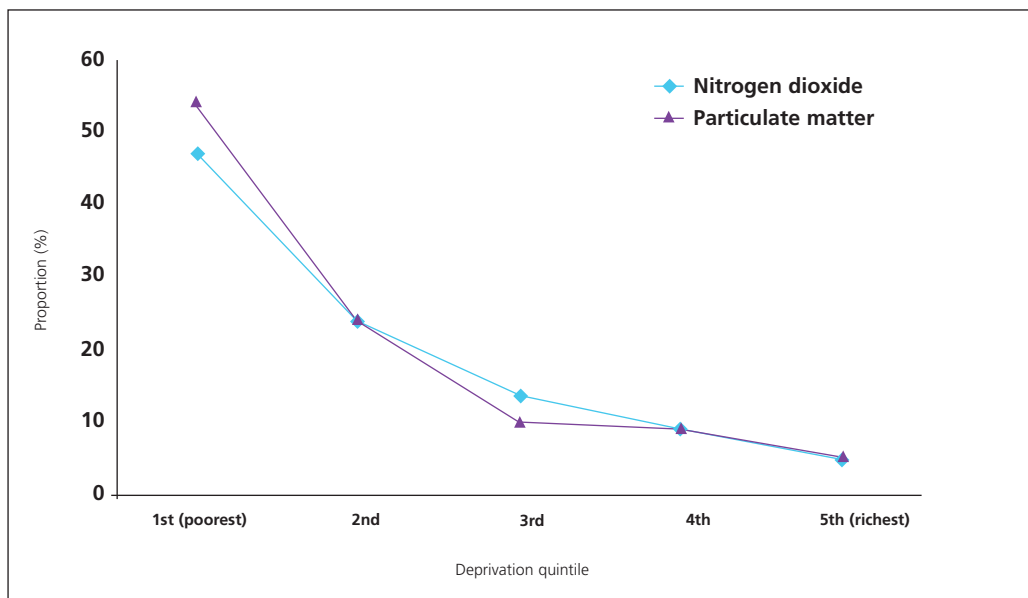
Source: Environment Agency (2003) *Environmental quality & social deprivation – phase II: national analysis of flood hazard, IPC industries and air quality*. Bristol: Environment Agency.

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f   Please note, levels for 2010 are estimates.

People living near large airports may experience greater exposure to air pollution. This can directly affect health and quality of life.[92] Exposure to air pollutants within these neighbourhoods may be influenced by:

- emissions from aircraft activity
- emissions from ground support equipment and other sources involved in ground operations
- traffic, created by passengers and staff travelling to and from airports.[93]

Air pollutant levels around large airports are similar to those seen in urbanised areas, and are to a large extent determined by road traffic emissions.[93]

5.2 Measures to reduce air pollution

Reducing levels of air pollution can have positive impacts on health. A number of studies have demonstrated that reducing air pollution in cities results in decreased cardiovascular and respiratory illness and mortality, and increased life expectancy.[15-17] Effective interventions specifically targeted at reducing transport-related emissions, such as those seen in Tokyo (see **Box 1**), range from general improvements in the transport sector's efficiency, to more specific regulatory, policy and institutional developments, including low emission zones.

Box 1 – measures to reduce air pollution in Tokyo

In 2000, the Tokyo Metropolitan Government amended its Pollution Control Ordinance in response to concerns over air pollution from road transport. The regulations achieved a reduction in exhaust particulate emissions from diesel-powered trucks and buses by 17 and 31 per cent in 2003 and 2004, respectively. This was achieved through the promotion of diesel particulate filters, oxidation catalysts, and by accelerating fleet turnover. Modest emission reductions were also observed for NO_x. These measures were shown to save 730 billion Japanese Yen (¥) (£5.97 billion) in avoided healthcare costs for adults, and ¥93billion (£760 million) for children.[94] The control programme implemented in Tokyo has been shown to have a cost benefit of six Yen for every one Yen spent.[94]

Green spaces can also play a role in controlling air pollution. Research has demonstrated that SO_2 and PM_{10} absorption by trees saves between five to seven deaths, and between four to six hospital admissions, per square kilometre.[95]

Low emission zones are areas or roads where the most polluting vehicles are charged or restricted from entering. It has been shown that, in the short-term, it is more efficient and cost-effective to tax polluting vehicles than to subsidise cleaner alternatives.[53] Low emission zones are an effective way of reducing emissions, through discouraging the widespread use of high emission vehicles and promoting the purchase of low emission vehicles. Low emission zones are often implemented to improve the air quality in areas where air pollution has reached levels dangerous to health. A low emission zone has been introduced in London in order to address air pollution levels that are in

breach of EU air quality targets[9] (see **Box 2**). Modelling conducted by the Greater London Authority, shows areas that exceed the annual mean NO_2 (2010) EU limit, (shaded yellow and red in **Figure 9**). In some of these locations the limit value is exceeded by a factor of two or more.

Low emission zones have been shown to be highly effective in reducing emissions in Europe. In Berlin, the low emission zone has reduced diesel emissions by 24 per cent and PM_{10} by 8 per cent.[96] Low emission zones in the Swedish cities Stockholm, Gothenburg and Malmo are estimated to have reduced exhaust particulate matter emissions from heavy goods vehicles (HGV) by 40 per cent.[97]

Figure 9 – modelled London nitrogen dioxide (NO_2) average concentration, 2011
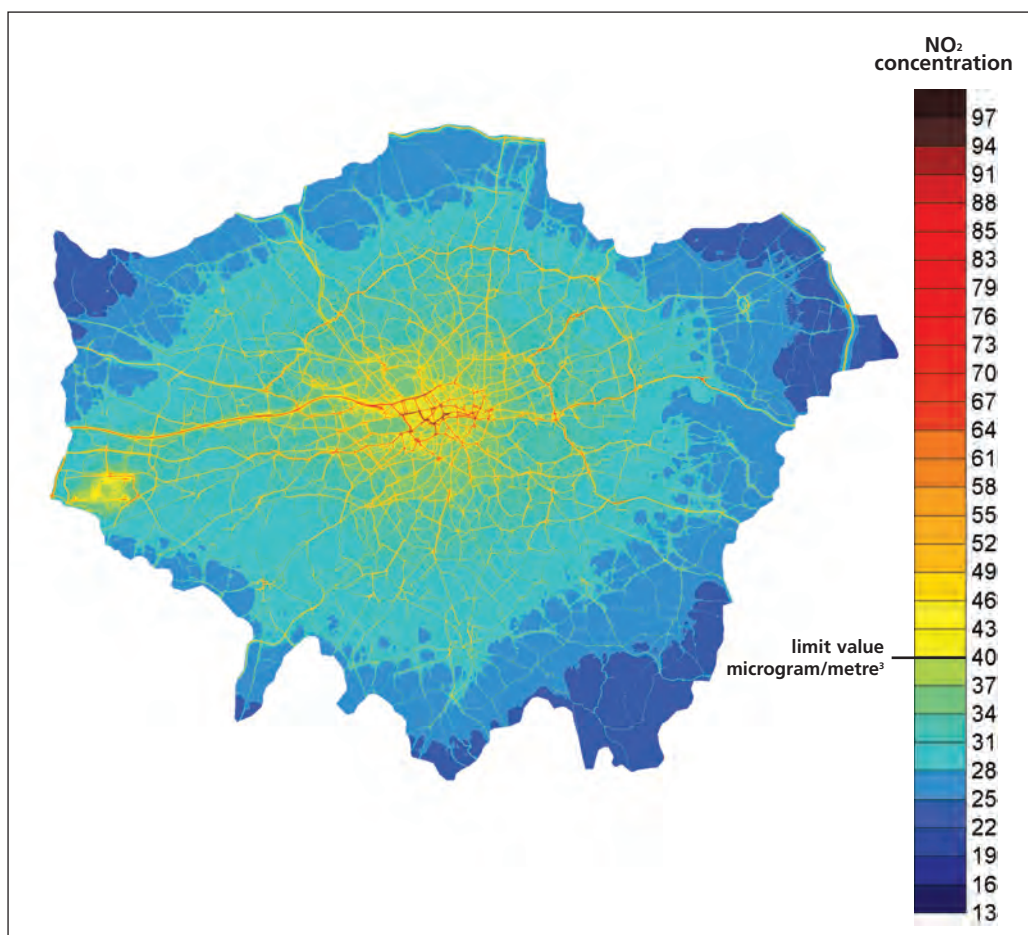
Source: Greater London Authority (2011).

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g   The European Commission Air Quality Directive sets legally binding limits on a number of pollutants including particulate matter, SO_2, and NO_x. Greater London is in breach of the air quality limits set in the Directive, and may face substantial fines if measures to reduce air pollution in the capital – in particular with respect to PM_{10} levels – are not urgently implemented.

Box 2 – the London low emission zone

The London low emission zone operates all year round on all roads within Greater London. There are no barriers or tollbooths within the London low emission zone. Cameras read number plates within the low emission zone and check against the Transport for London (TfL) database of registered vehicles. Vehicles weighing 3.5 tonnes and over that do not confirm to Euro IV levels for particulate matter (the Euro IV levels place limits on a vehicle's emissions) are charged between £100 to £200 a day, depending on the size of the vehicle.

Source: www.lowemissionzones.eu

The feasibility study for implementation of the London low emission zone predicted improvements in air quality throughout and beyond Greater London, through a reduction in the number of heavy polluting vehicles entering London, as well as an increase in low emission vehicles.[97] Improvements are expected to contribute to reductions in respiratory disease and CVD, as well as contributing to a reduction in health inequalities in deprived communities.[97]

It is estimated, based on observed data, that in 2008, the scheme produced savings of 28 tonnes of PM_{10}, 26 tonnes of $PM_{2.5}$, and 529 tonnes of NO_x.[98] While in line with TfL forecasts, these figures equate to modest reductions in total emissions, with a 1.9 per cent reduction of total road traffic PM_{10} emissions, a 2.4 per cent saving of road traffic exhaust emissions of $PM_{2.5}$, and a 2 per cent saving of total road traffic exhaust emissions.[98] Further evaluation is required on the impact on health of the low emission zone.

5.3 Transport-related noise pollution

Transport is the leading cause of noise pollution.[47] In addition to annoyance and sleep disturbance, there is increasing evidence that transport noise adversely affects the cardiovascular system (including increasing blood pressure), mental health, and school performance in children.[30,99] Motorised transport is the main source of noise pollution. Sustainable forms of transport, such as active travel and electric vehicles, do not contribute to noise pollution levels.

A 2005 European study, estimated that 3,900 myocardial infarctions per year could be attributed to traffic noise in Germany.[100] Road traffic noise exposure has also been linked to increased rates of hypertension and psychological problems, including anxiety symptoms.[100] There is strong and consistent evidence that the most common effect of excessive noise on children is cognitive impairment.[101, 102]

A meta-analysis of studies of road traffic noise and CVD suggests that for noise levels between 60 decibels (dB) and 80 dB, the relative risk of CVD increases significantly.[103] **Figure 10** depicts road noise in and around BMA House, located in central London. As is apparent, a large proportion of main roads in this area exceed 60dB.

Figure 10 – noise map of an area of Central London, 2012

BMA House

Source: www.defra.gov.uk (accessed May 2012)

Roads, railways and airports are the main sources of ambient transport noise.[104] Road vehicle noise is created by tyres interacting with the road, as well as the noise from engines, exhaust systems, transmissions and brakes.[16] Tyre-road interaction is the main cause of noise from cars travelling at high speed, while engine noise is the predominant source of noise for cars travelling at lower speeds.[16]

Epidemiological studies show that socially disadvantaged people are more likely to live near busy roads, and are at greater risk of the negative effects of noise pollution.[105]

The aviation industry is also a significant source of noise. For many living around airports, noise is the most evident health impact of aviation.[106] Research has demonstrated that those living near civil and military airports are adversely affected by take off and landing noise. Ground noise (including taxiing aircraft, engine testing generators or airport-related traffic) can are also be a source of noise pollution.[106]

5.4 Measures to reduce noise pollution

There are two main ways to reduce noise pollution. Noise can be reduced at source, through measures relating to vehicles, tyres, road surfaces and traffic management. Alternatively, noise can be abated by anti-propagation methods, such as policy measures that increase the distance between the source and recipient, or hampering noise propagation by insulating buildings or constructing noise barriers.

Measures that tackle noise at the source have the greatest potential to reduce exposure. Research has demonstrated that at source measures can reduce exposure to noise pollution by up to 70 per cent.[107] It is estimated that the health benefits of taking action to make low noise tyres and low noise road pavements, are on average two to four times higher than their cost.[108]

At source measures are generally preferred to anti-propagation policy measures. This is, in part, because anti-propagation methods are not cost-effective, especially if implemented without also taking action to reduce at source noise.[108] Given penetration of new technologies within the vehicle fleet for cars and public transport can take a long time, at source reduction measures based on technological development can take many years to have a positive impact.[108] This is particularly relevant for rail vehicles. Any strategy to reduce noise pollution may need to consider noise propagation policy measures, to ensure it has the optimal impact. The cheapest intervention, and the one with large co-benefits, is speed reduction: this is a further argument for area-wide 20 miles per hour speed limits (see **Section 4.4** for further information).

6. Active travel

6.1 Health benefits of active travel

Active travel can bring about major health benefits and an improved quality of life. Physical activity is a major component of weight control, and key to maintaining the structure and function of muscles, bones, joints and the cardiovascular system.[3] Individuals who are physically active reduce their risk of premature death and of developing major chronic diseases – such as coronary heart disease (CHD), stroke, type 2 diabetes, osteoporosis, depression, dementia and cancer – by up to 50 per cent, and the risk of premature death by up to 30 per cent (see **Figure 11**).[4,5] Mental wellbeing can increase with physical activity.[6,7] The health benefits are widely recognised by the public as an advantage of active travel.[109] The potential for health improvement from active travel, however, does not appear to significantly influence decisions to travel actively (see **Appendix 2**).[109]

Figure 11 – health benefits of physical activity

Cancer
Physical activity can reduce the risk of several types of cancer, including cancers of the breast, colon, prostate, and endometrium.[8-10]

Cardiovascular disease
Regular physical activity is a protective factor for, and reduces the risk of, cardiovascular diseases, including CHD and stroke.[3, 11]

Obesity
Physical activity is a key element in maintaining healthy weight and the prevention of weight gain.[20]

Mental health
Regular physical activity has psychological health benefits, and can lead to improvements in self-esteem and mood, and reduced anger, depression and anxiety.[11-13]

Diabetes
Physical activity has a role to play in the prevention and management of diabetes.[21,22]

Bone density
Physical activity can increase bone mineral density in adolescents, maintain it throughout adulthood, and slow its decline in old age.[14-19]

Source: shutterstock.co.uk

Walking at a moderate pace of three miles per hour expends sufficient energy to meet the definition of moderate intensity physical activity.[11, 110] Research has demonstrated that cycling to and from work can provide exercise of sufficient intensity and duration to improve fitness and health.[111] Travel by bicycle also provides greater increases in measured fitness than walking does.[112] Changing travel behaviour (from motorised to active travel) has been found to be positive for health in children. A 2011 small scale longitudinal study, found that children changing from sedentary school travel to cycling had an improved cardiovascular risk factor profile, compared with children using other means of transport.[113]

Accumulating 30 minutes of moderate intensity physical activity on most days is enough to provide substantial health benefits. This minimum level of activity is recommended by the WHO. Guidance from the UK Chief Medical Officers (CMO) advises that:

• all children and young people (5 –18 years) should engage in moderate to vigorous physical activity (MVPA) for at least 60 minutes and up to several hours every day
• adults (19–64 years) and older adults (65+ years) should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least 5 days a week, or 75 minutes of vigorous intensity activity spread across the week, or a combination of MVPA.[11]

In England, the majority of adults do not engage in recommended levels of physical activity (see **Figure 12**). This equates to 39 per cent of men and 29 per cent of women meeting minimum recommendations for physical activity in adults.[114] In Scotland, 45 per cent of men and 33 per cent of women are not active enough to have a health benefit.[115, 116] For Wales, only 37 of men and 24 per cent of women meet the recommended levels of activity.[117] In Northern Ireland, 44 per cent of men and 35 per cent of women meet the recommend levels of activity.[118]

Figure 12 – prevalence of activity and inactivity among adults in England, 2008
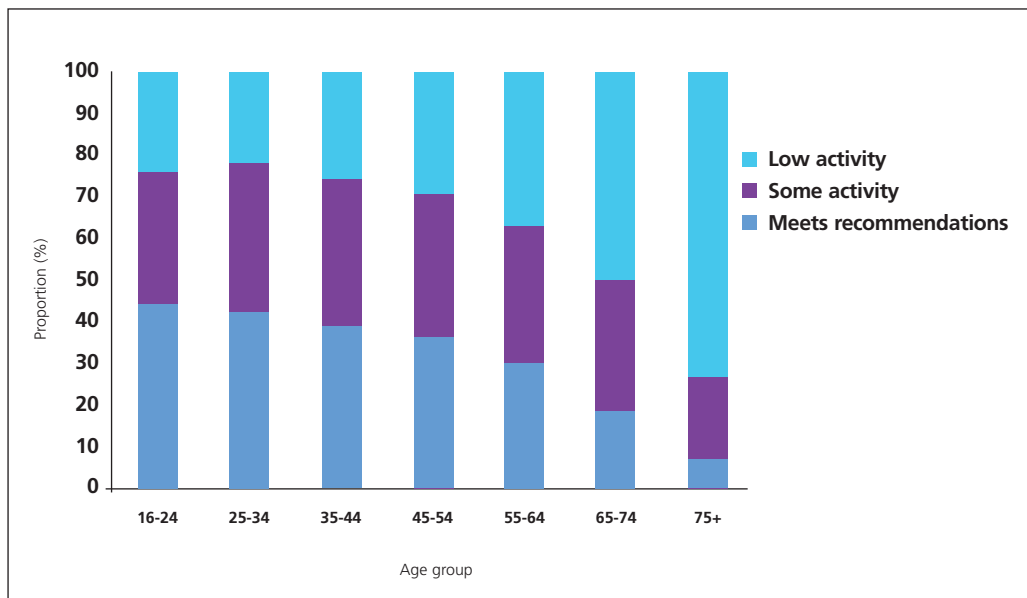
Source: The NHS Information Centre (2009) *Health survey for England 2008: physical activity and fitness*. London: The NHS Information Centre.

The health impacts of sedentary lifestyles

Physical inactivity is the fourth leading risk factor for global mortality.[119] The WHO estimates that overall physical inactivity causes 1.9 million deaths per year worldwide – which accounts for 3.3 per cent of all deaths, and 19 million DALYs globally.[120]

When physical activity levels are low or non-existent, clinical disorders such as CVD, metabolic disorders and some cancers are more likely to occur.[11, 121] Sedentary lifestyles are often associated with other damaging health behaviours such as smoking, alcohol misuse and poor diet.[122] The physical inactivity inherent in certain transport modes can contribute to ill health; a 2004 study found individuals that spent an additional non-essential hour in their car daily, had an increased risk of 6 per cent for developing obesity.[123]

6.2 Cycling and walking levels in the UK

Since 1985, walking and cycling have declined by 19 and 58 per cent respectively in the UK.[124] Approximately a quarter of all journeys are made by walking across all age ranges (see **Figure 13**). As is apparent from **Figure 14**, the average distance walked or cycled per person per year has declined over the past three decades, as has uptake of public transport. In contrast the average distance travelled by car has dramatically increased. These figures suggest that there is scope to increase levels of active travel.

Figure 13 – average number of trips made by mode of transport in UK, 2010
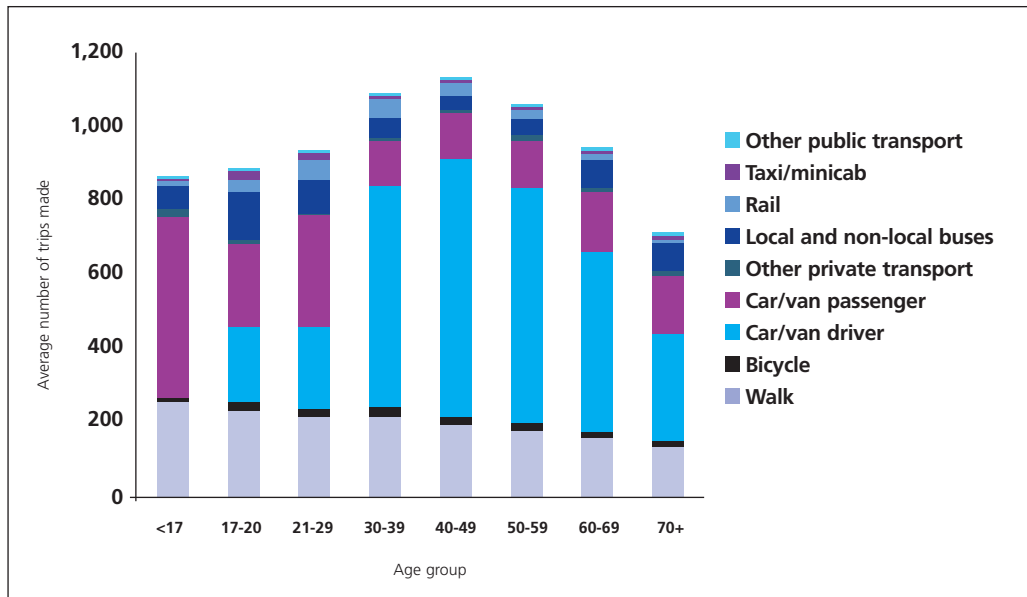
Source: Department for Transport (2011) *National travel survey 2010*. London: Department for Transport.

Figure 14 – average distance travelled in miles, 1976 and 2009

	1976	2009	Change
Walk	408	314	-94
Bicycle	82	73	-9
Car	5,118	8,517	+3,399
Local bus	686	493	-193
Other	1,287	1,444	+157
Total	7,584	10,841	+3,257

Source: Department for Transport (2010) *National Travel Survey 2009*. London: Department for Transport and Department for Transport (2001) *National Travel Survey 2000*. London: Department for Transport.

Walking is widely accessible to the population, and travel by bicycle is the second most convenient form of active travel. It is fast and energy efficient, and can extend the geographical range that a person can easily cover, from approximately two miles for pedestrians to more than five miles for cyclists.[125]

Levels of cycling have decreased over the past 60 years (see **Figure 15**). Research from the Department for Transport (DfT) has shown that of all trips made in the UK each year, trips made by cycling account for only 2 per cent of journeys (an average of 73 miles cycled).[h, 126]

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h   It should be noted that the DfT statistics do not consider journeys made on routes and paths where motorised vehicles cannot go, such as traffic free cycle paths. In addition they only consider a main transport mode, which risks excluding those who may cycle to or from another mode of transport. As such, these figures, while the best available, are likely to under-represent actual levels of UK cycling.

Figure 15 – number of kilometres cycled in the UK, 1949 to 2010
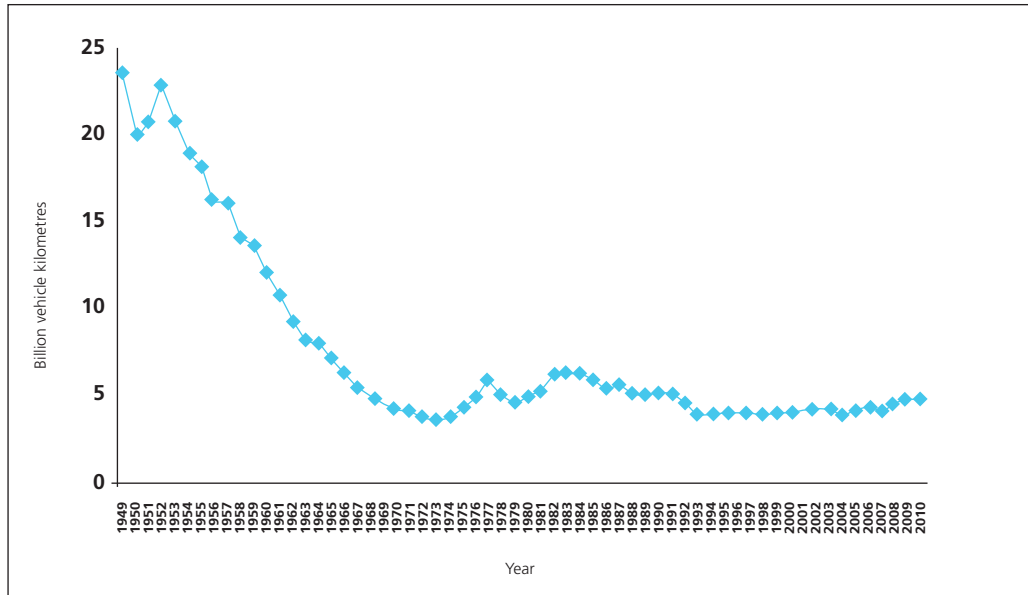
Source: Department for Transport (2012) *National traffic survey.* London: Department for Transport.

Suitable provision of cycling infrastructure is likely to reverse this trend. Unlike the rest of the UK, cycling levels in London are increasing (see **Figure 16**). This is attributed, in part, to London having a higher standard of cycling infrastructure and continual investment.[50] These findings suggest that while the focus on motorised mobility in the UK throughout the 21st century may have led to dramatic falls in cycling levels, if cycling infrastructure is well integrated into the built environment, there is demand and scope for cycling levels to increase.
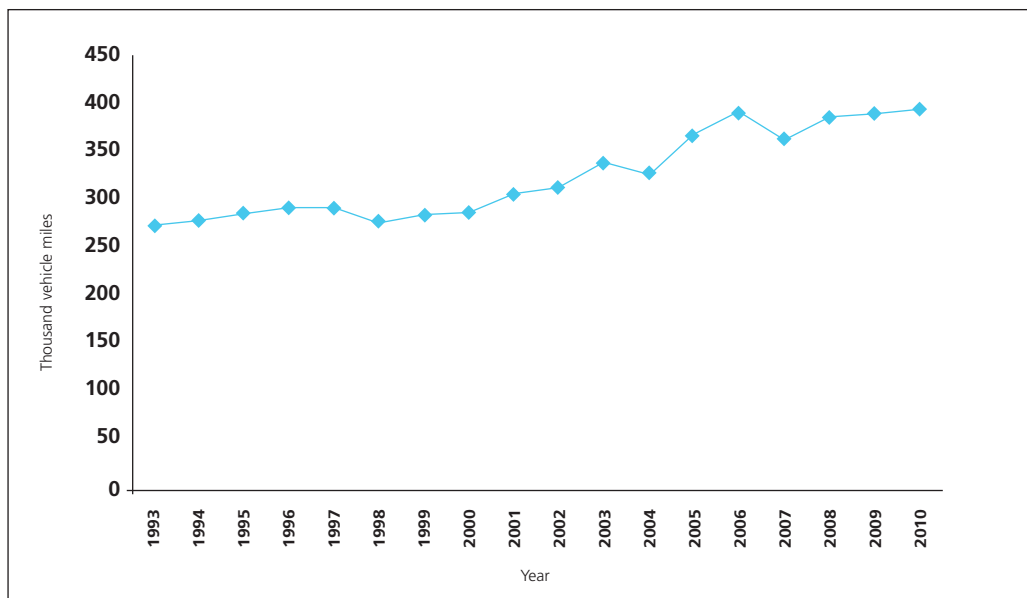
Figure 16 – number of miles cycled in London, 1993 to 2010

Source: Department for Transport (2011) *National road traffic survey*. London: Department for Transport.

Area for action
- Ambitious growth targets for walking and cycling should be set at national and regional levels, with increased funding and resources proportional to target levels.

6.3 Promoting active travel

Underlying factors in travel behaviour, such as the high levels of car use for short journeys, indicate that there is potential for change. As highlighted previously, nearly a quarter of all car journeys in the UK are within one mile, and over 40 per cent are within two miles.[62] There is also evidence of suppressed demand for active travel. The usage for walking and cycling on the National Cycle Network[j], for example, has increased by more than 400 per cent over its lifetime.[127] Research looking at the 2004–05 DfT Sustainable Transport Demonstration Towns programme[i] has also shown potential for change. It was found that almost half of local car trips in the three demonstration towns (Darlington, Peterborough and Worcester) could be made by walking, cycling or public transport under existing conditions, with the main obstacle being lack of awareness of the options.[128] The greatest potential for changing travel behaviour was found to be increasing cycling, providing a viable alternative to nearly one in three local car journeys.[128]

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i   The National Cycle Network was created by Sustrans in 1995 through funding from the National Lottery with the purpose of providing a network of walking and cycling routes across the UK.

j   In 2004, the DfT selected and funded Darlington, Peterborough and Worcester as Sustainable Travel Demonstration Towns (STDT) to showcase the role of soft measures in promoting walking, cycling and public transport and reducing car use.

Guidance published by the National Institute for Health and Clinical Excellence (NICE) in 2007 sets out a series of generic principles that can be used as the basis for planning, delivering and evaluating activities, aimed at supporting health-related attitude and behaviour change.[129] These recommendations include:

- basing interventions on a proper assessment of a target group, where they are located and the behaviour which is to be changed
- working with other organisations and the community itself to decide on and develop initiatives
- building on the skills and knowledge that already exists in the community, for example, by encouraging networks of people who can support each other
- taking account of, and resolving, problems that prevent people changing their behaviour
- basing all interventions on evidence of what works
- training staff to help people change their behaviour
- evaluating all interventions.[129]

Walking

Interventions that encourage walking have been shown to be effective at increasing levels of walking in communities. The THSG highlight that because levels of walking are low people overestimate the time taken to walk between locations.[16] At the same time they underestimate the time taken to do the same journey by car.[16]

Providing information about the distance between places, and the time taken to walk there, is a useful way of promoting walking. In London, information on the time taken to walk between underground stations is provided by TfL in a move to reduce station overcrowding. To encourage more active travel, TfL also provides a walking journey planner on their website, which provides information on the distance and time taken to walk between destinations, as well as a map. The *Transportdirect* website, funded by the DfT, Welsh Assembly Government and the Scottish Government, provides walking or cycling journey planner functions. Similar functions are offered by companies such as Google and Walkit and are also available on the majority of smart phones. The efficacy of these measures at improving walking levels has not been evaluated.

Community measures can contribute to a net increase in walking.[130] These include mass media campaigns and community events. Other measures include environmental improvements, formation of walking groups, and written materials or brief advice.[130] The Cabinet Office Behavioural Insights team, in their 2010 report *Applying behavioural insights to health*, highlighted the TfL and Intelligent Health *Step2Get* initiative as good practice.[109] This measure combines swipe card technology, online gaming and rewards to encourage pupils to walk to school. Pupils are provided with a card to swipe against machines placed on lamp-posts along a route to school. The more miles they walk the more points they earn, which can then be redeemed for rewards. Initial research suggests the *Step2Get* initiative increased the number of children walking to school by 18 per cent.[109]

Cycling

A 2010 systematic review of interventions to promote cycling found that interventions such as community-wide promotional activities, in conjunction with improving infrastructure for cycling, have the potential to increase cycling by modest amounts.[131] Promoting cycling as a mode of transport can be an effective way to increase physical activity in obese individuals.[132]

Australian research found that community-based social marketing programmes involving information provision, cycle training, free bike hire, and a ride to work campaign aimed at promoting the use of existing cycle paths increased the use of cycle networks.[133] In Denmark, the use of a multifaceted approach, that included promotional campaigns and infrastructural measures, such as cycle lanes and cycle hire facilities, was shown to increase the proportion of all trips cycled, and a net increase in the number of metres travelled per day.[134]

The Netherlands, Denmark and Germany all have large numbers of cyclists.[135] Research suggests that these high numbers result from the provision of separate cycling facilities along heavily travelled roads and at intersections, combined with traffic calming of most residential neighbourhoods.[135] Extensive cycling rights of way in the Netherlands, Denmark and Germany are complemented by ample bike parking, full integration with public transport, comprehensive traffic education and training of cyclists and motorists, as well as wide public support for cycling.[135] Driving is also expensive and inconvenient in city centres, due to a host of taxes and restrictions on car ownership, use and parking.[135] A similar pattern is observed in London, where provision of cycling infrastructure and the costs of motoring in the city centre are high compared with the rest of the UK.

In other case studies, cycling promotion on its own, without improved facilities and infrastructure, has been less effective. Research conducted in the US in 2007, suggested that combining the use of educational and promotional activities by teachers to motivate parents to walk and cycle to school had no effect on increasing rates of cycling to school.[136] This demonstrates that promotion of cycling alone is insufficient to increase uptake.

There are examples of good practice in the UK of promoting cycling. In London, the Barclays Cycle Hire scheme was launched in 2010, and is expected to cost approximately £190 million to implement over six years.[137] This involved approximately 5,000 bicycles, spread across 45 square kilometres of London.[98] In total more than 100,000 people signed up as members of the scheme, making an average of 20,000 journeys on bicycles every day.[98] The majority of trips by cycle replaced public transport trips, with the largest proportion replacing travel on the London underground.[98] In 2012, it was announced that the scheme would be expanded to have 65 square kilometres of East and Central London covered by approximately 8,000 bikes.[138] Further analysis is required to determine the effect of this scheme on wider health impacts.

Evaluation of the Cycling Demonstration Towns programme[k] in England found net increases of 27 per cent in the amount of time residents spent cycling and the number of cycling trips made. The number of regular cyclists increased from 2.6 per cent to 3.5 per cent.[139] While these levels are modest compared with many European towns, they represent an increase of 37 per cent.[139] A 10 per cent decrease in the number of physically inactive people was also observed, which is expected to have additional health benefits.[139] These gains were achieved through a combination of improvements and investment in cycling infrastructure, safety and facilities, town-wide media campaigns, personalised travel planning, cycle repair and also cycle training and education.

The development of the National Cycle Network has also seen increases in cycling and walking levels across the UK. In 2010, it carried 420 million trips (roughly half each walking and cycling), which were made by 2.8 million individuals.[127] User surveys found that over 70 per cent reported raised physical activity levels as a result of the improved walking and cycling infrastructure.[127] This meant that the then government's target to encourage two million people to be more physically active by the 2012 Olympic and Paralympic Games was met by increased uptake on the Network.[127]

The role of healthcare professionals in promoting active travel

Healthcare professionals can play an important role in promoting active travel. A 2007 systematic review of interventions, often referred to as 'soft measures' that promote walking and cycling, found a statistically significant increase in self reported walking among those given:
- brief face-to-face advice: either in the workplace, by a clinician, or by an exercise specialist in primary care
- remote support from healthcare professionals: either delivered by the telephone or internet
- group-based interventions delivered in healthcare settings: such as lay mentored meetings, led walks, or educational sessions from healthcare professionals
- pedometers.[130]

Various guidance published by the NICE[l] identify measures by which healthcare professionals can support physically active travel (such as walking or cycling) as a life-long habit from an early age. These include:
- whenever possible and clinically appropriate, identifying inactive adults (using a validated tool) and advising them to aim for 30 minutes of moderate activity on five days of the week (or more)
- ensuring parents and carers are aware of advice that children and young people should undertake a minimum of 60 minutes MVPA a day
- encouraging parents, carers and families to complete at least some local journeys (or some part of a local journey) with young children using a physically active mode of travel

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k   The Cycling Demonstration Towns programme was developed by Cycling England to evaluate whether increased funding and bespoke projects could have a significant impact on cycling rates. Six towns were awarded cycling demonstration town status in 2005 (Aylesbury, Brighton and Hove, Darlington, Derby, Exeter, and Lancaster with Morecambe), followed by a number of other towns and cities in 2009 (Blackpool, Bristol, Cambridge, Chester, Colchester, Leighton Buzzard with Linslade, Shrewsbury, Southend, Southport, Stoke-on-Trent, Woking, and York).
l   NICE guidance in the following areas is currently under development: walking and cycling (October 2012) and physical activity advice in primary care (May 2013).

- acting as a role model by incorporating physical activity into daily life, such as opting for travel involving physical activity
- sign post activity opportunities in the local community.[140, 141]

Some healthcare professionals have responsibilities for promoting workplace health, which provides the opportunity to encourage employees to be physically active. Guidance on workplace health promotion published by the NICE outlines that employers:

- should implement and monitor an organisation-wide plan or policy to encourage and support employees to be more physically active, including policies to encourage employees to walk, cycle or use other modes of transport involving physical activity (to travel to and from work and as part of their working day)
- should help employees to be physically active during the working day by providing information about walking and cycling routes, encouraging them to take short walks during work breaks, and encouraging them to set goals on how far they walk and cycle.[142]

In recognising the importance of active travel, the BMA has previously called on local authorities to create safe and comprehensive cycle networks, and improve the usability and safety of ordinary roads for pedestrians and cyclists. Healthcare professionals can exert significant influence as local strategic partners, encouraging local authorities to incorporate walking and cycling into all their policies and programmes (see **Box 3**). There are a number of areas identified by the NICE that healthcare professionals can advocate for, including:

- ensuring local transport plans/infrastructure, and proposals for urban development and regeneration support physically active travel, including prioritising the needs of pedestrians and cyclists over motorists
- ensuring local facilities and services are easily accessible on foot, by bicycle and by other modes of transport involving physical activity
- the provision of a comprehensive network of routes for walking, cycling and using other modes of active travel that offer everyone (including people whose mobility is impaired) convenient, safe and attractive access to workplaces, homes, schools and other public facilities
- that schools develop travel plans which have physical activity as a key aim, and provide suitable cycle and road safety training for all pupils
- the coordination of local transport and school travel plans so that all local journeys can be carried out using a physically active mode of travel
- that there should be coordinated working between health professionals, local highways authorities, and local strategic partnerships to promote measures to reduce speed in streets that are primarily residential or where pedestrian and cyclist movements are high (including traffic-calming measures and speed limit restrictions).[140, 143-45]

A more detailed overview of the NICE guidance is provided in **Appendix 3**.

To support this advocacy role at a local level, healthcare professionals can use the WHO health economic assessment tool (HEAT) for cycling and walking. This is an online resource that estimates the economic savings resulting from reductions in mortality as a consequence of regular cycling and/or walking.[m]

Areas for action

- Healthcare organisations should work in partnership with local authorities to ensure local transport plans/infrastructure, and proposals for urban development and regeneration support physically active travel, including prioritising the needs of pedestrians and cyclists over motorists. This should incorporate the use of the WHO health economic assessment tool (HEAT) for cycling and walking.

- Healthcare professionals and managers in the NHS who have responsibility for promoting workplace health should ensure there is an organisation-wide plan or policy to encourage and support employees to be more physically active, including policies to encourage employees to walk, cycle or use other modes of transport involving physical activity (to travel to and from work and as part of their working day).

- When it is clinically appropriate, healthcare professionals should:
  - promote walking and cycling as an effective way of improving physical activity levels through the use of brief face-to-face advice, remote support (either delivered by the telephone or internet), and approved individual (eg pedometers) and group-based interventions (eg walking and cycling schemes)
  - encourage parents, carers and families to complete at least some local journeys (or some part of a local journey) with young children using a physically active mode of travel
  - sign post to information about opportunities for active travel in the local community.

- Healthcare professionals can use their influence as community members and leaders to promote walking, cycling and other modes of transport involving physical activity by:
  - acting as role models and opting for travel involving physical activity whenever it is practical
  - working as advocates in local strategic partnerships to ensure accessibility is prioritised over mobility in planning decisions so that workplaces, homes, healthcare services, schools and other public facilities are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

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m   See www.euro.who.int/HEAT for further information.

6.4 Road danger reduction for pedestrians and cyclists

Pedestrians and cyclists are among the most vulnerable road users, and road danger is a barrier to the uptake of active travel.[62] Pedestrians and cyclists have a higher rate of fatality per distance travelled than for any other mode of transport, with the exception of motorcycles.[62]

The WHO recommends that the dangers of roads would be reduced through an approach that prioritises vulnerable road users and limits the speed and volume of traffic through traffic calming measures.[146] This contrasts with a traditional approach, which often seeks to reduce casualties by limiting pedestrians and cyclists from making the trips they need to undertake (eg by the use of guardrails and barriers). Reducing casualties should be considered at a strategic level, through a danger reduction approach that addresses the factors that put pedestrians and cyclists at risk. While the number of pedestrians and cyclists killed will generally be low on these types of roads – because of the high risk – dangerous roads can negatively impact on health through discouraging active travel and through community severance.

Box 3 – recognising the public health benefits of improved road safety in Liverpool
Proposals for increasing the proportion of Liverpool's residential roads subject to a 20 miles per hour speed limit are being led by Liverpool City Council and the city's primary care organisation, with the support of Merseyside Police. The plans aim to increase the proportion of roads covered by the lower speed limit from 31 per cent to 70 per cent. It is estimated that the initiative could reduce the number of road traffic accidents in Liverpool by 54 a year, providing an annual saving of over £5.2 million in associated costs. Under the plans, Liverpool has been divided up into seven areas, and these are being prioritised based on the number of collisions. The scheme would cover the majority of residential roads, including roads outside schools on strategic routes. The lower speed limits would only be introduced where there is clear support from local residents.

Source: Liverpool City Council press release (27.10.12) 20mph plans to make city safer.

Pedestrians

The universal and inclusive nature of walking is set against a backdrop of steadily increasing vehicle numbers and traffic volume. Cars present the greatest risk to pedestrians, and are a barrier to more widespread uptake of walking.[31] Buses and cycling present less risk to pedestrians (see **Figure 17**).[31]

In 2009, 6,045 pedestrians were killed or seriously injured on UK roads.[37] This represents around a fifth of all those killed or seriously injured.[37] In 2010, roughly a third of pedestrians killed or seriously injured were aged under 16 (see **Figure 18**).

Figure 17 – reported UK pedestrian incidents by vehicle user type in the UK, 2010
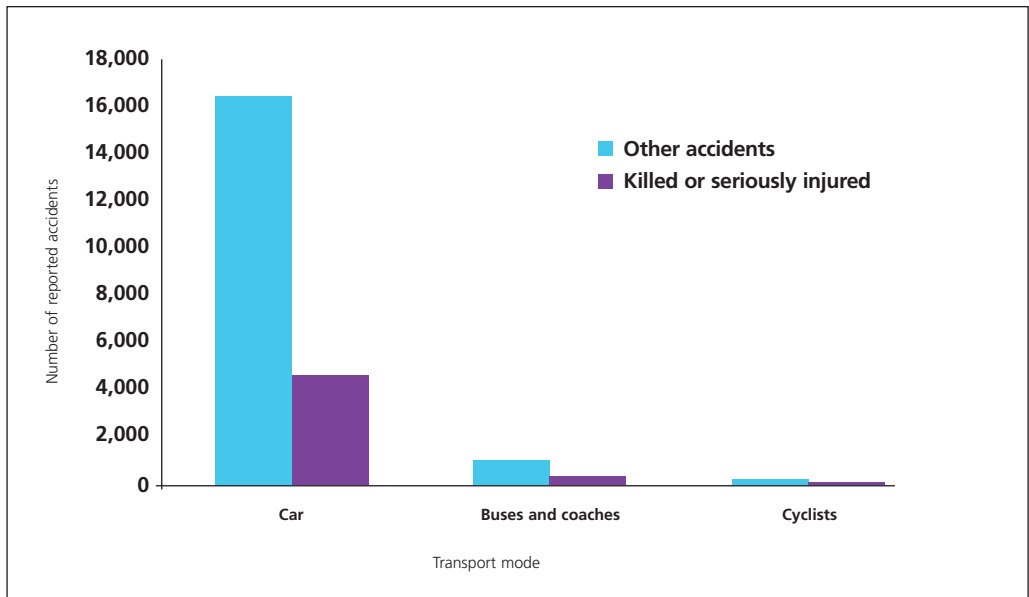
Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.

Figure 18 – reported killed or seriously injured UK pedestrians by age, 2010
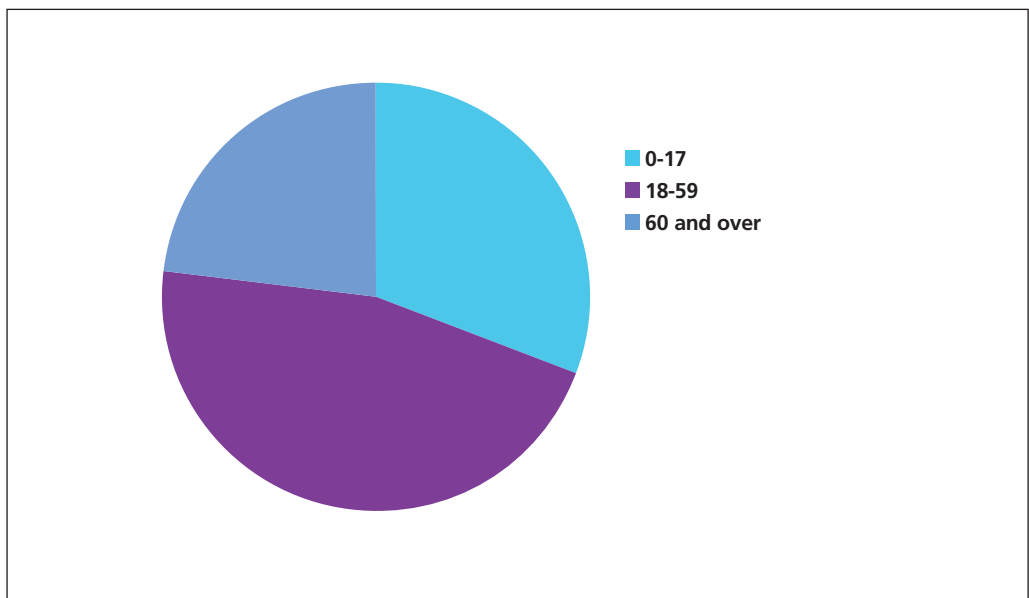
Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.

Walking almost inevitably involves crossing a road, where the pedestrian is at greatest risk of coming into conflict with motor vehicles. The pedestrian mortality rate in the UK is 35 people per billion passenger kilometres, compared to 2.3 for car occupants (see **Figure 19**).[37] The THSG note that these figures should be regarded with caution when considering the risk to pedestrians.[16] Creating reliable estimates of pedestrian collision rates are highly problematic without adequate information about pedestrian exposure to road traffic, due to the lack of information about the micro-environments met by pedestrians.[147] The THSG have suggested that the absolute risk of harm to pedestrians is much lower than the mortality rate per billion passenger kilometres would suggest, and any calculation on risk should be made using comparisons of shorter distances in urban environments.[16] This does not diminish the risk that road traffic presents to pedestrians.

Figure 19 – average mortality rate by mode of transport per billion UK passenger kilometres, 2001 to 2010

Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010.* London: Department for Transport.

Most pedestrian injuries occur on built-up roads in towns and cities (see **Figure 20**). Figures from the DfT suggest that the greatest number of pedestrian injuries occur when crossing away from a designated crossing area (see **Figure 21**). The majority of casualties occur between the hours of 08:00 and 09:00, and 15:00 and 17:00.[37] This suggests that pedestrians are at greatest risk when car use is at its highest, such as during the commute to and from work, and on the school run.[37] The relative numbers of collisions between locations depends on the local transport network, pedestrian exposure to road traffic, and the facilities and resources devoted to pedestrian safety on different types of road. The consequences of a collision, measured by the injury severity, are a function of the impact speed, the vehicle design, the road design, and the vulnerability of the pedestrian.

Children in the UK are at twice the risk of injury from road traffic compared to their peers in France and Germany.[33] The 2010 Marmot review, quoting National Travel Survey data, highlighted that fewer primary school children walk to school now (52%) than they did twenty years ago (62%).[2, 148] To reverse this trend, improvements in child road safety are needed, including comprehensive road safety educational training supported by parents, and direct measures, such as safe routes to school.[149] Examples of good practice include Salisbury, where roads approaching infant schools have been designated traffic free roads.

Figure 20 – number killed or seriously injured in the UK by road user type and type of road, 2010

Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.
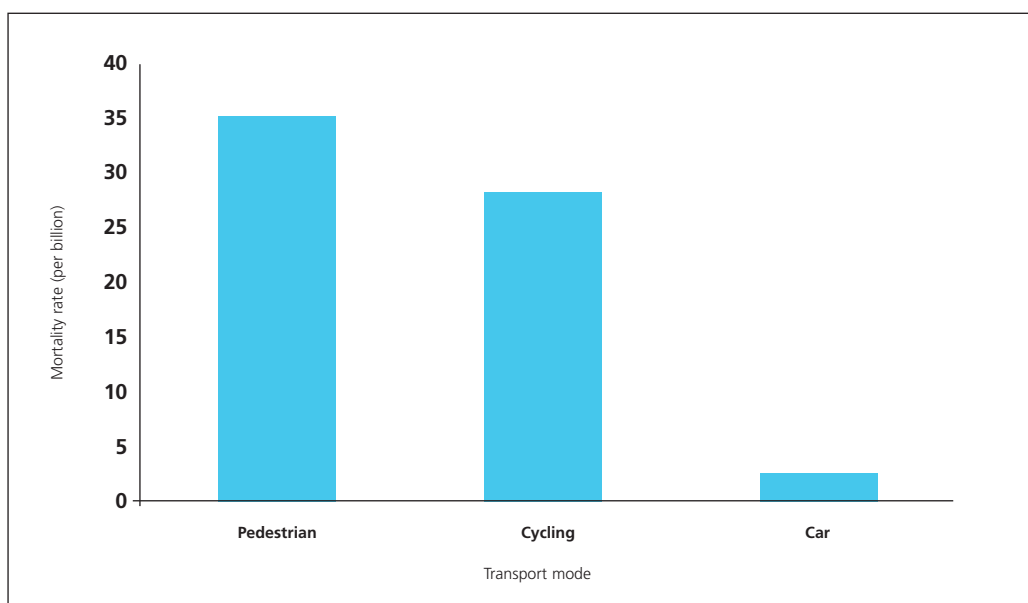
Figure 21 – number of pedestrian casualties in the UK by location, 2010

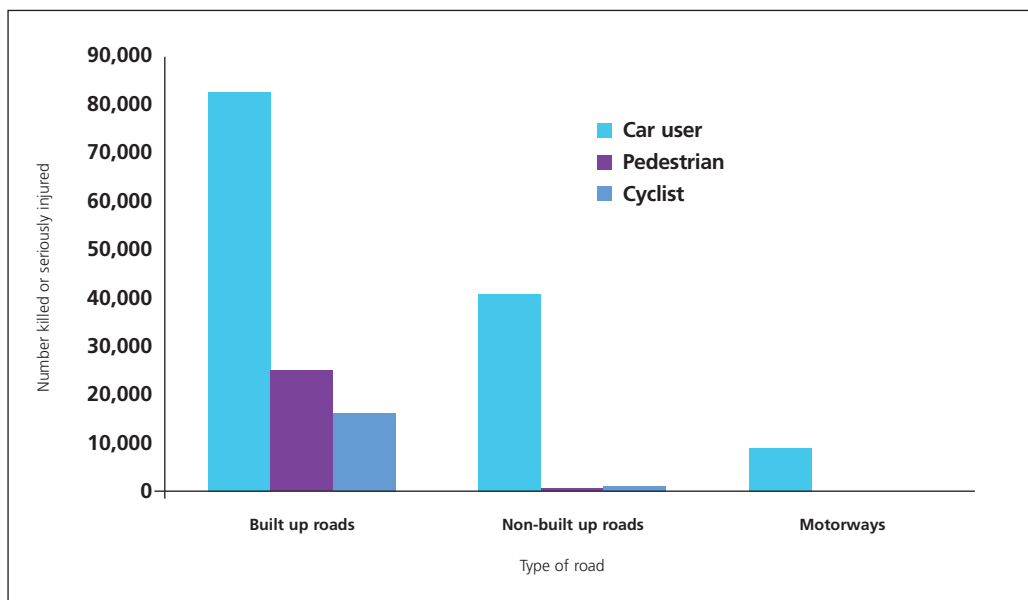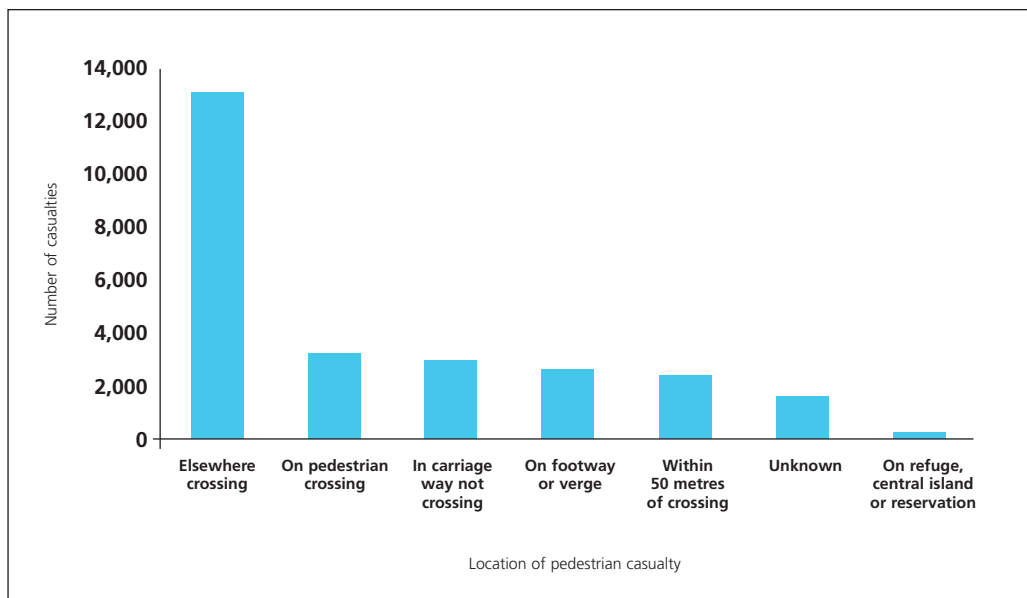**Source:** Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.

Social pressure is an important factor in determining pedestrian's crossing decisions, particularly among children and adolescents.[150] Pedestrians in the UK are more likely to ignore traffic signs and signals (such as the red man at signal crossings) than those in continental Europe, putting them at greater risk to the dangers of cars on the road.[150] It is important that the public receive appropriate road safety training to ensure awareness of road safety. This should include universal public health campaigns and publicity, as well as the provision of road safety education and training.

Specific traffic management and planning measures can have an impact on improving pedestrian safety. These include:
• enhancement of pedestrian crossings to increase their visibility to motorists
• relocating crossings to prioritise the pedestrian
• adjusting the green periods for crossing according to the walking pace of pedestrians
• pedestrianised or shared space streets in town centres and commercial areas.[150]

Cyclists

Despite cycling levels being very low in the UK, cyclists experience a high rate of injury by distance travelled. Per million kilometres cycled, 0.022 cyclists are killed in road traffic incidents.[31] In spite of the harms cyclists face in terms of safety and exposure to air pollution, a number of studies have found that the health benefits of cycling, such as improved quality of life, weight control, and protecting against major chronic diseases, greatly outweigh these risks, by up to a factor of 20 to 1.[6, 7, 151] The THSG note that, when considered from an absolute risk perspective, cycling is low risk compared to car use, as cycling offers very little harm to other road users, and the health benefits of engaging in cycling outweighs the health harms.[16]

Crossing junctions present the greatest casualty risk to cyclists (see **Figure 22**).[37] Worldwide, in collisions involving cyclists and motor vehicles, a higher proportion of cyclists are killed than drivers.[152] Freight vehicles are a major risk to cyclists, and are 20 times more likely to be involved in cyclist road traffic injuries than cars, per kilometre travelled.[24, 153] Research on cyclist fatality rates in London between 1992 and 2006 has shown that freight vehicles were involved in more than four out of ten incidents.[153] It has been suggested that to reduce the risk of freight vehicles to cyclists, freight should have restricted access to urban roads, and alternative means of delivering essential goods found.[153] This may include river or rail transport bringing goods into urban environments, and light goods vehicles (LGV) then being utilised for local distribution.[153]

Figure 22 – cyclists involved in reported incidents by junction type in the UK, 2010
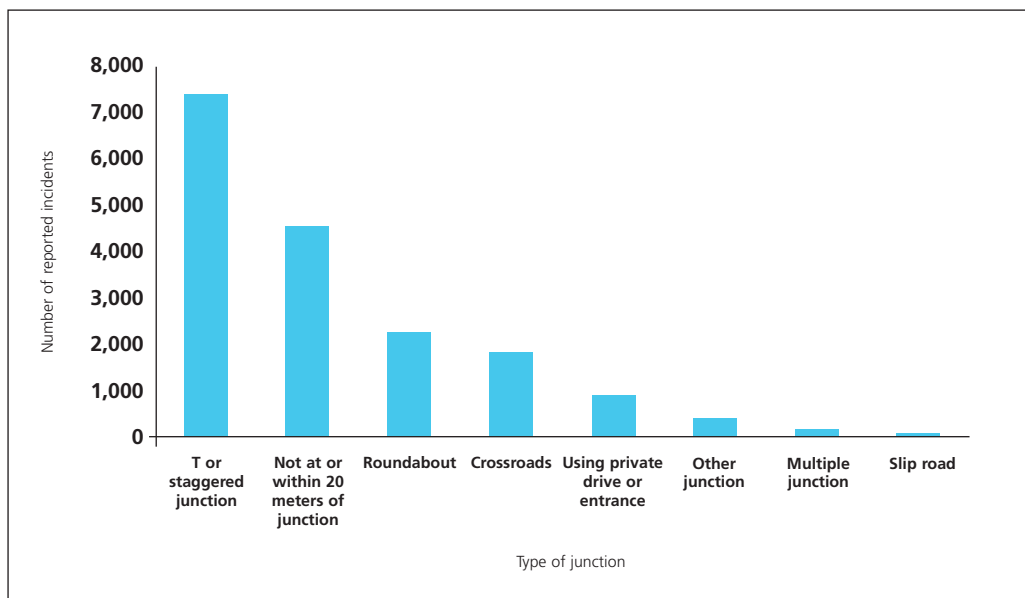
Source: Department for Transport (2011) *Reported road casualties Great Britain: 2010*. London: Department for Transport.

Cycle helmets are designed to prevent injury from low speed crashes. As highlighted in the BMA's 2010 briefing paper *Promoting safe cycling*, helmets have been found to be effective at reducing the incidence and severity of head, brain and upper facial injury for users of all ages.[154] Cycle helmet legislation has also been found to increase helmet wearing rates and reduce the number of head injuries.[154]

Cycle helmet wearing is not compulsory in the UK. Although a highly controversial area, with strong proponents for and against, the BMA believes that to reduce some of the dangers to cyclists, cycle helmet wearing should be made compulsory once levels of voluntary helmet wearing are sufficiently high. This requires the implementation of educational and promotional campaigns that aim to encourage cyclists to wear helmets, as well as measures to incentivise their use, such as subsidising the cost of helmets.

Concern has been expressed that compulsory helmet wearing may discourage some cyclists and deter new cyclists, leading to decreased bicycle use, and the loss of the health benefits associated with this form of physical activity. While a number of reviews have considered the impact of compulsory helmet legislation on cycling levels,[155, 156] there is no consensus in the scientific literature. To prevent any likelihood of cyclists being discouraged from cycling, the implementation of compulsory helmet legislation in the UK should not be considered in isolation. It is important that the range of measures outlined in this report to encourage and allow children and adults to cycle safely are implemented. In addition to other measures noted in this report, this includes the provision of cycling training for all children, and recognising road safety (including cycling proficiency education) as part of the curriculum for all school children. Cycle training is important for reducing the dangers of the road to cyclists, ensuring cyclists are aware of how to manage traffic, and recognise the safest places to position themselves on roads.

The more cyclists there are on the roads, the less their risk of death or injury – a phenomenon termed the 'safety-in-numbers' effect. Research in Sweden has shown that the risk of collision diminishes the greater the number of cyclists on roads.[157, 158] Modelling has predicted that increasing the number of pedestrians and cyclists in London would result in fewer injuries per passenger kilometre than current levels.[24] The mechanism behind a safety-in-numbers effect is still not clear. One explanation is that motorists adjust their driving behaviour in the presence of more cyclists and pedestrians, including driving more slowly and carefully.[158] An alternative suggestion for this effect is that increased levels of cycling will result in fewer cars being on the roads,[24] which provides a safer environment for cyclists.

Cycling rates in UK towns and cities are some of the lowest globally (see **Figure 23**).[24,33] Research by the National Cyclists' Organisation, found that countries in Europe with higher levels of cycle use tend to be less dangerous for cyclists, which they attributed to a safety-in-numbers effect, as well as better provisions for cyclists.[159] A 2009 study by Vandenbulcke et al found that this effect continues down to the local level, with a correlation between cycle use and cycling casualties measured across communes (local authorities) in Belgium.[160]

Figure 23 – proportion of trips made by cycling in Europe, North America and Australia, 2005
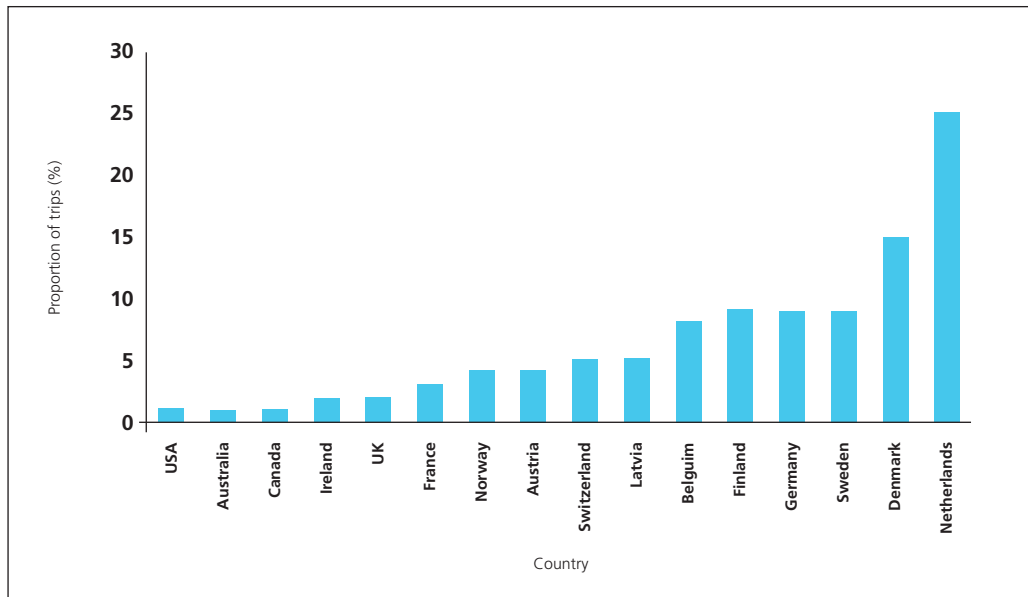
Source: Bassett D, Purcher J, Buehler D et al (2008) Walking, Cycling, and Obesity Rates in Europe, North America, and Australia. *Journal of Physical Activity and Health* **5**: 795-814.

Areas for action

- Road safety should be addressed at a strategic level though a danger reduction approach that addresses the factors that put pedestrians and cyclists at risk, rather than seeking to reduce casualties by limiting pedestrians and cyclists from making the trips they need to undertake.

- Transport policy should aim to encourage the creation of safe routes to school so that children and parents can travel to school by walking or cycling, and the provision of suitable cycle and road safety training for all pupils.

- There should be provision of a comprehensive network of routes for walking, cycling and using other modes of active travel that offer everyone (including people whose mobility is impaired) convenient, safe, well-designed and direct access to workplaces, homes, schools and other public facilities.

- To maximise the potential for car-free travel, facilities for combining cycling with local and longer-distance public transport should be improved.

6.5 Economic benefits of active travel

Active forms of transport, such as cycling and walking, are highly cost effective forms of transport. To the individual, walking has few costs associated with it, while the costs associated with cycling are minimal compared to those of motorised transportation.

Active travel contributes savings to healthcare budgets, in terms of savings on treating chronic illness.[11, 161, 162] Transport-related physical inactivity in England is estimated to cost £9.8 billion per year to the economy.[11, 52] This figure is in addition to the £2.5 billion in healthcare costs spent annually on treating obesity.[11] It has been estimated that the cost of physical inactivity to Wales is around £650 million per year.[163] In Northern Ireland, the economic benefits of increasing levels of physical activity, in relation to preventing CHD, stroke and colon cancer, are estimated to be £131 million.[164] For Scotland, research from 2003 estimated the economic benefits of reducing the level of inactivity by 1 per cent each year for five years, in relation to preventing CHD, stroke and colon cancer, would lead to NHS savings of £3.5 million a year.[116]

A 2007 Cycling England report that estimated the economic value of cycling, found that the health benefits could be valued at £87-300 per cyclist per year, depending on their age, fitness level, and neighbourhood.[165] This did not account for the substantial social benefits of cycling, which include offering more independence to children, improving the quality of life for communities and, in some areas, supporting tourism.[165]

If current levels of cycling could be increased by 20 per cent, it is estimated this could produce health savings of £500 million.[165] Increases by 30 per cent are estimated to lead to savings of £785 million, and a 50 per cent increase could lead to health savings of £1.3 billion.[165] Research has estimated that even including cyclist deaths, the health benefits of cycling in Copenhagen could be valued at £498 per cyclist per year.[113]

A 2010 review of the evidence base from peer reviewed and grey literature in the UK and internationally found that almost all of the studies reported highly significant economic benefits of walking and cycling interventions.[166] The median result for all data identified was a benefit to cost ratio of 13:1 and for the UK, the figure was higher at 19:1.[166]

7. Public transport

7.1 Public transport and health

Access to public transport has a role in helping individuals to achieve recommended levels of daily physical activity, and has health-related benefits. This is because public transport typically incorporates physical activity as a component of the journey, increasing the likelihood that individuals will meet physical activity recommendations for walking.[167] Research from 2011 has demonstrated that the popularity of free bus passes has a protective health effect among older populations, including protecting against obesity.[168]

In addition to physical activity health benefits associated with public transport, the energy consumption of public transport is less than that used by cars, when at average occupancy.[23] This means the emissions produced by public transport are proportionally less than those emitted by cars, which benefits health directly, and mitigates transport's contribution to climate change.[23]

7.2 Bus services

Local bus services can be an efficient and flexible mode of transport which, ideally, are tailored to the needs of users in terms of capacity and speed. Buses operate in mixed traffic and are easy to put into service. Unlike rail services, buses require minimal specialist infrastructure to operate. They have the potential to be an excellent form of transport for young and older generations, low income and low socioeconomic status groups, and people living in cities and urban areas.[169]

The uptake of bus services is low. This, in part, is a result of the increasing number of cars on the road, which contributes to increased congestion. This has a direct impact on the operational speed of buses, service quality, reliability, energy consumption, and overall profitability. The ease of using a car over the bus to reach destinations is commonly cited as a reason for diminishing levels of use (see **Appendix 2**).[41, 169]

Chronic underinvestment in bus services has led to a situation where travelling by bus is not always an attractive option. In 1986, under the Transport Act 1985, all bus services outside London and Northern Ireland were deregulated. Deregulation was intended to increase competition. Rather than reduced costs and increased services, the deregulated bus system has been accompanied by a general downward trend in patronage levels, increased costs, and higher levels of complaints, particularly in major metropolitan areas outside London.[170] Improving bus services to ensure they are reliable and fit for purpose and offer a cost effective means of transport is vital to encouraging their use.[171]

Enhancing bus services

Ensuring buses are cost effective is important in terms of making them a more attractive alternative to car use. Public transport fares, in contrast to motoring costs, have increased between 25 to 30 per cent over the last 20 years.[172] This has been accompanied by flat or declining bus patronage across the UK, and in many places outside London, transport by car is more convenient than public transport.[172] Public transport fares in the UK are 20 per cent above the European average.[172]

A reduction in travellers using buses, because they are expensive, has the counter-productive effect of further increasing bus fares. This is because bus operators must continue to meet their overheads, and lower patronage results in higher ticket prices. This creates a cycle, where patronage levels decline, and travel fares increase. The outcome is that more people opt to travel by car, which is a cheaper alternative.

Accessibility is also important in improving the use of buses. A 2009 DfT survey found that 93 per cent of adults lived within a 13 minute walk of a bus stop; only 80 per cent of them were serviced by at least an hourly service, or are on a route relevant to them.[169]

Local bus services can be enhanced through relatively inexpensive infrastructure interventions, to make bus use more attractive and efficient to potential passengers. Segregation of traffic – including the use of priority lanes for buses – can enhance safety, increase the efficiency and reliability of public transport, and lead to lower bus fuel consumption and emissions.[173] Additional measures to improve the desirability of travelling by bus include:
- bus terminals and stops at convenient central locations
- permanent bus lanes
- priority for buses at junctions
- park and ride facilities
- real time information for passengers
- easily accessible buses for those with reduced mobility
- electronic payment and ticket options
- development of electronic card payment systems.[173]

The International Road Transport Union have suggested that wide scale implementation of these policy measures will lead to increases in bus use.[173]

Bus rapid transit
Bus rapid transit (BRT) is a term applied to a variety of public transportation systems using buses to provide a faster, more efficient service than an ordinary bus line. This is often achieved through using specialised vehicles on roadways, or dedicated lanes to quickly and efficiently transport passengers to their destinations.

Although not widely developed throughout the UK, BRT is seen as having potential for improving public transport.[16] This is in part because of the lower cost associated with BRT, as they incorporate most of the high-quality aspects of underground metro systems, and because they use established infrastructure.

Area for action
- Public transport should be affordable to all to ensure that it represents an effective alternative to car use.

7.3 Metropolitan rail

Metropolitan railways, which include light rail and underground rail, are urban, electric transport systems with a high capacity and a high frequency of services. They operate independent from other traffic, roads or pedestrians.

Metropolitan rail is an optimal public transport mode for transporting large numbers of individuals in urban areas, and is commonly used in large cities where their uptake is high. Throughout the world metropolitan rail systems carry 150 million passengers per day.[174] Metropolitan rail is equally popular in the UK, where, for example, 196.5 million passenger journeys took place in England on light rail and tram networks in 2010–11, representing the highest level ever recorded for any year.[175] The use of underground rail is also commonplace. Over two million passengers use the London underground daily, while an average 13.6 million passenger journeys take place each year on the Glasgow underground system.[174, 176]

With such high levels of uptake, it is important that the focus is on ensuring services remain reliable, high quality and accessible to all. This will ensure they continue to provide an effective element of an integrated transport network, and a feasible alternative to car use journeys.

Given that underground metropolitan rail systems often operate within heavily crowded confined spaces, concern has been expressed as to whether exposure to particulate matter on underground rail systems represents a risk to health.[177] In 2003, the British Lung Foundation highlighted research suggesting that air quality in carriages and at stations was up to 73 times worse than at street level, and that 20 minutes on the Northern line through central London had the same effect on the lungs as smoking a cigarette.[177] Research conducted between 2005 and 2008, however, suggests that, while there are elevated levels of particulate matter on underground rail systems, these are within acceptable levels for health.[178-81]

In New York, Rome and Stockholm, the level of particulate matter on these underground rail systems, while higher underground compared to surface levels, is well below the allowable workplace concentration.[178-80] Similar research for the London Underground railway system concluded that particulate matter levels are unlikely to represent a cumulative risk to the health of workers or commuters.[181]

The high levels of passengers using metropolitan rail services mean they are likely to lead to high casualty numbers following safety or other incidents. Accidents, fires and other incidents, such as terrorist activities, on metropolitan rail, while very rare, have received large amounts of publicity. Given the specific dangers associated with metropolitan rail and the high volume of users, it is important that all relevant authorities are involved in contingency planning related to the safety of metropolitan rail.

7.4 Equitable access to public transport

There are significant inequalities in access to public transport, in particular in relation to disabled people and the elderly. Disabled people often face issues in accessing public transport, in terms of their ability to reach services and gain access to them. Many public transport services are inaccessible to wheelchair users.[47] Research from 2003 found only 29 per cent of buses met the required standards of the 1995 Disability Discrimination Act.[n, 47] By 2010, 39 per cent of buses did not have accessibility certificates.[47]

The difficulty in obtaining information regarding accessibility issues is also a significant barrier to the uptake of public transport by disabled people.[47] Many disabled people are restricted in their travel options and in turn their access to services. Research from 2003, surveying transport among disabled groups, reported that around 20 per cent found it either difficult or impossible to access healthcare with the public transport options available to them.[182] Of those surveyed, almost half turned down job offers or interviews due to lack of accessibility to public transport.[182] These figures rise to 62 per cent when considering wheelchair users only, and 86 per cent among those with a visual impairment.[182] The same survey found that 21 per cent felt that transport problems had limited the availability of education and training, and 30 per cent reported difficulties in attending social functions.[182]

Ease of access to public transport is equally important for older people. As people age and operating a car becomes impractical, they become increasingly reliant on public transport.[47] Research from 2005 estimated that around 40 per cent of 65 to 84 year olds use public transport.[183]

Among older generations, the use of public transport is affected by a number of barriers.[183] These include concerns about personal safety, difficulty in carrying heavy loads, problems with reliability, and the behaviour of transport staff as well as other passengers.[183] Fears about safety, such as the fear of falling, can also become a significant factor.[183]

Research from Sweden has suggested that to ensure public transport is accessible to all, it is necessary to provide:
- mainstream public transport services (road and rail) which are accessible to people in wheelchairs, those with other impairments, and elderly people
- service routes that use accessible low-floor entrances, especially on routes close to housing for elderly and disabled people, health facilities, shopping, and other common destinations
- accessible taxi services with user-side subsidies to assist older travellers and those with mobility limitations
- door-to-door services such as dial-a-ride, community buses, and voluntary car services for passengers who need assistance from house to vehicle, during travel, or at their destination.[184]

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n   The 1995 Disability Discrimination Act has been superseded by the Equality Act 2010. This sets out specific legislative measures in relation to access to public transport for disabled groups. Under these provisions it unlawful for public transport operators, including taxi, bus, coach and rail (including underground) to refuse or deliberately fail to provide a service to a disabled person. They must also make reasonable adjustments to take away or overcome elements in their services which present barriers to disabled people.

For public transport to offer a realistic and effective transport alternative to car use, it is vital that they are responsive to the needs of all groups, including elderly and disabled people.

Area for action
- Adequate provision of public transport, that is tailored to meet the needs of users, should be available and accessible to all passengers, including elderly and disabled people. This requires public transport services which are accessible in terms of the distance taken to reach them, and in terms of gaining access to them.

8. The urban transport environment

8.1 The urban transport environment and health

While increasing levels of active travel through individual interventions are vital to achieving transport-related health aims, they are not the only solution. Other issues, such as the environment in which transport behaviours take place should also be considered in order to facilitate and optimise the efficacy of transport policy.

The physical characteristics of the built environment, and the degree to which they enable and promote positive health behaviours, all make a contribution to health.[2] Effective design elements in the built environment – which include street layout, land use, the location of recreation facilities, parks and public buildings, as well as the transport system – can facilitate physical activity, promote mental well-being, and improve access to health, employment, education, and cultural and recreation facilities.[185] As identified in the 2007 Foresight Project on obesity, given the general increase in sedentary employment and the longer hours worked in the UK over the past decades, there are limited opportunities for other forms of activity during the working day.[185] Policy that optimises the amount of energy expended during routine daily activities, such as travel in the local environment, can have benefits on health.[185] The Foresight Project highlighted "increasing walkability/cyclability of the built environment" as one of the top five policy responses assessed as having the greatest average impact on levels of obesity.[185]

Health transport behaviour requires spaces that are safe, accessible and pleasant, with high quality pedestrian and cycling infrastructure. The 2010 Marmot Review highlighted that well designed, car free and pleasant streets encourage feelings of well being, social interactions, and promote active travel.[2] People are more active when they can easily access key destinations, such as parks, workplaces and shops. Paths that link these places can provide safe and attractive thoroughfares for pedestrians.[186] **Figure 24** demonstrates the factors that influence physical activity in communities.

Figure 24 – factors influencing physical activities in communities
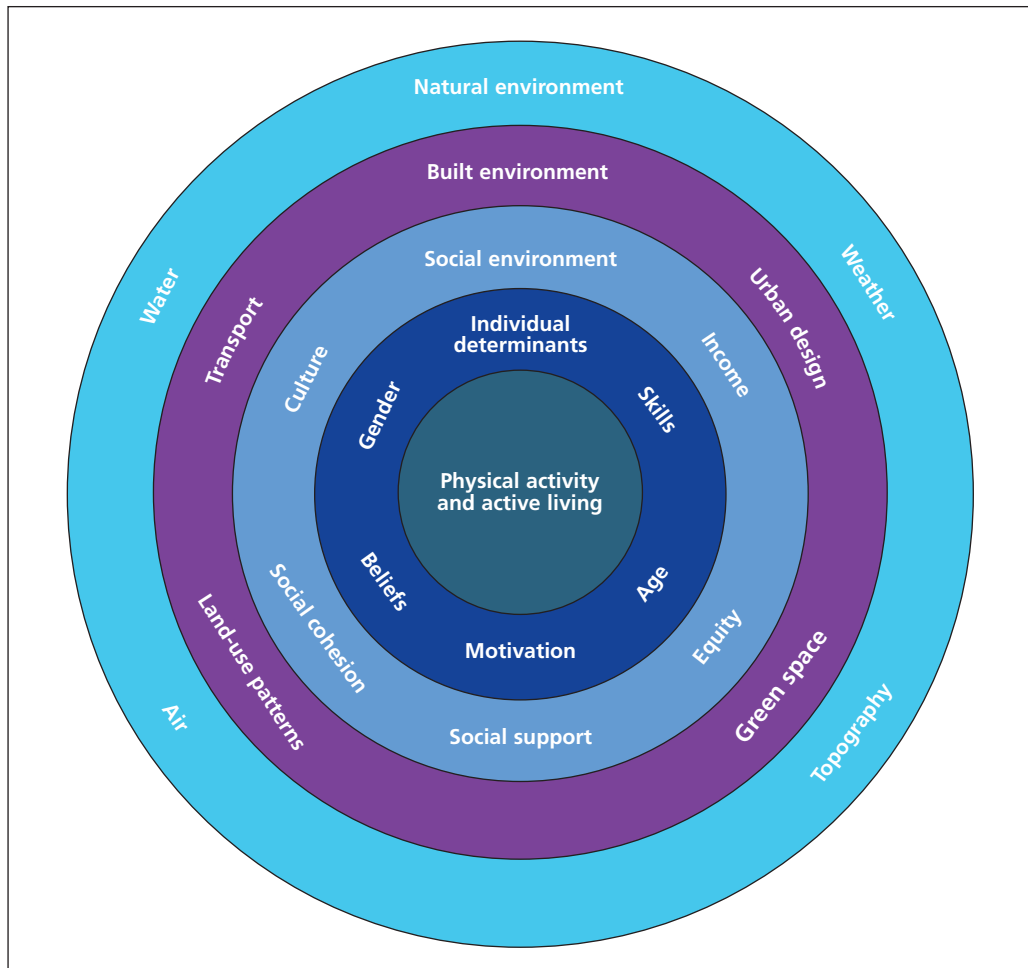
Source: World Health Organization (2006) *Promoting physical activity and active living in urban environments.*
Turkey: World Health Organization.

Green spaces

Living close to green spaces, with access to nature, can improve health and well-being across the social gradient.[2, 187, 188] Numerous studies have demonstrated the direct benefits from green spaces to physical and mental health, and well-being.[12, 189, 190] Access to green spaces has been associated with a decrease in health complaints, blood pressure and cholesterol, improved mental health, reduced stress levels, lower risk of diabetes, migraines, depression and cancer, perceived better general health, and improved ability to face problems.[190-94] Neighbourhood parks within walking or cycling distance of a person's home, or workplace, have also been shown to promote greater physical activity.[186] High quality, and easily accessible public spaces contribute to pride in the community, integration, and social cohesion.[2] Some urban traffic-free routes are considered green spaces, often called greenways.

8.2 Urban density

Urban density is an important factor in encouraging active travel. It affects the distances between destinations and the range of destinations that can be reached by walking or cycling. Mixed-use urban planning that combines shops, schools, healthcare services, residential streets and workplaces is most beneficial in terms of health.[53, 195]

In areas of high urban density, the distances travelled on foot or bike, and the amount of time spent walking and cycling, are high.[165] High urban density is associated with less emissions, as a result of greater amounts of active and public transport.[75] Car use decreases in high density areas.[123]

Designing walkable neighbourhoods, where a prime consideration is the movement of cyclists and pedestrians, can encourage active travel. The likelihood of a pedestrian walking for non-work purposes increases proportionately to the level of street connectivity where they live.[186] A 'walkable neighbourhood' is characterised by having a range of facilities which can be accessed comfortably on foot. Complete streets are the US equivalent of walkable neighbourhoods. The National Complete Streets Coalition, a coalition of advocacy and trade groups, has demonstrated that complete streets improve safety, lower transportation costs, provide alternatives to private cars, encourage health through walking and cycling, create a sense of place, improve social interaction, and generally improve adjacent property values.[196] In the UK, neighbourhood walking often accounts for a large proportion of total walking; neighbourhood design and quality are crucial factors in optimising the walking levels for the population as a whole.[197]

8.3 Poor urban design and health

Just as good design of the urban environment can promote healthy behaviours, poor design can present barriers to the uptake of healthy transport behaviours. Low-density land use patterns (such as urban sprawl) restrict the number of accessible destinations within walking distance, and encourage car use. Residents who live on cul-de-sacs make three to four fewer walking or cycling trips per week compared to those who reside on through streets. Urban sprawl and low urban density also decreases social capital and increases the segregation of wealth in towns and cities.[33]

Elements that act as barriers to improving health include the dangers associated with cars on roads, traffic volume, and a lack of separate lanes, tracks and paths for active travel.[36, 198] Lack of pavement and protected areas for walking and cycling can contribute to increased collisions.[198] Short duration traffic signals and wide streets also compromise the safety of less physically able pedestrians, for example frail older people or disabled people.[198] Other factors in the built environment that can discourage active travel include: a lack of quality lighting, lack of access to open spaces, rundown houses and neighbourhoods, poor aesthetics, and a lack of awareness about, as well as an overestimation of, the time needed to walk (or cycle) to destinations.[36]

The dominance of mobility over accessibility in planning decisions has resulted in urban design that prioritises motorists and personal car use. Access to healthcare, employment, services, and social networks is now increasingly dependent on car ownership, and access is difficult for those who

cannot afford a car. The centralisation of healthcare services has meant that in 2009, only 79 per cent of households were within 15 minutes of a doctor's surgery, while 83 per cent were within the same distance of a pharmacist.[126]

Even where destinations are geographically near, they are often separated from the people that need them by busy and wide roads, or railways, that prevent or make it difficult to access them by foot and bike.[162] This phenomenon is known as community severance and occurs when a busy transport corridor reduces access to the communities either side of it.[199] High volume traffic can act as a barrier to reaching services, in addition to impacting on quality of life and social inclusion.[33] Community severance can also result in increased road traffic crashes, as pedestrians and cyclists encounter high volume traffic and engage in greater risk-taking behaviour, leading to reductions in cycling and walking levels.[199] Cyclists and pedestrians can be dissuaded from using a route due to safety concerns, noise levels, and air pollution from fast-moving traffic. Neighbourhood social networks are greater on streets with light traffic, compared to streets with heavy traffic.[35] The young, elderly or disabled are at particular risk of suffering the negative consequences of community severance.[200]

This leads to a situation whereby travelling by car often represents the easiest and safest option for accessing services, irrespective of journey length. This perpetuates the use of cars as the main form of transport. While active travel and public transport are well placed to absorb any modal shift in demand from cars for short- and medium-length journeys, this is only possible within a transport environment that facilitates their use.

8.4 Designing the built environment for health

People are responsive to the environment in which they find themselves and the importance of health in planning decisions is becoming increasingly recognised. Guidance published by the NICE recommends that:

- pedestrians, cyclists and users of other modes of transport that involve physical activity (including people whose mobility is impaired) should be given the highest priority when developing or maintaining streets and roads through reallocation of road space, restricting motor vehicle access, road-user charging schemes, traffic-calming schemes, and safer routes to schools
- all planning applications for new developments should prioritise the need for people (including those whose mobility is impaired) to be physically active as a routine part of their daily life
- action should be taken to ensure local facilities and services are easily accessible on foot, by bicycle and by other modes of transport involving physical activity
- the impact (intended and unintended) of any proposed changes to the built environment on physical activity levels should be assessed in advance
- part of the local transport plan block allocation should be apportioned to promoting walking and cycling and other forms of travel that involve physical activity (in line with growth targets for the use of these modes of transport) (see **Appendix 3** for further details).[145]

The concept of a hierarchy of users has been established for use in the planning and design processes for new developments and proposed traffic management schemes (see **Figure 25**).

By following the steps set out in this hierarchy, transport planners will effectively be able to prioritise health in planning decisions.

Figure 25 – a sustainable transport hierarchy

Priority	Action	Description
1	Reduce demand for motorised transport	Reducing the demand for powered transport can be achieved through a wide range of measures, including good spatial planning. If some of these measures result in increased demand for walking and cycling this should be viewed positively.
2	Modal shift to more sustainable and space efficient modes	This includes: a) shifting away from motorised modes to cycling and walking b) shifting from private motor vehicles to public transport. This also includes better integration between different public transport systems, walking and cycling.
3	Efficiency improvements to existing modes	These can be achieved through: a) behavioural changes. These include encouraging higher occupancy rates for private vehicles (eg car sharing), promoting public transport, the promotion of car clubs, promotion of eco-driving techniques, and incentives to spread demand peaks on public transport b) technical interventions to improve vehicle efficiency. This involves measures, such as the prioritisation of public transport efficiency improvements over private vehicles c) technical interventions to promote more efficient use of transport infrastructure and networks.
4	Capacity increases for powered transport	Capacity increases should only be considered once the first three steps have been fully explored. Any capacity increases that are required should be prioritised to the most efficient and sustainable modes.

Source: Sustainable Development Commission (2011) *Fairness in a car dependent society.* London: Sustainable Development Commission.

Area for action
- Land use and planning policy should prioritise:
  - high density mixed-use neighbourhoods, which facilitate active travel and the use of public transport
  - accessibility of goods and services by a range of high quality active and sustainable travel options, including walking and cycling networks, and public transport
  - providing green spaces and access to nature, to encourage social contact and integration, as well as space for physical activity.

9. Rural transport

9.1 Rural transport and health

The consequences of road traffic crashes are often more severe in rural areas than in urban areas. In the UK, the number of fatalities on all urban roads in 2010 was 572, compared to 1,046 for all rural roads, and 113 for motorways.[31] This is despite the risk of being involved in crashes in urban areas being higher than in rural areas (in 2010 the crash rate per billion miles travelled was 828 for urban roads, compared to 376 for rural roads).[31]

This is because, in addition to the design of rural roads, higher speed limits, compared with urban roads, mean that road traffic crashes are likely to occur at higher speeds, with a higher risk of injury. Access to rural roads is also often poor, which means the distance the emergency services must travel to reach those involved in crashes, and the equivalent delay in reaching healthcare services, poses a greater risk. Almost two-thirds of all road deaths are on rural roads, with the proportion increasing as overall figures fall.[31] This suggests that policies that have reduced urban road deaths have not had a similar effect on rural roads.[201]

9.2 Access to services in rural areas

Rural communities face a complex, and distinct, series of transport issues compared to those found in the urban environment. The sparse geographic distribution of rural settlements can result in large distances and journey times between destinations leading to reliance on car use as a means of transport. The average journey length for those in rural communities is 10.5 miles; two miles higher than that of the UK average.[202] Rural residents travel over 2,000 more miles per annum, in comparison to the UK average of 6,800 miles.[202, 203]

The centralisation of healthcare, jobs, shops, education, training and services has led to the closure of many facilities, which has resulted in rural communities becoming increasingly reliant on travelling further to access services.[204] The 2005 Board of Science report *Healthcare in a rural setting* identified this as a particular issue for rural communities in relation to the provision of healthcare.[203] Health outcomes for rural populations are therefore often poor, when compared to urban areas.[203] The centralisation of services, and the large geographical distances patients must travel to access them, mean rural patients also often face a lack of choice.[203]

Figure 26 outlines the percentage of rural households in England who have a service within a given distance, compared to urban areas. **Figure 27** depicts the proportion of households in Scotland within a 15 minute drive of services, by geographical area. As is apparent, a higher proportion of rural residents live further away from services, compared to those who live in urban communities.[205]

Figure 26 – proportion of rural and urban households in England who have a service within the given distance, 2011
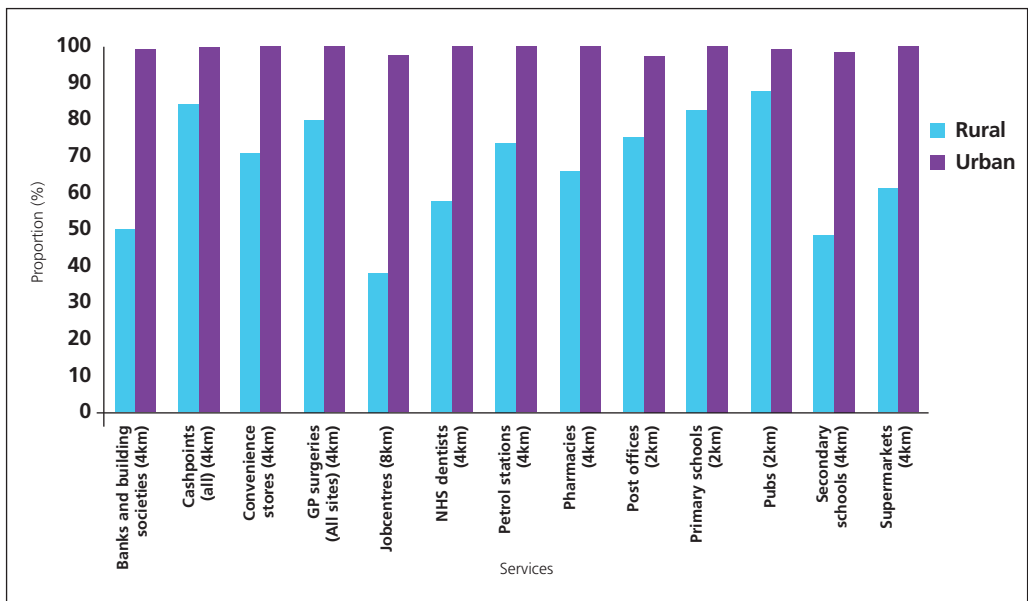
Source: ruralcommunities.gov.uk (accessed May 2012)

Figure 27 – proportion of Scotland within 15 minute drive time to service by geographic area, 2009
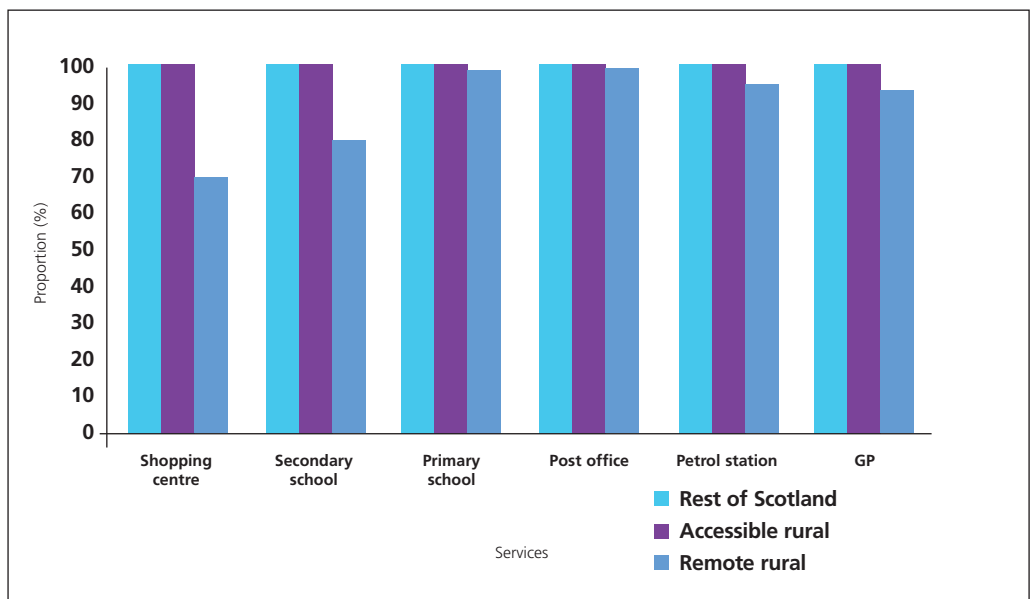
Source: The Scottish Government (2011) *National Statistics – Rural Scotland Key Facts 2011.* Edinburgh: The Scottish Government.

The Welsh Index of Multiple Deprivation shows that rural areas in Wales have wide ranging deprivation when it comes to geographical access. In terms of travelling by car, bus and actively, access in rural areas to GP surgeries, NHS dentists, food shops, leisure centres, primary schools, secondary schools, post offices and public libraries is poor.[206] The time taken to drive to general hospitals in much of rural Wales is over 40 minutes, compared to up to 20 minutes in urban areas.[206] Community hospitals have shorter drive times in rural areas, however, these hospitals do not offer the same specialist and wide ranging services as district general hospitals.[206] Access to services in Northern Ireland is predominantly poorer in rural areas, compared to urban areas.[207]

9.3 Active travel in rural areas

The dominance of cars in rural transport areas has meant that infrastructure for active travel can be poorly developed or maintained, which decreases personal mobility and accessibility.[208] Active travel in rural areas is not always a viable option, particularly where there are large distances between villages. Walking and cycling networks in rural areas are often designed for leisure purposes, rather than to connect destinations, or as commuting trips to work or school. Research has suggested that of all rural active travel trips, only 28 per cent were for commuting or shopping purposes.[209]

Personal safety can be a barrier to active travel in rural communities.[208] Footways along rural roads are often of poor quality, non-existent, or obstructed.[208] Many roads are not lit at night and do not have equivalent crossing facilities compared to roads in urban areas.[208] The poor provision of active travel networks in rural communities perpetuates the reliance on car use as the primary source of transport in rural areas.

Despite these difficulties in promoting active travel in rural areas, there are some examples of good practice. The Sustrans *Rural safe routes to school* project was found to increase active travel among children in rural communities.[210] This project worked with 18 schools in Northern Ireland to change attitudes and behaviours, and to create a cycling and walking culture, aided by improving the infrastructure around many of the schools. The project was effective in reducing the proportion of pupils driven to school from 64 per cent to 49 per cent, and increasing levels of cycling to school from 5 to 7 per cent, as well as levels of children walking increasing from 20 to 33 per cent.[210] Parents also reported that the project had made them reconsider their own travel modes.[210] This suggests that there is scope to improve levels of active travel to some degree in rural areas. Similar projects of this nature should be encouraged. Given the large amount of investment necessary to improve active travel infrastructure in rural areas, promotion of, and investment in, public transport represents the most effective solution for greater travel and health improvement in rural areas.

9.4 Public transport in rural areas

For many residents in rural areas, the car represents the most viable option for transportation, leaving those without access to a car excluded and isolated. Public transport modes can have economic barriers due to rising fares on many rural bus services. Poverty and deprivation in rural communities can often be masked by surrounding affluence.[208] This can make it harder to identify, and reduce, economic barriers.

The provision of public transport to increase accessibility to key services and activities is an important solution in rural areas. The challenges of providing public transport in areas where demand is sparse and distances are great can result in inadequate service provision, especially along key routes and at high demand times.

The distance from isolated residences to public transport waiting areas (eg bus stops, train stations etc) can be great. It is estimated that 82 per cent of households in rural areas are within a 13 minute walk of a bus stop with an hourly or better service.[126] This compares to 99 per cent of London residents and an average of 96 per cent across the UK. Inadequate public transport provision further exacerbates rural dependence on cars. In rural areas, only 51 per cent of households are within 15 minutes, by active or public transport, of healthcare facilities, compared to 80 per cent in medium urban areas, and 89 per cent in London.[211] This has led to increased reliance by rural dwellers on car use for mobility.

Improvements to the affordability, frequency and routes of public transport, such as buses, can play a role in promoting a viable alterative to cars for those living in rural areas. This offers a complex challenge to bus operators as bus routes in rural areas are generally unprofitable without public subsidy. The net Government support per passenger for local bus travel is 74.2p per journey for those in rural areas (compared to 51.5p for those in urban areas).[212] Despite this, rural residents take approximately 12 per cent fewer trips by bus per person per year, compared to those who live in the smallest urban areas.[211] Research from the 1980s found that subsidising bus services increased their use, in terms of distances travelled, and concurrently provided health benefits.[213] The Government have recognised that, because of the lack of profitability to rural bus operators, reductions in levels of subsidy for those living in rural areas could lead to savings, but would also contribute to making rural communities more isolated.[212] Any changes to the subsidisation of public transport will require careful modelling.

Integrating public and active travel may also be a useful measure to increasing bus occupancy in rural areas. This could include equipping buses to accept cycles on board. In Sheffield, a number of rural minibuses have been fitted to accept cycles onboard and carry approximately 30 bicycles per month.[214]

While improvements to buses can play an important role in rural areas, running regular buses at low occupancy is not necessarily a sustainable transport policy because demand in rural areas is often low. Demand responsive transport may offer a more effective transport solution for improving social inclusion and meeting the needs of rural communities. Demand responsive transport, such as dial-a-ride, is an advanced, user-oriented form of public transport. It is characterised by flexible routing and scheduling of small- and medium-sized vehicles operating in shared-ride mode between pick-up and drop-off locations according to passenger needs. A 2009 review of demand responsive transport in England and Wales concluded that this mode of transport has an important role to play in tackling social exclusion caused by poor accessibility, but that they take time to become established, to achieve their objectives, and to reach an acceptable

performance in terms of subsidy level.[215] They may present a useful option for transport operators and passengers in rural areas.

Areas for action

- To ensure public transport represents an affordable and effective alternative to car use in rural areas, consideration should be given to the use of subsidies.

- Demand responsive transport may offer a more effective transport solution for improving social inclusion and meeting the needs of rural communities.

10. Rail

10.1 Rail and health

Rail travel is considered less harmful to health, when compared to forms of transportation which can transport passengers over comparable distances. This is because it is a safe mode of travel, electric forms of rail do not contribute significantly to air pollution, and, when integrated with active travel networks, can encourage physical activity.[216] Rail's relative impact on climate change is considered to be less than that of car and plane travel.[217]

As has been demonstrated throughout this report, transport-related air pollution has a negative effect on health.[85] Rail transport emits less pollutants than cars, accounting for less than 2 per cent of harmful emissions from transport in the UK, compared to 55 per cent for passenger cars.[161] Emissions from rail have decreased by 22 per cent between 1995 and 2007 through increased efficiency.[218] Electrification of the rail network and replacing diesel trains could achieve further reductions in emissions. It is estimated that the operation of electric trains in the UK results in 22 per cent less CO_2 emissions than diesel trains per vehicle kilometre.[217]

Although full electrification of the UK rail network would benefit health, it is not thought to be cost effective.[217] The national rail network is around 15,800 kilometres long, and it is estimated that the cost of completely electrifying would be around £13 billion.[217] Technologies such as hybrid diesel-electric trains may represent a useful interim technology.[217]

10.2 Rail network capacity

There is already a high demand for rail services in the UK, and that demand is increasing.[219, 220] Achieving a modal shift away from road transport is likely to create a further increase in demand for rail. The House of Commons Environmental Audit Committee reported that, due to the relative capacities of road and rail in the UK, a 1 per cent shift away from road transport would generate a 10 per cent increase in demand for rail.[221] It is essential that rail network capacity keeps pace with this growing demand. Chronic under-investment in rail network capacity threatens to undermine its ability to deliver a viable alternative.[220]

The numbers of passengers using rail services are increasing at a greater rate than capacity is being increased on the UK rail network. Capacity grew by 18.6 per cent between 2003-04 and 2007-08, while estimated passenger journeys grew by 22 per cent, over the same time period, to 1.27 billion passenger journeys.[220] Data suggest train crowding is widespread, especially on London routes.[220] In 2008, for train services arriving in London between 07.00 and 09.59, more than a third of passengers were on services that were either at, or above, their designated capacity.[220] This figure rose to nearly half of all passengers between 08.00 and 09.59.[220] Overcrowding contributes to stress and injury, and increases the risk to health in the event of rail incidents.[222]

In England and Wales, the DfT is undertaking a five-year £9 billion investment programme, which began in 2009, to improve rail travel, in particular by increasing the number of passenger places on trains by March 2014. This involves a combination of longer platforms, station improvements and more carriages coming into major cities during peak hours. Latest figures suggest that all the

relevant targets will be missed.[223] The DfT has also been working with individual train operating companies, on a needs basis, to increase capacity.[224] This is mainly in the form of increasing the number of rail carriages. A number of the older train operating companies are contractually obligated to increase capacity, in contrast with the newer train operating companies, who do not have this included in their contracts.

Similar improvements are also underway in Scotland because of overcrowding, with work on the £1 billion Edinburgh-Glasgow Improvements Programme underway. These improvements include upgrades to infrastructure, in addition to increasing rolling stock and service provision. In Northern Ireland, between £100 million and £120 million is being spent on increasing rolling stock on the Northern Ireland rail network to increase capacity.[225]

10.3 Rail network cost

The cost of rail transport can impact on passengers' transport decisions. The real cost of rail travel has increased over the past 30 years, whereas the real cost of all motoring has decreased.[39] This suggests it is more expensive to travel by train than by car. Contrasting research commissioned by the Association of Train Operating Companies in 2010, conducted by the University of Southampton, found that approximately four out of five trips are cheaper by rail, than by car (in terms of marginal costs).[226] This strongly contrasts with the public perception of rail travel, where the cost of fares is rated as one of the biggest barriers to the uptake of rail travel (see **Appendix 2**).[227]

The cost of travelling by rail and car is more complex than comparing like with like. This is because the cost associated with travelling by rail is not only dependent on where an individual travels, but also at what time they are travelling. Travelling off-peak, when trains are less busy, is usually substantially lower in price than travelling on-peak. While rail travel may be similar in cost to car use, it may not necessarily be practical, convenient or possible to travel at the time available. To ensure rail travel represents a realistic alternative to car use, it should be priced at a level that encourages its uptake.

10.4 High speed rail

High speed rail is a form of rail passenger transport that operates at speeds higher than normal rail services (more than 250 kilometres per hour). The advent of HSR has made it possible for the railway to substitute air travel on routes of around 600 kilometres, or a one hour flight, by offering comparable or shorter travel times.[228] In 2011, the UK Government announced plans to develop a national HSR network from London to Birmingham, Manchester and Leeds. The implementation of this HSR network is likely to see journey times between major UK city centres reduce.[229] These journey time reductions are not achievable by upgrading the existing rail network.[229]

The use of HSR is widespread throughout Europe and worldwide, with major networks developed in France, Germany, Italy, Spain, Japan and China. **Figure 28** outlines the miles of high speed lines in place, or planned to be in place by 2025, by country.

Figure 28 – miles of high speed rail lines in place or planned by 2025
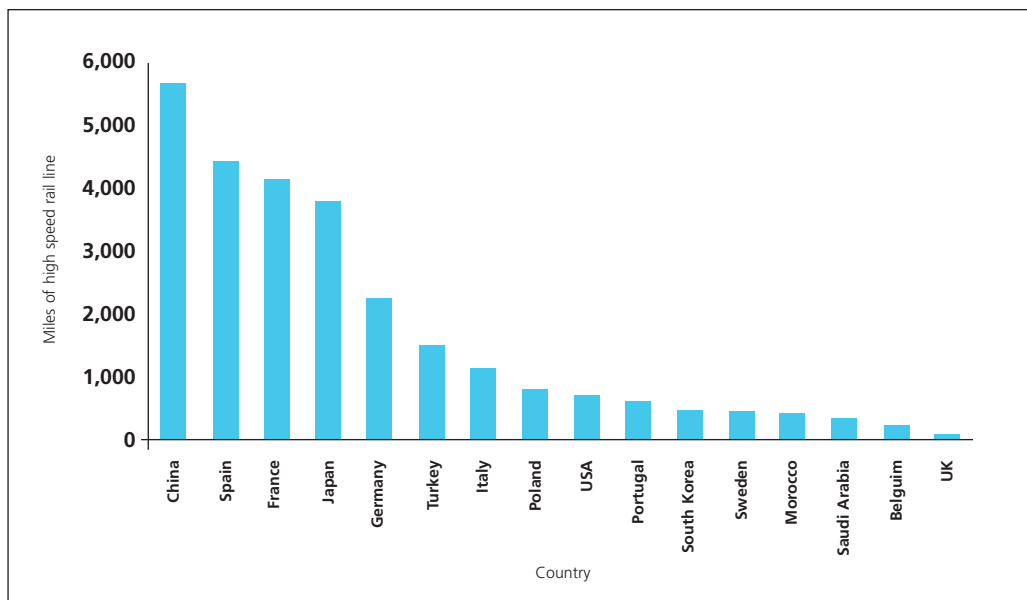
Source: Network Rail (2009) *Meeting the capacity challenge: the case for new lines.* London: Network Rail.

High speed rail and health

When compared to alternative forms of passenger transport, such as car and aviation, HSR is seen as preferable in health terms, as it produces fewer emissions when at optimal capacity. A comparison of CO_2 emissions from aircraft and HSR when travelling between London and Paris found that HSR has lower CO_2 emission levels.[230] It is assumed that as energy production improves, the carbon performance of HSR should improve further. The development of a HSR network in the UK (with the aim of shifting from aviation to HSR) is supported by the THSG.

It is important to note that there are indirect costs with developing a HSR network. Any development of transport infrastructure has high costs in terms of emissions produced. Evidence has shown that construction of rail infrastructure is energy intensive.[231] The Government's latest assessment for potential emissions associated with the implementation of a HSR network recognised this, and estimated that as a worse case scenario total annual domestic transport emissions would increase by around 0.3 per cent.[229] More detailed assessments as to the potential impact of the UK HSR network are planned during the next stage of design.[229]

Cost-efficiency of high speed rail

A 2012 assessment of the economic case for a UK HSR network found the HSR lies towards the lower end of being considered value for money.[232] Definitive assessments have only been made for the introduction of HSR between London and the West Midlands. The benefit cost ratio for the development of HSR between these two destinations was 1.4, meaning that the benefits of HSR outweigh the costs.[232]

A 2010 analysis conducted by the DfT on the potential costs and benefits of improving rail and road networks, indicated that major, multi-billion pound upgrades to existing road and rail networks would provide far less additional capacity than a new HSR line.[233] The West Coast Route Modernisation rail project cost £8.9 billion, took almost a decade to complete, delivered fewer benefits than originally envisaged, and caused serious ongoing delays to travellers and businesses.[233] Research on transport infrastructure projects has demonstrated that cost escalation is related to the length of the implementation phase of any project.[234]

Modal shift in demand

Demand for travel between the UK's largest cities is expected to increase over the coming decades.[233] This has the potential to see congestion and crowding gradually worsen across all modes of transport. Increased travel across conventional networks would result in slower and less reliable journeys for travellers, in addition to the associated health harms of increased road transport.

High speed rail networks in Europe have been shown to lead to a modal shift away from domestic air travel towards HSR. The HSR network between Madrid and Seville took 90 per cent of the domestic air market share between these two cities, over a period of 17 years.[235] The HSR line between Barcelona and Madrid has captured 46 per cent of the domestic air market share in little over a year.[235] Research conducted by Eurostar, found that by 2005, Eurostar gained 71 per cent of the market for the London to Paris route, and 64 per cent on the London to Brussels route.[236]

Analysis by the Government predicts that a UK HSR network offers the capability to absorb increases in demand for rail, and that developing a HSR network will release space on conventional rail, improve intercity connections, and reduce journey times between cities.[237] It is predicted that by 2043, 136,000 passengers will be using HSR between London and Birmingham. It is envisaged that by 2043 the introduction of HSR will lead to an annual 6 per cent shift away from aviation, and 7 per cent shift away from car use, relative to current levels.[238] It is worth noting that concern has been expressed that the predicted shift in transport patterns has been overestimated, in particular that the implementation of HSR would only be expected to address demand and rail capacity on existing transport corridors.[229]

Further concerns have been expressed that a modal shift away from air travel towards HSR would not necessarily correspond to a reduction in total air travel without additional policy measures.[228] Freed capacity at airports from reductions in short-haul domestic flights means there would be increased capacity for longer-haul flights, which produce greater emissions. While HSR is likely to be a more efficient form of travel, its implementation may lead to increases in overall transport emissions without additional policy measures to restrict aviation growth.

In light of these concerns, it is essential that the development of a HSR network in the UK is monitored to assess the extent to which it encourages a modal shift in transport behaviour away from car use and air travel, as well as the wider impacts on health. Consideration also needs to be given to the cost of using HSR. Given that there are already high costs associated with rail fares,

which look set to increase in the near future, there is a risk that the cost of HSR will be prohibitively high, and not accessible to all. Low cost airlines, competing against high speed trains, may reduce the HSR market share, and it is predicted that HSR in the UK is likely to face more intense price competition from airlines than that seen in the continent.[239]

Area for action
- The introduction of HSR should be monitored to assess the extent to which it encourages a modal shift in transport behaviour away from car and air travel, and its wider impact on health.

11. Transport and the NHS

The NHS is the largest single organisation in the UK. It accounts for 5 per cent of all road traffic in England, and travel is responsible for 18 per cent of the NHS carbon footprint.[240, 241] In the UK, NHS staff, patients and visitors travel approximately 25 billion kilometres each year.[240] Transport is therefore a key area where the NHS can have a demonstrable impact on health.

Central to achieving this is to ensure NHS services are accessible by a range of different forms of transport. This should be included in the design and commissioning of any new NHS facilities, and include a particular emphasis on access by walking, cycling and public transport. This does not mean that patients and healthcare staff should be expected to refrain from car use when it is essential, but it is important to shift the balance of advantage towards health promoting modes of transport. Changes are needed to the NHS transport network to provide safe, efficient, accessible and reliable public and active travel links that will encourage patients and healthcare staff to avoid unnecessary car use. In addition to the health benefits to staff and patients that an integrated transport system would bring, the NHS is legally bound by the Climate Change Act to reduce carbon emissions by 80 per cent by 2050 (compared to 1990 levels). It is therefore essential that steps are taken to reduce emissions from the NHS transport sector.

The NHS can also play a key role in developing a health focused integrated local transport environment. As noted previously, the NHS is involved in many local partnerships, which provides the opportunity to influence local transport policy. This might include ensuring that communities which commonly lack access to a car are able to reach medical appointments through the provision of high quality active and public transport links.

Area for action
- All planning decisions in the NHS should prioritise accessibility over mobility to ensure healthcare services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

12. Conclusion

Transport unquestionably impacts on the health of the population. Whether this impact is positive or negative depends on the transport environment. Transport policy in the UK over the last two decades has contributed to a situation where travelling by car is more attractive than travelling actively or by using public transport. The deregulation of public transport, rather than leading to improvements in standards, has led to reductions in the provision and quality of bus and rail services. It has also led to increases in the cost of travelling by public transport. As a result, the uptake of public transport is low compared to car use.

Spatial planning within the built environment has also played a significant part in making car travel more attractive, compared to other transport options. Planning decisions have overemphasised the importance of being able to travel, and provided insufficient attention to the ability of individuals to access services and destinations. This has often meant that the distances needed to reach essential services, such as healthcare, have become so prohibitively large that travelling actively or by public transport is not a viable option.

The continued expansion in the number of cars on UK roads over the past 60 years has further increased people's reliance on them. It has also negatively influenced the levels of active travel, as cyclists and pedestrians are subjected to a higher level of risk of harm from cars and the experience of walking or cycling has become more unpleasant.

Reducing the negative impact of transport on health will necessitate a shift in societal norms, to one where travelling by car is not always seen as the most effective means of travel. The focus should be on developing an environment where travelling actively or by public transport is as efficient and effective as travelling by car. This will provide a range of co-benefits to the health of the nation, in terms of reductions in road traffic crashes and health-related harms from emissions. It will also contribute to mitigating the impact of climate change.

Policy decisions that reduce demand for car use, while in tandem encouraging a modal shift to more active and sustainable forms of transport, are vital. Maintaining a commitment to reducing road capacity will be necessary to ensure the benefits of this modal shift are realised. Improvements in the efficiency of private motorised transport are also important, but they will not be enough on their own to have a significant impact on health.

Achieving this shift in UK transport policy requires strong governmental commitment and leadership as the benefit to health will not always be instant. Given transport decisions have the potential to last decades, it is essential the right decisions are made, and health improvement should always be recognised as a pivotal component in transport strategies and programmes. Healthcare professionals and the NHS can also play a key role in supporting a modal shift. This includes the advice given to patients promoting physical activity through active travel, being exemplars of good practice as employers and in the provision of healthcare, and working as a part of local strategic partnerships to promote change.

The following sets out a number of areas for action to support a modal shift in UK transport policy.

A strategic approach to transport policy and the urban environment

- Transport policy should aim to reduce the need to travel long-distances to access jobs, education, services and other destinations, and encourage a modal shift away from private motor transport towards active forms of travel which benefit health. This will include:
  - prioritising accessibility over mobility in planning decisions to ensure local facilities and services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity
  - reducing congestion and improving usability of roads by pedestrians and cyclists through reallocation of road space, restricting motor vehicle access, road-user charging schemes, and traffic-calming and traffic management (including area-wide 20 miles per hour speed limits)
  - the provision of a comprehensive network of routes for walking, cycling and using other modes of active travel that offer everyone (including people whose mobility is impaired) convenient, safe, well-designed and direct access to workplaces, homes, schools and other public facilities
  - the creation of safe routes to school so that children and parents can travel to school by walking or cycling, and the provision of suitable cycle and road safety training for all pupils.

- Ambitious growth targets for walking and cycling should be set at national and regional levels, with increased funding and resources proportional to target levels.

- Road safety should be addressed at a strategic level through a danger reduction approach that addresses the factors that put pedestrians and cyclists at risk, rather than seeking to reduce casualties by limiting pedestrians and cyclists from making the trips they need to undertake.

- Land use and planning policy should prioritise:
  - high density mixed-use neighbourhoods, which facilitate active travel and the use of public transport
  - accessibility of goods and services by a range of high quality active and sustainable travel options, including walking and cycling networks, and public transport
  - providing green spaces and access to nature, to encourage social contact and integration, as well as space for physical activity.

- Low carbon transport options and energy efficient technology should be adopted where car use and motorised transport is necessary. Any efficiency savings in engine technologies should be accompanied by regulation that prioritises active and sustainable forms of transport, and planning decisions that prioritise accessibility over mobility, to ensure efficiency savings are not translated into a higher prevalence of car use.

- There should be further development of, and incentives for, alternatives to traditional car usage patterns such as workplace car sharing schemes and car clubs.

Public transport

- Adequate provision of public transport, that is tailored to meet the needs of users, should be available and accessible to all passengers, including elderly and disabled people. This requires public transport services which are accessible in terms of the distance taken to reach them, and in terms of gaining access to them.

- Public transport should be affordable to all to ensure that it represents an effective alternative to car use in cities, towns and rural areas. Special consideration should be given to the use of subsidy in rural areas.

- Demand responsive transport may offer a more effective transport solution for improving social inclusion and meeting the needs of rural communities.

- To maximise the potential for car-free travel, facilities should be improved for combining active travel with local and longer-distance public transport.

- The introduction of HSR should be monitored to assess the extent to which it encourages a modal shift in transport behaviour away from car and air travel, and its wider impact on health.

The role of healthcare professionals and the NHS

- All planning decisions in the NHS should prioritise accessibility over mobility to ensure healthcare services are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

- Healthcare organisations should work in partnership with local authorities to ensure local transport plans/infrastructure, and proposals for urban development and regeneration support physically active travel, including prioritising the needs of pedestrians and cyclists over motorists. This should incorporate the use of the WHO health economic assessment tool (HEAT) for cycling and walking.

- Healthcare professionals and managers in the NHS who have responsibility for promoting workplace health should ensure there is an organisation-wide plan or policy to encourage and support employees to be more physically active, including policies to encourage employees to walk, cycle or use other modes of transport involving physical activity (to travel to and from work and as part of their working day).

- When it is clinically appropriate, healthcare professionals should:
  - promote walking and cycling as an effective way of improving physical activity levels through the use of brief face-to-face advice, remote support (either delivered by the telephone or internet), and approved individual (eg pedometers) and group-based interventions (eg walking and cycling schemes)
  - encourage parents, carers and families to complete at least some local journeys (or some part of a local journey) with young children using a physically active mode of travel
  - sign post to information about opportunities for active travel in the local community.

- Healthcare professionals can use their influence as community members and leaders to promote walking, cycling and other modes of transport involving physical activity by:
  - acting as role models and opting for travel involving physical activity whenever it is practical
  - working as advocates in local strategic partnerships to ensure accessibility is prioritised over mobility in planning decisions so that workplaces, homes, healthcare services, schools and other public facilities are easily and safely accessible on foot, by bicycle and by other modes of transport involving physical activity.

Appendix 1: Transport and climate change

Climate change refers to a significant and lasting deregularisation to the climate over a period of time, whether through natural variability, or through human activity.[242] A key process in the regulation of the climate is the greenhouse effect. The greenhouse effect is the process by which greenhouse gases (GHG) – which include CO_2, methane (CH4) and nitrous oxide (N_2O) – and water vapour, absorb and re-emit solar infrared radiation.[84] It is a natural process which contributes to regulating global atmospheric temperatures.

Alterations to the concentrations of GHGs have an effect on the climate. Human activities, such as the burning of fossil fuels for transport, have contributed to an increase in GHG emissions.[32] This has the effect of intensifying the impact of the greenhouse effect, and thus contributing to changes in the earth's climate, such as increases in temperature.

Transport is the fastest growing source of emissions; responsible for 25 per cent of global CO_2 emissions.[243] In the UK transport makes up 29 per cent of total CO_2 emissions, of which personal car use accounts for 55 per cent of these emissions.[161, 244] Emissions from transport have grown by 45 per cent between 1990 and 2007 – including by 6 per cent for personal car use (see **Figure 29**).[161] If the current transport environment remains unchanged, these figures are expected to increase by a further 40 per cent by 2030.[33, 245] Transport's contribution to carbon emissions contrasts with all other carbon producing sectors, which have achieved a reduction in emissions since 1990 (**Figure 29**).[161]

Freight is also a contributor to transport emissions. After cars and taxis, LGVs and HGVs are the second largest contributors in terms of CO_2 emissions.[45] Emissions from LGVs and HGVs have increased by almost 20 per cent from over 33 million tonnes of CO_2 per year in 1990, to over 39 million tonnes of emissions in 2008.[45] This is in contrast to rail and domestic shipping, where CO_2 emissions have remained fairly static at around seven to nine million tonnes of CO_2 over the same time period.[45]

Figure 29 – estimated greenhouse gas (GHG) emissions for transport in the UK, 1990 to 2007
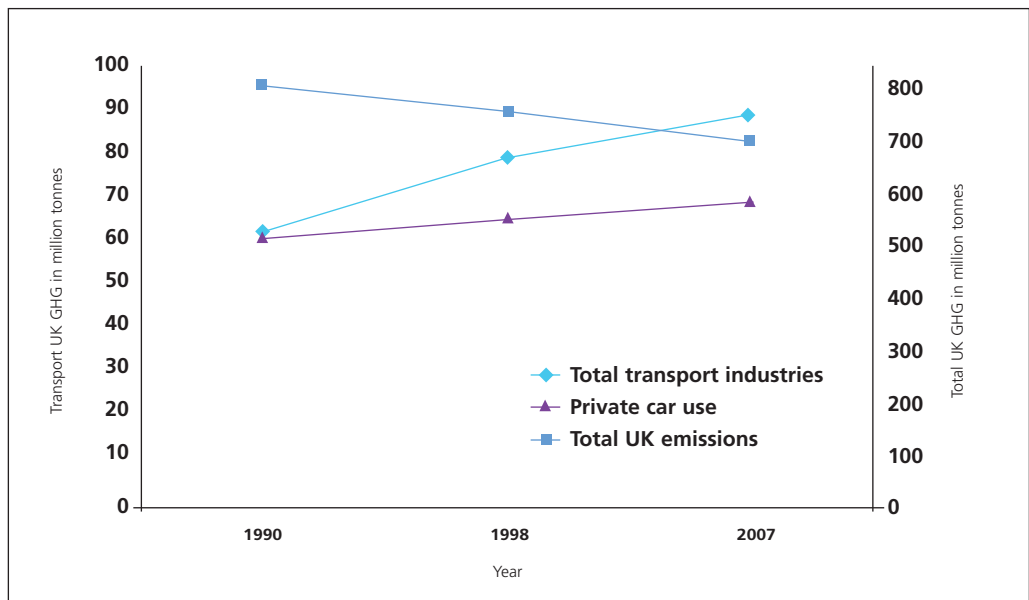
Source: Department for Transport (2008) *UK transport and climate change data factsheet*. London: Department for Transport.

There are a number of potential consequences of future changes in climate. On a global scale, climate change may affect many of the key determinants of wealth and wellbeing, including water supply, food production, human health, availability of land, economic stability, infrastructure, and the environment.

Climate change contributes to the global burden of disease and premature death, and its impact on health is expected to increase as climate change accelerates.[243] It is estimated that the modest climate change that occurred between the mid 1970s and 2000 caused the loss of over 55,000 lives and over 1.5 million DALYs per year.[246] The main ways that climate change can affect the health of a population are through increased deaths, disease and injury due to:

- heatwaves (with the greatest impact on the elderly, babies and young children, and people with ill-health)
- flooding and storms (including drowning, chemical hazards and contamination of drinking water and mental stress)
- increased spread of infections previously only seen in other parts of the world (such as tick-borne encephalitis, lyme disease, malaria, dengue, leptospirosis and West Nile Virus)
- reduced food safety associated with warmer temperatures
- greater exposure to UV radiation with increased risk of sunburn, sunstroke and skin cancers
- reduced air quality and increased pollens.[247]

Appendix 2: Perceptions of transport

The following provides an overview of the various perception surveys[o] into transport attitudes in the UK.

Car use

A 2007 survey of attitudes to transport among those aged 50 years of age and over in England found that cars were widely perceived to offer convenience and comfort, giving drivers a feeling of personal freedom and control.[40] Driving itself was a source of enjoyment for some.[40] Those with mobility problems, that restricted the use of other modes of transport, identified driving as particularly important.[40] The disadvantages associated with driving included high costs, damage to the environment, and congestion on the roads.[40] A similar survey conducted among English 16 to 25 year old respondents found that the main benefits and attractions associated with cars were practical advantages.[109] These included independence, the ability to help others, and the fact that driving was a leisure activity. Disadvantages to car use included concerns over cost and safety.[109]

A 2005 Scottish survey found the most common reason cited for not driving was the expense, especially among young people.[41] The proportion of individuals indicating that they did not drive because car use is bad for the environment was highest among those in the top income quartile.[41] Around one in ten Scottish drivers felt they had no alternative to the car for the type of journey that they made most often.[41] The most common reasons for not switching to other forms of transport were related to length of journey time and convenience.[41]

In 2010, the DfT reported on British attitudes to transport over the past 20 years. It found that dealing with congestion was a contentious issue. Approximately 40 per cent of all car users believed the government should build more roads to reduce traffic congestion.[248] A further 40 per cent disagreed, believing that building more roads encourages more traffic.[248] Over 40 per cent of drivers believed that many of the car journeys they made that were less than two miles, could be made by walking, cycling, or taking the bus.[248] Almost two-thirds felt that those who drive at busy times do so because there is no alternative.

Support for traffic calming measures is high. A 2011 survey of British attitudes to transport found the greatest support was for the introduction of 20 miles per hour zones in residential streets.[249] Support for traffic calming measures, such as speed bumps and closing residential streets to traffic, were less well supported.[249] The same survey found that more than two thirds of the public were concerned about the effects of car use on climate change, and believed that levels of car use should be reduced to protect the environment.[249] Evidence suggests, however, that these concerns have been declining in recent years.[248]

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o   It is important to note that survey findings should be treated with caution, as they generally do not provide strong evidence of cause and effect.

Active travel

A 2007 survey among 18 to 25 year olds in England found the advantages associated with active travel were related to personal space, freedom, reducing the environmental impacts of transport use, and improving air quality.[109] Negative concerns included safety and exposure to the weather.[109] A similar survey conducted in the same year in England among those aged 50 years of age and over found active travel was seen as popular because of the inherent health benefits and the enjoyment it gives.[40]

Attitudes towards walking and cycling were explored in a 2008 systematic review. It was found that barriers to active travel included a culture of car use, fed by a fear and dislike of local environments, and parental responses that emphasised children's safety at the expense of developing their independence.[250]

Specific to perceptions of walking, research has demonstrated that, for all but the shortest journeys, walking is perceived be an ineffective means of transport.[251] This is mainly due to physical and social barriers, long journey times and distances. The combination of these factors results in walking being considered impractical for daily requirements, as a specific or preferred option, or is completely removed from consideration altogether.

Results from a 2010 survey of English road users found the single most important barriers to road cycling were related to other road users.[252] In particular, the behaviour of other road users, as well as the volume and speed of traffic.[252] Other motivations not to cycle included the inconvenience, the perceived effort involved, concerns over being out in the open (such as poor weather), the level of commitment needed, and concerns over personal security.[252] Individuals may also have had inadequate facilities at their destinations, such as showers and changing rooms, which may discourage cycling.

Public transport

Among English public transport users, survey data suggests that services are rated highly.[248] Four out of five passengers rate bus services as good, and are happy with the frequency of services.[248] The perceived benefits of bus users include its low cost, compared with other transport modes, as well as the wide coverage of bus routes across many areas.[40] The key barriers to bus use include problems with access for people with mobility impairments, fear of crime, and the limited nature of bus networks, particularly in rural areas.[40]

Views about public transport among 18 to 25 year olds in England largely centre on the quality of local transport provision, and about contact with public transport officials, such as bus drivers, who are perceived by younger passengers as treating them discourteously.[109] Safety is also a key factor in young people's views about public transport, particularly the fear of harassment or attack.[109]

A 2009 English survey found that, of those who do not use local bus services, the most frequently cited reason for doing so was the ease and convenience of using a car.[169] Other reasons cited

included long journey time, poor reliability of services, difficulty accessing services, services not going where required, perceived high costs, and concerns about crime.

In Scotland, in general levels of bus passenger satisfaction are high.[253] This is particularly in reference to accessibility of bus stops, ease of fare paying, personal safety on the bus, provision and visibility of handrails, and the demeanour of the driver.[253] Bus users aged 60 or over are generally more satisfied with buses than those under 60, with a large difference in satisfaction between age groups in terms for value for money.[253]

Rail

A 2010 survey of UK short and long distance rail users perceptions of rail transport, found that most users rated services as good and were generally positive about services.[227] Of those that did not rate rail services as good for short and long distance journeys, a little over half did not use rail regularly.[227] The main reason people did not use trains for short distance journeys, or only did so infrequently, was the perceived convenience of travelling by car, as well as stations not being close to the start of their journey.[227] The aspects of rail services often rated least highly by rail users were the cost of fares and ease of parking at stations.[227]

Appendix 3: public health guidance on transport and health

The following provides an overview of the key recommendations from NICE public health guidance relevant to transport and health.

Four commonly used methods to increase physical activity: brief interventions in primary care, exercise referral schemes, pedometers and community-based exercise programmes for walking and cycling (PH2).

Brief interventions in primary care
• Primary care practitioners should take the opportunity, whenever possible, to identify inactive adults and advise them to aim for 30 minutes of moderate activity on five days of the week (or more). They should use their judgement to determine when this would be inappropriate (for example, because of medical conditions or personal circumstances). They should use a validated tool, such as the Department of Health's forthcoming general practitioner physical activity questionnaire (GPPAQ), to identify inactive individuals.
• Local policy makers, commissioners and managers, together with primary care practitioners, should monitor the effectiveness of local strategies and systems to promote physical activity. They should focus, in particular, on whether or not opportunistic advice is helping to increase the physical activity levels of people from disadvantaged groups, including those with disabilities (and thereby tackling health inequalities). They should also assess how effective professionals from a range of disciplines are at raising long-term physical activity levels among these groups.

Pedometers, walking and cycling schemes
• Practitioners, policy makers and commissioners should only endorse pedometers and walking and cycling schemes to promote physical activity that are part of a properly designed and controlled research study to determine effectiveness. Measures should include intermediate outcomes such as knowledge, attitude and skills, as well as measures of physical activity levels.

Promoting and creating built or natural environments that encourage and support physical activity (PH8)

Strategies, policies and plans

Who should take action?

Those responsible for all strategies, policies and plans involving changes to the physical environment. This includes the development, modification and maintenance of towns, urban extensions, major regeneration projects and the transport infrastructure. It also includes the siting or closure of local services in both urban and rural areas.

What action should they take?

- Involve all local communities and experts at all stages of the development to ensure the potential for physical activity is maximised.
- Ensure planning applications for new developments always prioritise the need for people (including those whose mobility is impaired) to be physically active as a routine part of their daily life. Ensure local facilities and services are easily accessible on foot, by bicycle and by other modes of transport involving physical activity. Ensure children can participate in physically active play.
- Assess in advance what impact (both intended and unintended) the proposals are likely to have on physical activity levels. (For example, will local services be accessible on foot, by bicycle or by people whose mobility is impaired?) Make the results publicly available and accessible. Existing impact assessment tools could be used.

Transport

Who should take action?

Those responsible for all strategies, policies and plans involving changes to the physical environment, including local transport authorities, transport planners and local authorities.

What action should they take?

Ensure pedestrians, cyclists and users of other modes of transport that involve physical activity are given the highest priority when developing or maintaining streets and roads. (This includes people whose mobility is impaired.) Use one or more of the following methods:

- re-allocate road space to support physically active modes of transport (as an example, this could be achieved by widening pavements and introducing cycle lanes)
- restrict motor vehicle access (for example, by closing or narrowing roads to reduce capacity)
- introduce road-user charging schemes
- introduce traffic-calming schemes to restrict vehicle speeds (using signage and changes to highway design)
- create safe routes to schools (for example, by using traffic-calming measures near schools and by creating or improving walking and cycle routes to schools).

Who should take action?

Planning and transport agencies, including regional and local authorities.

What action should they take?

Plan and provide a comprehensive network of routes for walking, cycling and using other modes of transport involving physical activity. These routes should offer everyone (including people whose mobility is impaired) convenient, safe and attractive access to workplaces, homes, schools and other public facilities. (The latter includes shops, play and green areas and social destinations.) They should be built and maintained to a high standard.

Public open spaces

Who should take action?
- Designers and managers of public open spaces, paths and rights of way (including coastal, forest and riverside paths and canal towpaths).
- Planning and transport agencies including regional and local authorities.

What action should they take?
- Ensure public open spaces and public paths can be reached on foot, by bicycle and using other modes of transport involving physical activity. They should also be accessible by public transport.
- Ensure public open spaces and public paths are maintained to a high standard. They should be safe, attractive and welcoming to everyone.

Buildings

Who should take action?
Architects, designers, developers, employers and planners.

What action should they take?
- Those involved with campus sites, including hospitals and universities, should ensure different parts of the site are linked by appropriate walking and cycling routes. (Campuses comprise two or more related buildings set together in the grounds of a defined site.)
- Ensure new workplaces are linked to walking and cycling networks. Where possible, these links should improve the existing walking and cycling infrastructure by creating new, through routes (and not just links to the new facility).

Who should take action?
Architects, designers and facility managers who are responsible for public buildings (including workplaces and schools).

What action should they take?
- During building design or refurbishment, ensure staircases are designed and positioned to encourage people to use them.
- Ensure staircases are clearly signposted and are attractive to use. For example, they should be well-lit and well-decorated.

Schools

Who should take action?
Children's services, School Sport Partnerships, school governing bodies and head teachers.

What action should they take?
- Ensure school playgrounds are designed to encourage varied, physically active play.
- Primary schools should create areas (for instance, by using different colours) to promote individual and group physical activities such as hopscotch and other games.

Workplace health promotion: how to encourage employees to be physically active (PH13)

Policy and planning

Who should take action?
- Employers in organisations of all sizes (in larger organisations this might include their representatives, for example, human resources [HR] directors and senior managers).
- Public health professionals, occupational health professionals, workplace health promoters.
- Trades unions, other employee representatives, employees.

What action should they take?
Develop an organisation-wide plan or policy to encourage and support employees to be more physically active. This should:
- include measures to maximise the opportunity for all employees to participate
- be based on consultation with staff and should ensure they are involved in planning and design, as well as monitoring activities, on an ongoing basis
- be supported by management and have dedicated resources
- set organisational goals and be linked to other relevant internal policies (for example, on alcohol, smoking, occupational health and safety, flexible working or travel)
- link to relevant national and local policies (for example, on health or transport).

Implementing a physical activity programme

Who should take action?
- Employers in organisations of all sizes (in larger organisations this might include their representatives, for example, HR directors and senior managers).
- Public health professionals, occupational health professionals, workplace health promoters.
- Trades unions, other employee representatives, employees.

What action should they take?
Introduce and monitor an organisation-wide, multi-component programme to encourage and support employees to be physically active. This could be part of a broader programme to improve health. It could include:
- flexible working policies and incentive schemes
- policies to encourage employees to walk, cycle or use other modes of transport involving physical activity (to travel to and from work and as part of their working day)
- the dissemination of information (including written information) on how to be more physically active and on the health benefits of such activity. This could include information on local opportunities to be physically active (both within and outside the workplace) tailored to meet specific needs, for example, the needs of shift workers
- ongoing advice and support to help people plan how they are going to increase their levels of physical activity
- the offer of a confidential, independent health check administered by a suitably qualified practitioner and focused on physical activity.

Components of the physical activity programme
Who should take action?
• Employers in organisations of all sizes (in larger organisations this might include their representatives, for example, HR directors and senior managers).
• People responsible for buildings and facilities.
• Public health professionals, occupational health professionals, workplace health promoters.
• Trades unions, other employee representatives, employees.
What action should they take?
• Encourage employees to walk, cycle or use another mode of transport involving physical activity to travel part or all of the way to and from work (for example, by developing a travel plan).
• Help employees to be physically active during the working day by:
• where possible, encouraging them to move around more at work (for example, by walking to external meetings)
• putting up signs at strategic points and distributing written information to encourage them to use the stairs rather than lifts if they can
• providing information about walking and cycling routes and encouraging them to take short walks during work breaks
• encouraging them to set goals on how far they walk and cycle and to monitor the distances they cover
• take account of the nature of the work and any health and safety issues. For example, many people already walk long distances during the working day, while those involved in shift work may be vulnerable if walking home alone at night.

Promoting physical activity, active play and sport for pre-school and school-age children and young people in family, pre-school, school and community settings (PH17)

National campaign

Who is the target population?
- Children and young people aged 18 and under, their families and carers.
- Planners and providers of services and facilities.

Who should take action?
- Department of Health, Department for Children, Schools and Families and Department for Culture, Media and Sport working with:
  - Department for Business, Enterprise and Regulatory Reform
  - Department for Communities and Local Government
  - Department for Energy and Climate Change
  - Department for Environment, Food and Rural Affairs
  - Department for Innovation, Universities & Skills
  - Department for Transport
  - Cabinet Office
  - Home Office
  - Ministry of Justice.

What action should they take?
- Deliver a long-term (minimum 5 years) national campaign to promote physical activity among children and young people. The campaign should be integrated with and support other national health campaigns and strategies to increase participation in play and sport and reduce obesity (such as 'Change4Life').
- Use research, consult and actively involve children and young people and their parents to determine the best media to use, the most effective messages and the most appropriate language for different groups. (Examples of different groups that could be covered include families, parents and carers, and children of different ages, ethnicity and who have different levels of physical ability.)
- Ensure the campaign is consistent and sustained. It should convey that physical activity:
  - is healthy, fun and enjoyable, makes you feel good and can be sociable (that is, it can be undertaken with existing friends or can help develop new ones)
  - promotes children and young people's independence
  - helps develop children's movement skills
  - can involve a wide variety of formal and informal activities such as play, dance, swimming, the gym, sport (including street sport and games) and physically active travel (such as walking, cycling and wheelchair travel)
  - can (and should) become a regular part of daily life and that small lifestyle changes can be worthwhile (for example, active travel to school, the shops or the park, using the stairs and ramps instead of lifts and helping with housework)
  - can be maintained by trying new and challenging activities to keep children and young people interested and motivated
  - is something that adults, especially parents and carers, should incorporate into their lives to set an example.

National campaign (continued)

- Ensure the campaign addresses any concerns that parents and carers may have about their children's safety.
- Encourage regional and local campaigns to use the same messages, as well as promoting examples of local opportunities to be physically active.
- Develop resources for regional and local dissemination of the campaign (for example, promotional materials and support for those delivering it).
- Use process, impact and outcome measures to ensure national, regional and local campaigns are delivered effectively.

Raising awareness of the importance of physical activity

Who is the target population?
Children and young people aged 18 and under, their families and carers.

Who should take action?
- Chairs of children's trusts.
- Chairs of local strategic partnerships.
- Chief executives of primary care trusts (PCTs).
- Directors of children's services.
- Directors of public health.

What action should they take?
- Ensure the following explicitly address the need for children and young people to be physically active:
  - children and young people's plans
  - joint strategic needs assessments
  - local development and planning frameworks
  - sustainable community plans and strategies.
- Ensure there is a coordinated local strategy to increase physical activity among children and young people, their families and carers. The strategy should help achieve local area agreement targets.
- The strategy should ensure:
  - there are local indoor and outdoor opportunities for physical activity where children and young people feel safe
  - individuals responsible for increasing physical activity are aware of national and local government strategies as well as local plans for increasing physical activity
  - partnership working is developed and supported within local physical activity networks
  - physical activity partnerships establish and deliver multi-component interventions involving schools, families and communities. (Partners may include: schools, colleges, out-of-school services, children's centres and play services, youth services, further education institutions, community clubs and groups and private sector providers).
  - local factors that help children and young people to be (or which prevent them from being) physically active are identified and acted upon
  - local transport and school travel plans are coordinated so that all local journeys can be carried out using a physically active mode of travel.

Raising awareness of the importance of physical activity (continued)

- Ensure physical activity initiatives aimed at children and young people are regularly evaluated. Evaluations should measure uptake among different groups (for example, among those with disabilities or from different ethnic backgrounds). Any changes in physical activity, physical skills and health outcomes should be recorded. In addition, progress towards local area agreement targets should be monitored.
- Identify a senior council member to be a champion for children and young people's physical activity. They should:
  - promote the importance of encouraging physical activity as part of all council portfolios
  - ensure physical activity is a key priority when developing local authority programmes and targets
  - promote partnership working with council member leads of relevant departments (for example, transport, leisure and health)
  - explain to the public the local authority's role in promoting physical activity.

Planning the provision of spaces and facilities

Who is the target population?

Children and young people aged 18 and under, their families and carers.

Who should take action?

The following should take action in partnership with, or as part of, the local strategic partnership:

- Directors of children's services.
- Directors of leisure and cultural services.
- Directors of planning and regeneration.
- Governors and heads of schools and colleges, office managers and other decision-makers involved with buildings and outdoor spaces within the public, voluntary, community and private sectors.
- Planning and regeneration service managers and project managers and those involved in developing the 'Unitary development plan' (UDP) or other strategic planning documents.
- Representatives from crime and disorder reduction partnerships.

What action should they take?

- Ensure physical activity facilities are suitable for children and young people with different needs and their families, particularly those from lower socioeconomic groups, those from minority ethnic groups with specific cultural requirements and those who have a disability.
- Provide children and young people with places and facilities (both indoors and outdoors) where they feel safe taking part in physical activities. These could be provided by the public, voluntary, community and private sectors (for example, in schools, youth clubs, local business premises and private leisure facilities). Local authorities should coordinate the availability of facilities, where appropriate. They should also ensure all groups have access to these facilities, including those with disabilities.
- Make school facilities available to children and young people before, during and after the school day, at weekends and during school holidays. These facilities should also be available to public, voluntary, community and private sector groups and organisations offering physical activity programmes and opportunities for physically active play.

Planning the provision of spaces and facilities (continued)

- Actively promote public parks and facilities as well as more non-traditional spaces (for example, car parks outside working hours) as places where children and young people can be physically active.
- Town planners should make provision for children, young people and their families to be physically active in an urban setting. They should ensure open spaces and outdoor facilities encourage physical activity (including activities which are appealing to children and young people, for example, in-line skating). They should also ensure physical activity facilities are located close to walking and cycling routes.
- Ensure the spaces and facilities used for physical activity meet recommended safety standards for design, installation and maintenance. For example, outdoor play areas should have areas of shade from the sun and sheltered areas where children can play to reduce the impact of adverse weather.
- Assess all proposals for signs restricting physical activity in public spaces and facilities (such as those banning ball games) to judge the effect on physical activity levels.

Local transport plans

Who is the target population?
Children and young people aged 18 and under, their families and carers.

Who should take action?
- Governors and heads of schools and colleges.
- Local transport authorities and executives.
- Police casualty reduction officers.
- Road safety officers.
- School travel advisers.
- Transport planners.

What action should they take?
- Ensure local transport and school travel plans continue to be fully aligned with other local authority plans which may impact on children and young people's physical activity. This includes local area agreements, local area play strategies and healthy school plans. Liaise with the local strategic partnership to achieve this.
- Ensure local transport plans continue to be developed in conjunction with local authority departments and other agencies that provide spaces and facilities for children and young people to be physically active.
- Ensure local transport plans acknowledge any potential impact on opportunities for children and young people to be physically active. Transport plans should aim to increase the number of children and young people who regularly walk, cycle and use other modes of physically active travel. They should make provision for the additional needs of, or support required by, children, young people and their parents or carers with a disability or impaired mobility.
- Continue working with schools to develop, implement and promote school travel plans. This may, for example, include: mapping safe routes to school; organising walk and bike to school days and walking buses; organising cycle and road safety training; and helping children to be 'streetwise'.
- Organise training courses for school travel plan advisers.

Local transport plans (continued)

- Identify any aspect of transport policies which discourages children and young people from using modes of travel involving physical activity (such as walking or cycling). For example, policies that aim to keep traffic moving may make it difficult to cross the road. Consider how these policies can be improved to encourage physically active travel.

Active and sustainable school travel plans

Who is the target population?

Children and young people aged 18 and under who travel to:

- pre-school or an early years facility
- school or college
- local, out-of-school activities.

Who should take action?

- Governors and heads of schools and colleges.
- Those involved in governing or leading pre-school and early years education.
- School travel advisers.

What action should they take?

- Continue to encourage a culture of physically active travel (such as walking or cycling).
- Develop a school travel plan which has physical activity as a key aim, in line with existing guidance. Integrate it with the travel plans of other local schools and the local community. The aim is to encourage children and young people to choose physically active modes of travel throughout their school career.
- Ensure schools provide suitable cycle and road safety training for all pupils.
- Encourage children and young people, especially those who live within a 2-mile radius of their school or other community facilities, to walk, cycle or use another mode of physically active travel to get there.
- Work with local authorities to map safe routes to school and to local play and leisure facilities. Take into account the views of pupils, parents and carers and consult with the local community. Overcome any barriers that are identified (for example, a lack of secure cycle parking).
- Involve children and young people, their parents and carers, the local community and external agencies in implementing the school travel plan. Use a mix of measures to promote it (for example, walking buses, walk and bike to school days). Work with the local authority school travel plan adviser to recruit volunteers on a long-term basis to help implement it.
- Set performance targets for school travel plans which are audited annually and which form part of delivery plans for local strategic partnerships. Remedial action should be taken when agreed targets are not reached.
- Develop parents' and carers' awareness of the wider benefits of walking and cycling and other physically active modes of travel. For example, explain how it can improve children and young people's movement skills, social wellbeing, self-confidence and independence. Also explain how it can help children to explore and become more familiar (and at ease) with their local environment while, at the same time, being physically active.

Helping families to be active

Who is the target population?

Children and young people aged 18 and under, their families and carers.

Who should take action?

Groups and individuals who have regular contact with children, young people, their parents and carers including:

- health practitioners
- local authority personnel
- physical activity professionals in the public and private sector
- teachers and early years providers
- volunteers and staff from community organisations.

What action should they take?

- Ensure parents and carers are aware of government advice that children and young people should undertake a minimum of 60 minutes moderate to vigorous physical activity a day. Make them aware that, at least twice a week, this should include activities to improve bone health, muscle strength and flexibility.
- Provide information and advice on the benefits of physical activity, emphasising how enjoyable it is. Provide examples of local opportunities.
- Encourage parents and carers to get involved in physical activities with their children.
- Encourage parents and carers to complete at least some local journeys (or some part of a local journey) with young children using a physically active mode of travel. This should take place on most days of the week. The aim is to establish physically active travel (such as walking or cycling) as a life-long habit from an early age. Parents and carers should also be encouraged to allow their children to become more independent, by gradually allowing them to walk, cycle or use another physically active mode of travel for short distances.
- Act as a role model by incorporating physical activity into daily life. For example, opt for travel involving physical activity (such as walking or cycling), use the stairs and regularly participate in recreational activities or sport.
- Promote physically active travel as an option for all the family. Raise awareness of how it can help children and young people achieve the recommended daily amount of physical activity.

Prevention of cardiovascular disease at population level (PH25)

Physically active travel

Policy goal

Ensure government funding supports physically active modes of travel.

What action should be taken?

- Ensure guidance for local transport plans supports physically active travel. This can be achieved by allocating a percentage of the integrated block allocation fund to schemes which support walking and cycling as modes of transport.
- Create an environment and incentives which promote physical activity, including physically active travel to and at work.
- Consider and address factors which discourage physical activity, including physically active travel to and at work. An example of the latter is subsidised parking.

Physical activity

Whose health will benefit?

Everyone.

Who should take action?

- Local authorities.
- PCTs.

What action should they take?

- Ensure the physical environment encourages people to be physically active. Implement changes where necessary. This includes prioritising the needs of pedestrians and cyclists over motorists when developing or redeveloping highways. It also includes developing and implementing public sector workplace travel plans that incorporate physical activity (see 'Promoting physical activity in the workplace'). Encourage and support employers in other sectors to do the same.
- Ensure the need for children and young people to be physically active is addressed (see 'Promoting physical activity for children and young people'). This includes providing adequate play spaces and opportunities for formal and informal physical activity.
- Audit bye-laws and amend those that prohibit physical activity in public spaces (such as those that prohibit ball games).
- Consider offering free swimming to parents and carers who accompany children aged under five years to swimming facilities.
- Apportion part of the local transport plan (LTP) block allocation to promote walking, cycling and other forms of travel that involve physical activity. The proportion allocated should be in line with growth targets for the use of these modes of transport.
- Ensure cycle tracks created under the Cycle Tracks Act 1984 are part of the definitive map (the legal record of public rights of way).
- Align all 'planning gain' agreements with the promotion of heart health to ensure there is funding to support physically active travel. (For example, Section 106 agreements are sometimes used to bring development in line with sustainable development objectives.)

Preventing unintentional injuries among children and young people aged under 15: road design and modification (PH31)

Health advocacy and engagement

Who should take action?
- Directors of public health and other health professionals with responsibility for preventing or treating injuries.
- Local strategic partnerships.

What action should they take?
- Ensure a senior public health position includes leading on, and responsibility for, the health sector's involvement in injury prevention and risk reduction.
- Support and promote changes to the road environment as part of a broader strategy to prevent injuries and the risk of injuries.
- Support coordinated working between health professionals and local highways authorities to promote changes to the road environment.

Needs assessment and planning

Who should take action?
Local highways authorities.

What action should they take?
Work with other partners to introduce engineering measures to reduce speed as part of a broad strategy to prevent injuries and the risk of injuries. These measures should be:
- developed after considering data on risk of injury (such as traffic speed and volume) and injuries (including levels of casualties, their age, the groups involved and where they occur)
- designed and constructed in line with current good practice guidelines and case studies (such as 'Manual for streets'), and determined by local context and the characteristics of the site (including physical limitations such as geological considerations)
- designed taking into account all road users (not just car users), including vulnerable road users (such as pedestrians, cyclists and those with impaired mobility)
- developed using effective processes of community engagement to seek the views of children, young people, their parents and carers and with involvement of other interested parties such as the emergency services and local businesses
- implemented based on local priorities for modifying the transport infrastructure
- evaluated for their effect in terms of reducing the risk of injury and reducing the number of actual injuries
- evaluated for any unintended consequences, such as the impact on the number of people walking or cycling or on injury rates in neighbouring streets.

Measures to reduce speed

Who should take action?
- Local highways authorities.
- Local strategic partnerships.

What action should they take?
- Introduce engineering measures to reduce speed in streets that are primarily residential or where pedestrian and cyclist movements are high. These measures could include:
  - speed reduction features (for example, traffic-calming measures on single streets, or 20 mph zones across wider areas)
  - changes to the speed limit with signing only (20 mph limits) where current average speeds are low enough, in line with Department for Transport guidelines.
- Implement city or town-wide 20 mph limits and zones on appropriate roads. Use factors such as traffic volume, speed and function to determine which roads are appropriate.
- Consider changes to speed limits and appropriate engineering measures on rural roads where the risk of injury is relatively high, in line with Department for Transport guidance.
- Take account of the factors identified when introducing measures.

Popular routes

Who should take action?
- Directors of public health.
- Local highways authorities.
- Local strategic partnerships.
- Public health professionals with an injury prevention remit.
- School travel planners.

What action should they take?
- Consider opportunities to develop engineering measures to provide safer routes commonly used by children and young people, including to school and other destinations (such as parks, colleges and recreational sites). This should be done as part of the development of a broad package of measures to address travel, for instance when developing school travel plans.
- Include school governors and head teachers in discussions about changes relating to school travel.

References

1   Department for Transport (2007) *Towards a sustainable transport system.* London: Department for Transport.

2   The Marmot Review (2010) *Fair society, healthy lives.* London: The Marmot Review.

3   Parliamentary Office for Science and Technology (2001) *Health benefits of physical activity.* London: The Stationery Office.

4   Department of Health & Department for Transport (2010) *Active travel strategy.* London: The Stationery Office.

5   Warburton D, Charlesworth S, Ivey A et al (2010) A systematic review of the evidence for Canada's Physical Activity Guidelines for Adults. *International Journal of Behavioral Nutrition and Physical Activity* **7**: 39.

6   British Medical Association (1992) *Cycling: towards health and safety.* London: British Medical Association.

7   Johan de Hartog J, Boogaard H, Nijland H et al (2010) Do the health benefits of cycling outweigh the risks? *Environmental Health Perspectives* **118**: 1109-16.

8   Kushi LH, Byers T, Doyle C et al (2006) American cancer society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA: A Cancer Journal for Clinicians* **56**: 254-81.

9   Harriss DJ, Atkinson G, Batterham A et al (2009) Lifestyle factors and colorectal cancer risk (2): a systematic review and meta-analysis of associations with leisure-time physical activity. *Colorectal Disease* **11**: 689-701.

10   Macmillan Cancer Support (2011) *The importance of physical activity for people living with and beyond cancer.* London: Macmillan Cancer Support.

11   Department of Health (2011) *Start active, stay active. A report on physical activity for health from the four home countries' Chief Medical Officers*. London: Department of Health.

12   Pretty J, Peacock J, Hine R et al (2007) Green exercise in the UK countryside: effects on health and psychological well-being, and implications for policy and planning. *Journal of Environmental Planning and Management* **50**: 211-31.

13   Cavill N (2007) Health on wheels. *Primary healthcare* **17:** 12-3.

14   The Swedish Council on Technology Assessment in Health Care (2003) *Osteoporosis: prevention, diagnosis and treatment.* Stockholm: The Swedish Council on Technology Assessment in Health Care.

15   Kelley GA (1998) Aerobic exercise and bone density at the hip in postmenopausal women: a meta-analysis. *Preventive Medicine* **27**: 798-807.

16   Mindell JS, Watkins SJ & Cohen JM (2011) *Health on the Move 2*. Stockport: Transport and Health Study Group.

17   Hardman AE & Morris JN (1998) Walking to health. *British Journal of Sports Medicine* **32**: 184.

18   Rejeski WJ, Brawley LR & Shumaker SA (1996) Physical activity and health-related quality of life. *Exercise and Sport Sciences Reviews* **24**: 71-108.

19   Royal College of Physicians (1991) *Medical aspects of exercise: benefits and risks.* London: Royal College of Physicians.

20   Wareham N (2007) Physical activity and obesity prevention. *Obesity Reviews* **8:** 109-14.

21   Jeon CY, Lokken RP, Hu FB et al (2007) Physical activity of moderate intensity and risk of type 2 diabetes: a systematic review. *Diabetes Care* **30**: 744-52.

22   LaMonte MJ, Blair SN & Church TS (2005) Physical activity and diabetes prevention. *Journal of Applied Physiology* **99**: 1205-13.

23   UITP (2006) *The role of public transport to reduce green house gas emissions and improve energy efficiency: position on the European climate change programme and the green paper on energy efficienc*y. Brussels, Belgium: UITP.

24   Woodcock J, Edwards P, Tonne C et al (2009) Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *The Lancet* **374**: 1930-43.

25   Hoek G, Boogaard H, Knol A et al (2010) Concentration response functions for ultrafine particles and all-cause mortality and hospital admissions: results of a European expert panel elicitation. *Environmental Science and Technology* **44**: 476-82.

26   Finkelstein MM, Jerrett M & Sears MR (2004) Traffic air pollution and mortality rate advancement periods. *American Journal of Epidemiology* **160**: 173-7.

27   Peters A, von Klot S, Heier M et al (2004) Exposure to traffic and the onset of myocardial infarction. *New England Journal of Medicine* **351**: 1721-30.

28   Tonne C, Melly S, Mittleman M et al (2007) A case-control analysis of exposure to traffic and acute myocardial infarction. *Environmental Health Perspectives* **115**: 53-7.

29   Gauderman WJ, Vora H, McConnell R et al (2007) Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study. *The Lancet* **369**: 571-7.

30   European Environment Agency (2009) *Transport at a crossroads.* Luxembourg: European Environment Agency.

31   Department for Transport (2011) *Reported road casualties Great Britain: 2010.* London: Department for Transport.

32   Stern N (2006) *The economics of climate change. The Stern review.* London: HM Treasury.

33   Woodcock J, Banister D, Edwards P et al (2007) Energy and transport. *The Lancet* **370**: 1078-88.

34   Carter RM, de Freitas CR, Goklany IM et al (2006) The Stern review: a dual critique. *World Economics* **7**: 165-232.

35   Appleyard D & Lintell M (1972) The environmental quality of city streets: The residents' viewpoint. *Journal of the American Institute of Planners* **38**: 84-101.

36   World Health Organization (2006) *Promoting physical activity and active living in urban environments.* Turkey: World Health Organization.

37   Department for Transport (2010) *Reported road casualties Great Britain: 2009.* London: Department for Transport.

38   Department for Transport (2012) *Licensed cars by keepership (private and company), Great Britain, annually from 1994.* London: Department for Transport.

39   Department for Transport (2009) *Transport trends 2009.* London: Department for Transport.

40   Department for Transport (2007) *Understanding the travel needs, behaviour and aspirations of people in later life.* London: Department for Transport.

41   Scottish Executive (2005) *Attitudes towards car use and modal shift in Scotland.* Edinburgh: Scottish Executive.

42   Department for Transport (2011) *National travel survey 2010.* London: Department for Transport.

43   Department for Regional Development (2011) *Northern Ireland transport statistics 2010-11.* Belfast: Department for Regional Development.

44   House of Commons Transport Committee (2009) *Taxes and charges on road users.* London: The Stationery Office.

45   Department for Transport (2010) *Transport statistics Great Britain: 2010.* London: Department for Transport.

46   Department for Transport (2008) *Transport trends 2007.* London: Department for Transport.

47   Sustainable Development Commission (2011) *Fairness in a car dependent society.* London: Sustainable Development Commission.

48   Department for Transport (2010) *Public attitudes towards road congestion.* London: Department for Transport.

49   Department for Transport (2011) *Inter-urban congestion statistics: year ending December 2010.* London: Department for Transport.

50   Transport for London (2010) *Cycling revolution London.* London: Transport for London.

51   Levy J, Buonocore J & von Stackelberg K (2010) Evaluation of the public health impacts of traffic congestion: a health risk assessment. *Environmental Health* **9**: 65.

52   The Cabinet Office (2009) *The wider costs of transport in English urban areas in 2009.* London: The Stationery Office.

53   The World Bank (2004) *Reducing air pollution from urban transport.* Washington, DC: The World Bank.

54   Department for Energy and Cimate Change (2009) *Low carbon industrial strategy: a vision.* London: Department for Energy and Cimate Change.

55   Department for Transport (2008) *Building sustainable transport into new developments: a menu of options for growth points and eco-towns.* London: Department for Transport.

56   Department for Transport (2007) *Traffic calming.* London: Department for Transport.

57   Pilkington P & Kinra S (2005) Effectiveness of speed cameras in preventing road traffic collisions and related casualties: systematic review. *British Medical Journal* **330**: 331-4.

58   Jacobsen PL, Racioppi F & Rutter H (2009) Who owns the roads? How motorised traffic discourages walking and bicycling. *Injury Prevention* **15**: 369-73.

59   Transport Research Laboratory (2000) *The effects of drivers' speed on the frequency of road accidents.* London: Transport Research Laboratory.

60   Grundy C, Steinbach R, Edwards P et al (2009) Effect of 20 mph traffic speed zones on road injuries in London, 1986-2006: controlled interrupted time series analysis. *British Medical Journal* **339:** b4469.

61   Department for Transport (2009) *Good practice guidelines: delivering travel plans through the planning process.* London: Department for Transport.

62   National Audit Office (2009) *Improving road safety for pedestrians and cyclists in Great Britain.* London: National Audit Office.

63   Tonne C, Beevers S, Armstrong BG et al (2008) Air pollution and mortality benefits of the London congestion charge: spatial and socioeconomic inequalities. *Occupational and Environmental Medicine* **65:** 620-7.

64   David B (2008) The sustainable mobility paradigm. *Transport Policy* **15**: 73-80.

65   Transport for London (2007) *Central London congestion charging impacts monitoring – fifth annual report.* London: Transport for London.

66   Greater London Authority (2009) *The Mayor's transport strategy*. London: Greater London Authority.

67   Bunn F, Collier T, Frost C et al (2003) Area-wide traffic calming for preventing traffic related injuries. *Cochrane Database of Systematic Reviews* **1**: CD003110.

68   The Forestry Commission England (2010) *The case for trees in development and the urban environment.* Bristol: The Forestry Commission.

69   Deacon L, Perkins C & Bellis M (2011) *Road traffic collisions and casualties in the North West of England*. Liverpool: North West Public Health Observatory.

70   Sustrans (2010) *Taking action on active travel*. Bristol: Sustrans.

71   Department for Transport (2004) *Making car sharing and car clubs work: final report.* London: Department for Transport.

72   www.peterborough.gov.uk (accessed 23.04.12).

73   Parliamentary Office for Science and Technology (2006) *Low carbon private vehicles.* London: The Stationery Office.

74   Department for Transport (2011) *Values of time and operating costs.* London: Department for Transport.

75   Wilkinson P, Smith KR, Beevers S et al (2007) Energy, energy efficiency, and the built environment. *The Lancet* **370**: 1175-87.

76   Stansfeld SA & Matheson MP (2003) Noise pollution: non-auditory effects on health. *British Medical Bulletin* **68**: 243-57.

77   www.decc.gov.uk (accessed 18.04.12).

78   Department for Trade and Industry (2007) *Meeting the energy challenge: a white paper on energy*. London: The Stationery Office.

79   Haines A, McMichael AJ, Smith KR et al (2009) Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers. *The Lancet* **374**: 2104-14.

80   London Health Commission (2003) *Energy and health: making the link.* London: London Health Commission.

81   HM Treasury (2001) *Building a stronger, fairer Britain in an uncertain world: pre-budget report. Chapter 7: protecting the environment.* London: The Stationery Office.

82   HM Government (2005) *Securing the future: delivering UK sustainable development strategy.* London: The Stationery Office.

83   Department for Environment, Food and Rural Affairs (2010) *Valuing the overall impacts of air pollution.* London: Department for Environment, Food and Rural Affairs.

84   Department of Health (2008) *Health effects of climate change in the UK 2008: an update of the Department of Health report 2001/2002.* London: Department of Health.

85   Committee on the Medical Effects of Air Pollutants (2010) *Long-term exposure to air pollution: effect on mortality.* London: Committee on the Medical Effects of Air Pollutants.

86   Bhaskaran K, Hajat S, Armstrong B et al (2011) The effects of hourly differences in air pollution on the risk of myocardial infarction: case crossover analysis of the MINAP database. *British Medical Journal* **343:** d5531.

87   Committee on the Medical Effects of Air Pollutants (2010) *Is exposure to outdoor air pollution a cause of atopic (allergic) asthma?* London: Committee on the Medical Effects of Air Pollutants.

88   Fonken LK, Xu X, Weil ZM et al (2011) Air pollution impairs cognition, provokes depressive-like behaviors and alters hippocampal cytokine expression and morphology. *Molecular Psychiatry* **16**: 987-95.

89   World Health Organization (2005) *Health effects of transport related air pollution.* Copenhagen: World Health Organization.

90   Sustrans press release (18.01.12) Greenways to cleaner air.

91   Department for Environment, Food and Rural Affairs (2006) *Air quality and social deprivation in the UK: an environmental inequalities analysis.* London: Department for Environment, Food and Rural Affairs.

92   Passchier W, Knottnerus A, Albering H et al (2000) Public health impact of large airports. *Environmental Health* **15:** 83-96.

93   Cohen BS, Bronzaft AL, Heikkinen M et al (2008) Airport-related air pollution and noise. *Journal of Occupational and Environmental Hygiene* **5:** 119-29.

94   Voorhees AS, Araki S, Sakai R et al (2000) An ex post cost-benefit analysis of the nitrogen dioxide air pollution control program in Tokyo. *Journal of Air and Waste Management* **50:** 391-410.

95   Powe NA & Willis KG (2004) Mortality and morbidity benefits of air pollution (SO_2 and PM_{10}) absorption attributable to woodland in Britain. Journal of Environmental Management **70:** 119-28.

96   www.lowemissionzones.eu (accessed 18.04.12).

97   Transport for London (2006) *Health impact assessment of the low emission zone.* London: Transport for London.

98   Transport for London (2010) *Travel in London: report 3.* London: Transport for London.

99   London Health Commission (2003) *Noise and health: making the link.* London: London Health Commission.

100   Hardoy MC, Carta MG, Marci AR et al (2005) Exposure to aircraft noise and risk of psychiatric disorders: the Elmas survey. *Social Psychiatry and Psychiatric Epidemiology* **40**: 24-6.

101   Haines MM, Stansfeld SA, Head J et al (2002) Multilevel modelling of aircraft noise on performance tests in schools around Heathrow Airport London. *Journal of Epidemiology and Community Health* **56**: 139-44.

102   Hygge S, Evans GW & Bullinger M (2002) A prospective study of some effects of aircraft noise on cognitive performance in schoolchildren. *Psychological Science* **13**: 469-74.

103   Babisch W (2008) Road traffic noise and cardiovascular risk. *Noise Health* **10**: 27-33.

104   Royal Commission on Environmental Pollution (2007) *The urban environment.* Norwich: The Stationery Office.

105   World Health Organization (2012) *Environmental health inequalities in Europe. Assessment report.* Copenhagen: World Health Organization.

106   Parliamentary Office for Science and Technology (2003) *Aircraft noise.* London: Parliamentary Office for Science and Technology.

107   European Commission (2005) *Position paper on the effectiveness of noise measures.* Brussels: European Commission.

108   Transport and Environment (2007) *Traffic noise reduction in Europe.* Brussels: Transport and Environment.

109   Department for Transport (2007) *Understanding the travel aspirations, needs and behaviour of young adults.* London: Department for Transport.

110   The Cabinet Office (2010) *Applying behavioural insight to health.* London: The Cabinet Office.

111   Oja P, Mänttäri A, Heinonen A et al (1991) Physiological effects of walking and cycling to work. *Scandinavian Journal of Medicine and Science in Sports* **1**: 151-7.

112   Vuori I, Oja P & Paronen O (1994) Physically active commuting to work – testing its potential for exercise promotion. *Medicine and Science in Sports and Exercise* **26**: 844-50.

113   Andersen LB, Wedderkopp N, Kristensen P et al (2011) Cycling to school and cardiovascular risk factors: a longitudinal study. *Journal of Physical Activity and Health* **8**: 1025-33.

114   The NHS Information Centre (2009) *Health survey for England 2008.* London: The NHS Information Centre.

115   The Scottish Government (2011) *Scottish health survey 2010.* Edinburgh: The Scottish Government.

116   Scottish Executive: Physical Activity Taskforce (2003) *Let's make Scotland more active: a strategy for physical activity.* Edinburgh: Scottish Executive.

117   Welsh Government (2011) *Welsh health survey 2010.* Cardiff: Welsh Government.

118   Department of Health, Social Services and Public Safety (2011) *Health survey Northern Ireland: first results from the 2010/11 survey.* Belfast: Department of Health, Social Services and Public Safety.

119   World Health Organization (2010) *Global recommendations on physical activity for health.* Geneva: World Health Organization.

120   World Health Organization (2002) *Move for health.* Geneva: World Health Organization.

121   Woodcock J, Franco OH, Orsini N et al (2011) Non-vigorous physical activity and all-cause mortality: systematic review and meta-analysis of cohort studies. *International Journal of Epidemiology* **40**: 121-38.

122   Allender S, Foster C, Scarborough P et al (2007) The burden of physical activity-related ill health in the UK. *Journal of Epidemiology and Community Health* **61**: 344-8.

123   Frank LD, Andresen MA & Schmid TL (2004) Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine* **27:** 87-96.

124   Sonkin B, Edwards P, Roberts I et al (2006) Walking, cycling and transport safety: an analysis of child road deaths. *The Journal of the Royal Society of Medicine* **99:** 402-5.

125   Oja P, Vuori I & Paronen O (1998) Daily walking and cycling to work: their utility as health-enhancing physical activity. *Patient Education and Counseling* **33**: s87-94.

126   Department for Transport (2010) *National travel survey: 2009*. London: Department for
        Transport.

127   Sustrans (2011) *Solutions for life. Sustrans annual review 2010*. Bristol: Sustrans.

128   Sustrans (2011) *Written evidence from Sustrans (ETM 46) to the 2011 Transport Committee
        on effective road and traffic management*. Bristol: Sustrans.

129   National Institute for Health and Clinical Excellence (2007) *Behaviour change at population,
        community and individual levels.* London: National Institute for Health and Clinical
        Excellence.

130   Ogilvie D, Foster CE, Rothnie H et al (2007) Interventions to promote walking: systematic
        review. *British Medical Journal* **334**: 1204.

131   Yang L, Sahlqvist S, McMinn A et al (2010) Interventions to promote cycling: systematic
        review. *British Medical Journal* **341:** c5293.

132   Hemmingsson E, Udden J, Neovius M et al (2009) Increased physical activity in abdominally
        obese women through support for changed commuting habits: a randomized clinical trial.
        International Journal of Obesity **33**: 645-52.

133   Rissel CE, New C, Wen L et al (2010) The effectiveness of community-based cycling
        promotion: findings from the cycling connecting communities project in Sydney, Australia.
        International Journal of Behavioral Nutrition and Physical Activity **7:** 8.

134   Troelsen J (2005) Transport and health: Odense – the national cycling city of Denmark,
        1999-2002. *Ugeskrift for Laeger* **167:** 1164-6.

135   Pucher J & Buehler R (2008) Making cycling irresistible: Lessons from The Netherlands,
        Denmark and Germany. *Transport Reviews* **28**: 495-528.

136   Groesz L (2007) *A conceptual evaluation of school-based utilitarian exercise model*.
        Austin: University of Texas.

137   Serco press release (25.10.11) Serco's partnership for the Barclays Cycle Hire scheme
        expanded.

138   Barclays press release (23.02.12) Barclays Cycle Hire announces east London expansion.

139   Department for Transport (2009) *Analysis and synthesis of evidence on the effects
        of investment in six cycling demonstration towns*. London: for Department for Transport.

140   National Institute for Health and Clinical Excellence (2009) *Promoting physical activity,
        active play and sport for pre-school and school-age children and young people in family,
        pre-school, school and community settings*. London: National Institute for Health and
        Clinical Excellence.

141   National Institute for Health and Clinical Excellence (2006) *Four commonly used methods
        to increase physical activity: brief interventions in primary care, exercise referral schemes,
        pedometers and community-based exercise programmes for walking and cycling*. London:
        National Institute for Health and Clinical Excellence.

142   National Institute for Health and Clinical Excellence (2008) *Workplace health promotion: how to encourage employees to be physically active*. London: National Institute for Health and Clinical Excellence.

143   National Institute for Health and Clinical Excellence (2010) *Prevention of cardiovascular disease at population level.* London: National Institute for Health and Clinical Excellence.

144   National Institute for Health and Clinical Excellence (2010) *Preventing unintentional injuries among children and young people aged under 15: road design and modification*. London: National Institute for Health and Clinical Excellence.

145   National Institute for Health and Clinical Excellence (2008) *Promoting and creating built or natural environments that encourage and support physical activity.* London: National Institute for Health and Clinical Excellence.

146   World Health Organization (2004) *World report on road traffic injury prevention.* Geneva: World Health Organization.

147   Lassarre S, Papadimitriou E, Yannis G et al (2007) Measuring accident risk exposure for pedestrians in different micro-environments. *Accident Analysis and Prevention* **39**: 1226-38.

148   Department for Transport (2009) *National travel survey: 2008. Transport statistical bulletin.* London: Department for Transport.

149   National Institute for Health and Clinical Excellence (2005) *Making the case: improving health through transport.* London: National Institute for Clinical Health and Excellence.

150   Transport Research Laboratory (2006) *Factors influencing pedestrian safety: a literature review.* London: Transport Research Laboratory.

151   Sustrans (2006) *Economic appraisal of local walking and cycling routes*. Bristol: Sustrans.

152   Nantulya VM & Reich MR (2002) The neglected epidemic: road traffic injuries in developing countries. *British Medical Journal* **324**: 1139-41.

153   Morgan A, Dale H, Lee W et al (2010) Deaths of cyclists in London: trends from 1992 to 2006. *BMC Public Health* **10**: 699.

154   British Medical Association (2010) *Promoting safe cycling.* London: British Medical Association.

155   Department for Transport (2004) *Bicycle helmets: review of the effectiveness (No. 30).* London: Department for Transport.

156   Macpherson A & Spinks A (2007) Bicycle helmet legislation for the uptake of helmet use and the prevention of head injuries. *Cochrane Database of Systematic Reviews* **3:** CD005401.

157   Institutionen för Trafikteknik, Lunds Tekniska Högskola (1996) *On the treatment of flow in traffic safety analysis – a non parametric approach applied on vulnerable road users – bulletin 136.* Lund, Sweden: Institutionen för Trafikteknik, Lunds Tekniska Högskola.

158   Jacobsen PL (2003) Safety in numbers: more walkers and bicyclists, safer walking and bicycling. *Injury Prevention* **9**: 205-9.

159   Cyclists' Touring Club (2008) *Safety in numbers in England.* Guildford: Cyclists' Touring Club.

160   Vandenbulcke G, Thomas I, de Geus B et al (2009) Mapping bicycle use and the risk of accidents for commuters who cycle to work in Belgium. *Transport Policy* **16**: 77-87.

161   Department for Transport (2008) *UK transport and climate change data factsheet.* London: Department for Transport.

162   Sustrans (2010) *More haste, less speed: evidence and benefits.* Bristol: Sustrans.

163   Welsh Assembly Government (2005) *Climbing higher – the Welsh Assembly Government strategy for sport and physical activity.* Cardiff: Welsh Assembly Government.

164   Health Promotion Agency for Northern Ireland (2000) *A health economics model: the cost benefits of the physical activity strategy for Northern Ireland.* Belfast: Health Promotion Agency for Northern Ireland.

165   Department for Transport (2007) *Valuing the benefits of cycling.* London: Department for Transport.

166   Davis A (2010) *Value for money: an economic assessment of investment in walking and cycling.* Bristol: South West Public Health Observatory.

167   MacDonald J, Stokes R & Cohen D (2010) The effect of light rail transit on body mass index and physical activity. *American Journal of Preventative Medicine* **39:** 105-12.

168   Webb E, Netuveli G & Millett C (2011) Free bus passes, use of public transport and obesity among older people in England. *Journal of Epidemiology and Community Health* **66:** 176-80.

169   Department for Transport (2009) *Public experiences of and attitudes towards bus travel.* London: Department for Transport.

170   House of Commons Library (2010) *Buses: deregulation in the 1980s.* London: House of Commons Library.

171   Department for Transport (2009) *The future of urban transport.* London: Department for Transport.

172   Campaign for Better Transport (2008) *Transport costs and carbon emissions.* London: Campaign for Better Transport.

173   Bus and Coach Smart Move (2010) *Doubling the use of collective passenger transport by bus and coach.* London: Bus and Coach Smart Move.

174   UITP (2003) *The metro: an opportunity for sustainable transport.* Paris: UITP.

175   Department for Transport (2011) *Light rail and tram statistics: 2010/11.* London: Department for Transport.

176   Department for Transport (2011) *Glasgow Underground statistics, annual from 1982/83.* London: Department for Transport.

177   British Lung Foundation (2003) *Lung report III – casting a shadow over the nation's health.* London: British Lung Foundation.

178   Chillrud SN, Grass D, Ross JM et al (2005) Steel dust in the New York City subway system as a source of manganese, chromium, and iron exposures for transit workers. *Journal of Urban Health* **82**: 33-42.

179   Ripanucci G, Grana M, Vicentini L et al (2006) Dust in the underground railway tunnels of an Italian town. *Journal of Occupational and Environmental Hygiene* **3**: 16-25.

180   Bigert C, Alderling M, Svartengren M et al (2008) Blood markers of inflammation and coagulation and exposure to airborne particles in employees in the Stockholm underground. *Occupational and Environmental Medicine* **65**: 655-8.

181   Seaton A, Cherrie J, Dennekamp M et al (2005) The London Underground: dust and hazards to health. *Occupational and Environmental Medicine* **62**: 355-62.

182   Leonard Cheshire (2003) *Mind the gap.* London: Leonard Cheshire.

183   Economic and Social Research Council (2005) *Transport and Ageing: Extending quality of life for older people via public and private transport, ESRC report.* London: Economic and Social Research Council.

184   Transportation Research Board (2009) *Accessible transportation and mobility.* Washington, DC: Transportation Research Board.

185   Government Office for Science (2007) *Tackling obesities: future choices – project report.* London: Government Office for Science.

186   Active Living Research (2005) *Designing for active transportation.* San Diego, CA: Active Living Research.

187   Mitchell R & Popham F (2008) Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet* **372**: 1655-60.

188   Faculty of Public Health (2010) *Great outdoors: how our natural health service uses green space to improve wellbeing – briefing statement.* London: Faculty of Public Health.

189   Greenspace Scotland (2007) *The links between greenspace and health: a critical literature review.* York: University of York.

190   De Vries S, Verheij R, Greenwegen P et al (2003) Natural environments – healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environment and Planning* **35:** 1717-31.

191   World Health Organization Europe (2009) *Mental health, resilience, and inequalities.* Copenhagen: World Health Organization Europe.

192   Maller C, Townsend M, Pryor A et al (2006) Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International* **21**: 45-54.

193   Maas J, Verheij RA, Groenewegen PP et al (2006) Green space, urbanity, and health: how strong is the relation? *Journal of Epidemiology and Community Health* **60**: 587-92.

194   Maas J, Verheij RA, de Vries S et al (2009) Morbidity is related to a green living environment. *Journal of Epidemiology and Community Health* **63**: 967-73.

195   Commission for Integrated Transport (2001) *Rural transport: an overview of the key issues.* London: Commission for Integrated Transport.

196   Complete Streets Coalition (2011) *Complete streets in the United States*. Chicago, IL: Complete Streets Coalition.

197   Living Streets (The Pedestrians Association) (2011) *Making the case for investment in the walking environment.* London: Living Streets (The Pedestrians Association).

198   World Health Organization Regional Office for Europe (2004) *Preventing road traffic injury: a public health perspective.* Copenhagen: World Health Organization.

199   Department for Transport (2005) *Understanding community severance: views of practitioners and communities.* London: Department for Transport.

200   Royal Town Planning Institute (2008) *Health and spatial planning.* London: Royal Town Planning Institute.

201   Department for Transport (2009) *A safer way. Consultation on making Britain's roads the safest in the world.* London: Department for Transport.

202   Travel Watch (2006) *Rural transport funding: a review of public transport needs in the countryside.* London: Travel Watch.

203   British Medical Association (2005) *Healthcare in a rural setting.* London: British Medical Association.

204   Mitchinson K (2002) *Rural health and community strategies: key points for rural health and community planning.* Powys: The Rural Health Forum.

205   www.ruralcommunities.gov.uk (accessed 17.05.12).

206   Institute of Rural Health (2008) *Health in Rural Wales.* Powys: Institute of Rural Health.

207   Northern Ireland Assembly (2010) *Rural to urban journeys*. Belfast: Northern Ireland Assembly.

208   Commission for Rural Communities (2008) *Thinking about rural transport – the contribution of transport to sustainable rural communities.* London: Commission for Rural Communities.

209   Campaign for Rural England (2003) *Rural traffic fear survey.* London: Campaign for Rural England.

210   Sustrans (2009) *Rural safe routes to schools: project review.* Bristol: Sustrans.

211   Department for Transport (2007) *Travel in urban and rural areas: personal travel factsheet.* London: Department for Transport.

212   Department for Transport (2011) *Bus subsidy per passenger journey.* London: Department for Transport.

213   Nicholl JP, Freeman MR & Williams BT (1987) Effects of subsidising bus travel on the occurrence of road traffic casualties. *Journal of Epidemiology and Community Health* **41**: 50-4.

214   www.ctc.org.uk (accessed 17.05.12).

215   Laws REM & Ison S (2009) Demand responsive transport: a review of schemes in England and Wales. *Journal of Public Transportation* **12**: 19-38.

216   Institute for European Environmental Policy (2006) *The sustainable case for rail: position paper by the institute for European Environmental Policy for RMT Parliamentary group's seminar "The sustainable case for rail".* London: Institute for European Environmental Policy.

217   Givoni M, Brand C & Watkiss P (2009) Are railways climate friendly? *Built environment* **35**: 70-86.

218   Association of Train Operating Companies (2007) *Baseline energy statement – energy consumption and carbon dioxide emissions on the railway.* London: Association of Train Operating Companies.

219   House of Commons Transport Committee (2007) *Delivering a sustainable railway: a 30-year strategy for the railways?* London: The Stationery Office.

220   National Audit Office (2010) *Increasing passenger rail capacity.* London: National Audit Office.

221   House of Commons Environmental Audit Committee (2006) *Reducing carbon emissions from transport.* London: The Stationery Office.

222   House of Commons Transport Committee (2003) *Overcrowding on public transport.* London: House of Commons Transport Committee.

223   House of Commons Committee of Public Accounts (2010) *Increasing passenger rail capacity – fifth report of session 2010-11.* London: House of Commons Committee of Public Accounts.

224   Department for Transport (2008) *High Level output specification (HLOS) plan update July 2008.* London: Department for Transport.

225   www.isni.gov.uk (accessed 17.05.12).

226   Association of Train Operating Companies press release (12.07.10) Tens of thousands switch from cars to trains as petrol prices rise.

227   Department for Transport (2010) *Public experiences of and attitudes towards rail travel: 2006 and 2009.* London: Department for Transport.

228   Givoni M & Banister D (2006) Airline and railway integration. *Transport Policy* **13**: 386-97.

229   Department for Transport (2011) *Review of HS2 London to West Midlands appraisal of sustainability: A report to Government by HS2 Ltd.* London: Department for Transport.

230   Givoni M (2007) Environmental benefits from mode substitution: comparison of the environmental impact from aircraft and high-speed train operations. *International Journal of Sustainable Transportation* **1**: 209-30.

231   Wee BV, Janse P & Brink RVD (2005) Comparing energy use and environmental performance of land transport modes. *Transport Reviews* **25**: 3-24.

232   Department for Transport (2012) *The economic case for HS2: value for money statement.* London: Department for Transport.

233   Department for Transport (2010) *High speed rail summary.* London: Department for Transport.

234   Flyvbjerg B, Skamris Holm MK & Buhl SL (2004) What causes cost overrun in transport infrastructure projects? *Transport Reviews* **24**: 3-18.

235   Network Rail (2009) *Meeting the capacity challenge: the case for new lines.* London: Network Rail.

236   Eurostar press release (17.10.05) Eurostar achieves record market shares despite difficult summer period.

237   Department for Transport (2012) *High speed rail: investing in Britain's future. The Government's decisions.* London: Department for Transport.

238   Department for Transport (2011) *The economic case for HS2. The Y network and London – West Midlands.* London: Department for Transport.

239   Commission for Integrated Transport (2004) *High speed rail: international comparisons.* London: Commission for Integrated Transport.

240   NHS Confederation (2007) *Taking the temperature - towards an NHS response to global warning.* London: NHS Confederation.

241   NHS Sustainable Development Unit (2009) *Saving carbon, improving health: NHS carbon reduction strategy for England.* London: NHS Sustainable Development Unit.

242   Solomon S, Qin D & Manning M (2007) *Climate change 2007: the physical science basis. Contribution of working group I to the fourth assessment report of the Intergovernmental Panel on Climate Change.* Cambridge, UK and New York, USA: Cambridge University Press.

243   International Panel on Climate Change (2007) *Contribution of working group II to the fourth assessment report of the Intergovernmental Panel on Climate Change.* Geneva: International Panel on Climate Change.

244   Environment Agency (2010) *Evidence: climate change.* London: Environment Agency.

245   International Transport Forum (2010) *Reducing transport greenhouse gas emmissions: trends and data 2010.* Leipzig: International Transport Forum.

246   Ezzati M, Lopez AD, Rodgers A et al (2002) Selected major risk factors and global regional burden of disease. *The Lancet* **360**: 1347-60.

247   McMichael AJ, Woodruff RE & Hales S (2006) Climate change and human health: present and future risks. *The Lancet* **367**: 859-69.

248   Department for Transport (2010) *Trends in Attitudes to Transport 1990 to 2009.* London: Department for Transport.

249   Department for Transport (2011) *2010 British social attitudes survey: attitudes to transport.* London: Deparment for Transport

250   Lorenc T, Brunton G, Oliver S et al (2008) Attitudes to walking and cycling among children, young people and parents: a systematic review. *Journal of Epidemiology and Community Health* **62**: 852-7.

251   Darker CD, Larkin M & French DP (2007) An exploration of walking behaviour – an interpretative phenomenological approach. *Social Science and Medicine* **65**: 2172-83.

252   Department for Transport (2010) *Cycling, safety and sharing the road: qualitative research with cyclists and other road users.* London: Department for Transport.

253   Scottish Executive (2004) *Bus passenger satisfaction survey.* Edinburgh: Scottish Executive.

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